Energy Statement

Penistone Coal Drops, St. Mary's Street, Penistone, Sheffield, S36 6DT

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Yourspace Studio Ltd

Energy Efficiency Statement

Energy Efficiency

A. The expected rating of the Dwelling and commercial emission rate will be 15% better than the Target emission rate, utilising renewable energy to achieve this

B. The efficiency measures proposed are Air Source Heat Pumps, fabric thermally efficient and controls.

C. All dwellings will be compact or group formed and commercial units will employ efficient design

Renewable Energy

Carbon

The percentage of C02 reduction provided utilising on-site renewable will be at least 15%. The use of ASHP throughout the development will achieve this requirement.

The total C02 emissions of the development amounts to **55.2** tonnes/m2/yr and calculated as follows:

Plot 1	2.42
Plot 2	2.15
Plot 3	1.77
Plot 4	1.71
Plot 5	2.15
Plot 6	2.15
Plot 7	1.79
Plot 8	1.77
Plot 9	1.77
Plot 10	2.25
Plot 11	2.25
Plot 12	1.79
Plot 13	1.79
Plot 14	2.46
Plot 15	2.89

Sub Total 31.11

Commercial unit 1	3.66
Commercial unit 2	3.66
Commercial unit 3	3.66
Commercial unit 4	3.66
Commercial unit 5	3.66
Commercial unit 6	3.32
Commercial unit 7	2.47

Sub Total 24.09

Total for the whole Development 55.20

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Building materials

Energy Efficiency

The baseline target is the minimum requirements as required by Part L of the 2010 Building Regulations. These would be the required target emissions as set out in the SAP2009 and SBEM which adhere to the CLG guidelines. The local planning policy CSP2/CSP5 is to ensure the requirement is to achieve a minimum 15% improvement by means of use of renewable or low carbon technology on the site is achieved.
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The baseline target is to better requirements as required by Part L of the 2010 Building Regulations. These would be the required target emissions as set out in the SAP2009 and SBEM which adhere to the CLG guidelines.

This has been achieved at by a highly efficient thermal envelope and the use of ASHP to all dwellings and Commercial Units. There is a reduction in the DER (dwelling emission rate) over the TER (target emission rate) in respect to a dwelling or commercial unit built to pass the Part L of the 2010 Building Regulations.

Conclusion

The use of ASHP will be of enormous benefit to all house types and commercial units. High efficient thermal building elements will reduce the energy demand; in turn will reduce the heat and hot water demand, In accordance with CSP2/CSP5
Reduced flow tap restrictors and dual flush WCs, flow restrictors to showers and best practice white goods will reduce water consumption, In accordance with CSP2/CSP5
Good day lighting will reduce the need for high lighting levels In accordance with CSP2/CSP5

Methodology and scope

The strategy for C02 emissions reduction and renewable energy generation is based on the proposed layout and accommodation mix for the site.

Stage 1: Predict energy demand
To calculate the required C02 reduction, it is necessary to establish baseline energy consumption.

Stage 2: Energy efficiency improvements
Various options were considered to improve the efficiency beyond the standards required by the Building Regulations. These options include enhancements to the building envelope and upgrades to heating controls.

Stage 3: Identify appropriate LZC energy technologies
Following the application of energy efficiency measures, the most appropriate LZC energy technologies (i.e. those which make best use of available resources) were identified. The technical, economical, practical and environmental impacts of the range of available renewable energy technologies were investigated to establish their overall feasibility.

The selected renewable technology was determined using the following strategy:
Apply renewable technologies to achieve the 15% on Building regulations TER needed

The Government's Renewable Obligation defines renewable energy in the UK. The identified technologies are;
• Small hydro-electric
• Landfill and sewage gas
• Onshore and offshore wind
• Biomass
• Tidal and wave power
• Geothermal power
• Solar
The use of landfill or sewage gas, offshore wind or any form of hydroelectric power is not suitable for the site due to its location. The remaining technologies are considered below;

Energy efficiency improvements

Introduction

To reduce energy consumption, energy efficiency measures will be applied. Typically, this involves upgrading the building fabric of each dwelling (hence decreasing thermal energy demand for space heating) and improving heating controls. The following energy efficiency measures will be adopted on all dwellings In accordance with the Policy CSP2/CSP5

Dwellings
Air permeability rate: 5 m3/hr/m2;
Add zone time and temperature controls to heating controls;
Add thermostat to hot water cylinder;
External walls U values to 0.23 W/m2K
Window U values to 1.7 W/m2K
Floor to 0.2W/m2K
Insulated slope Roof to 0.11W/m2K
Insulated ceiling to 0.14W/m2K
Mitsubishi Ecodan Air source heat pump 366% Efficient or better.
The measures listed have been selected on the basis of their economic viability and effectiveness in reducing the overall energy demand/C02 emissions of the units.

Table 3.2 displays the energy and C02 savings arising from adoption of the above energy efficiency upgrades. In accordance with the Policy CSP2/CSP5

Table 2.2: Summary of energy and C02 savings following the adoption of energy efficiency measures

House types	Energy demand (kWh/m2 /year)	% Baseline unit carbon Performance over 2010 building regs	Heat source
1	118.48	21.5%	Air Source Heat Pump
2	105.5	19.9%	Air Source Heat Pump
3	126.77	16.2%	Air Source Heat Pump
4	122.72	18.8%	Air Source Heat Pump
5	105.05	19.9%	Air Source Heat Pump
6	105.05	19.9%	Air Source Heat Pump
7	128.42	15.2%	Air Source Heat Pump
8	142.68	17.1%	Air Source Heat Pump
9	142.68	17.1%	Air Source Heat Pump
10	109.8	16%	Air Source Heat Pump
11	109.8	16%	Air Source Heat Pump
12	128.42	15.2%	Air Source Heat Pump
13	128.42	15.2%	Air Source Heat Pump
14	108.21	15.9%	Air Source Heat Pump
15	123.24	20.2%	Air Source Heat Pump

SAP 2009 Calculations (attached) provided to substantiate the figures used in the table and 2.2

Commercial Units

Add zone time and temperature controls to boiler controls;
Direct fed Instantaneous hot water;
External walls U values to 1.30 W/m2K
Window U values to 1.7 W/m2K
Floor to 0.22W/m2K
Roof to 0.16 W/m2K
Mitsubishi Ecodan Air source heat pump 323 Efficient or better.
The measures listed have been selected on the basis of their economic viability and effectiveness in reducing the overall energy demand/C02 emissions of the units.

Table 3.2 displays the energy and C02 savings arising from adoption of the above energy efficiency upgrades. In accordance with the Policy CSP2/CSP5

Table 2.2a: Summary of energy and C02 savings following the adoption of energy efficiency measures

Commercial Unit	Energy demand (kWh/m2 /year)	% Baseline unit carbon Performance over 2010 building regs	Heat source
1	70.81	17.1%	Air Source Heat Pump
2	70.81	17.1%	Air Source Heat Pump
3	70.81	17.1%	Air Source Heat Pump
4	70.81	17.1%	Air Source Heat Pump
5	70.81	17.1%	Air Source Heat Pump
A1	64.27	15.3%	Air Source Heat Pump
A2	47.8	13.6%	Air Source Heat Pump

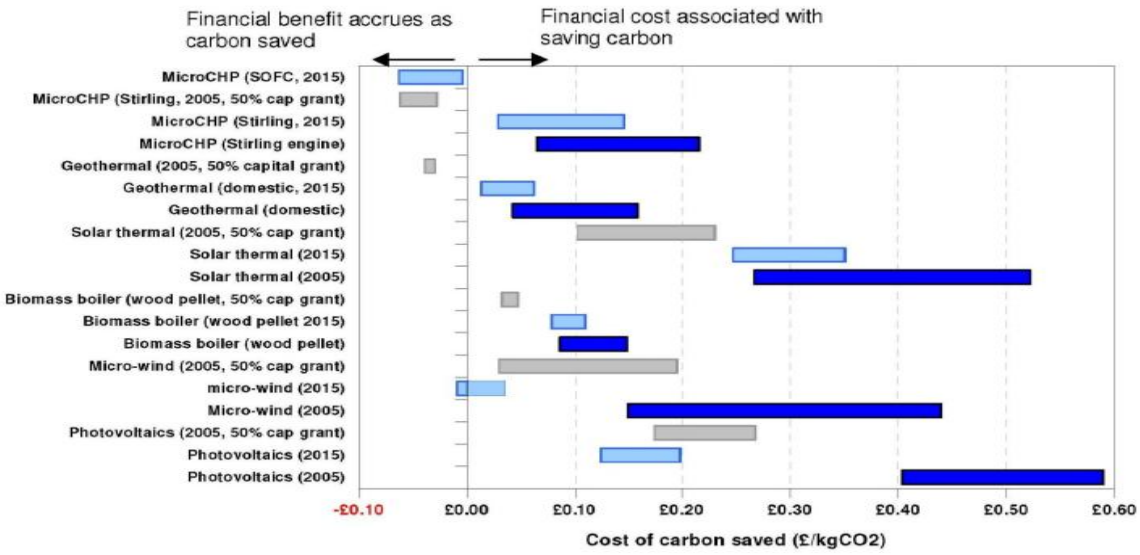
SBEM Calculations (attached) provided to substantiate the figures used in the table and 2.2a

Analysis of renewable energy technologies

Small-scale low carbon technologies suitable for installation in domestic properties (micro generation technologies) have been assessed in terms of economic and environmental benefits.

The figure below shows the cost of carbon saved by each of the micro-generation technologies considered under 3 scenarios – current capital costs, 2015 capital cost projections and current costs with 50% grant assistance.
Cost of carbon saved by each micro-generation technology under various capital cost assumptions.

Table 3.2



A range of renewable energy technologies have been considered for the site, these include:

- Photovoltaic's (PV);
- Solar thermal panels;
- Wind turbines;
- Biomass;
- Ground Source Heat Pumps (GSHP);
- Air Source Heat Pumps (ASHP);
- Combined Heat and Power (CHP).

The following section provides a description of the feasibility of each;

Photovoltaic's (PV)

Description
Photovoltaic systems use cells to convert sunlight into electricity. The PV cell consists of one or two layers of a semi conducting material, usually silicon. When light shines on the cell it creates an electric field across the layers causing electricity to flow. The greater the intensity of the light, the greater the flow of electricity.

Advantages
Tried and tested form of renewable energy generation with a mature supply chain and a long design life (20 - 30 years). Virtually no maintenance is required and the systems can easily be incorporated into the design of the buildings. A lot of research has been invested in the development of Thin-Film Photovoltaic's (TFPV) and there is anticipation that the cost of PV will be significantly reduced if this technique comes to fruition. The roof on all units is of adequate surface for installation of PV collectors (assuming 0° tilt of collector).

Disadvantages
At present, this technology has a relatively high cost and a low efficiency. The payback period is in excess of 35 years Compliance analysis

Compliance analysis
Solar PV will not meet the 15 % renewable alone and we need to work in conjunction with another technology, on the semi properties the only constraint is the area of roof available and the direction the roof is facing

Solar thermal

Description
Solar thermal panels produce hot water from solar energy and reduce the need for conventional water heating (i.e. gas).Typically around 40-60% of annual hot water demand can be provided through the use of solar thermal panels.

Advantages
Inexpensive, effective and straightforward technology in terms of operation and maintenance (little required).

Disadvantages
Installation of solar thermal panels for all flats of an apartment block, require the presence of a communal water tank on the ground. This complicates configuration of pipelines and increases the electricity consumed by the pumps to circulate hot water in all apartments. Payback period can be as long as 40 years with government grants included.

Compliance analysis
Solar thermal panels can be incorporated only on top of all units separately, to meet a portion of the hot water demand, however, on the semi properties the only constraint is the area of roof available and the direction the roof is facing.

Wind turbines

Description
Wind turbines use the wind's lift forces to rotate aerodynamic blades that turn a rotor to generate electricity.

Advantages
Zero emission electricity production. The cost of the turbines is low compared to other technologies with a further reduction in prices forecast as production-lines increase in size.

Disadvantages
For optimum performance the wind speed at the site needs to be between 8-12 m/s which could be achieved , however being a heritage site , they would not be in keeping

Compliance analysis
Wind turbines will not be used.

Biomass

Description
Burning wood or wood products, as a fuel is considered to be a "carbon neutral" process because the C02 released during combustion is equal to that absorbed during growth of the fuel. Biomass can be used to provide energy for district heating schemes. In district heating systems more than one building or dwelling is heated from a central source. Biomass fuels are combusted in a boiler and then heat in the form of steam or hot water is transferred, via a distribution network of underground pipes to different buildings. This is then used for space heating and hot water in each home.

Advantages
Reliable, cost effective and works well in areas where there is a dense housing layout, does not require a complex configuration and can easily meet 15% site wide renewable energy requirements.

Disadvantages
There are wider planning issues to consider such as the impact of stack emissions on local air quality. Fuel delivery and storage needs to be analysed in detail.

Compliance analysis
Installation of a district biomass heating system is adequate to meet 15% site wide renewable energy requirements without the use of additional renewable energy technologies in the rest of the dwellings, however there is a sizeable issue with fuel supply and storage.
Biomass will not be used.

Ground Source Heat Pumps (GSHP)

Description
Ground source heat pump systems (GSHP) extract constant temperatures from below ground, and convert them into temperatures which can be used for space heating. Heat can be extracted either by means of a "horizontal" system, where pipe coils are laid in trenches, or by a "vertical" system, which uses boreholes.

Advantages
The system does not require any external fuel and can be designed to heat a whole building, typically through underfloor heating.

Disadvantages
Systems required at site could add significant cost to the installation. Furthermore, this technology uses electricity to operate the circulation pumps, and the heat pumps themselves.

Compliance analysis
GSHP will not be used.

Air Source Heat Pumps (ASHP)

Description
Air Source Heat Pumps (ASHP) work in a similar way to the ground source system. Instead of heat being extracted from the ground it is extracted from the air by a unit that is sited outside.

Advantages
The system does not require any external fuel and can be designed to heat a whole building, typically through underfloor heating. The technology is less expensive than GSHP and has no need for ground loops. The installation of the units is straightforward. The Carbon saving is high compared to other renewable.

Disadvantages
Electricity is required to pump the heat. Typically, the efficiency and lifetime is lower than other renewables.

Compliance analysis
Use electricity as the primary source of energy and Installation of a ASHP heating system is adequate to meet 10% site wide renewable energy requirements without the use of additional renewable energy technologies .

ASHP are best suited for the meeting the 15% and practicality for this development will be used

Combined Heat and Power (CHP)

Description
Combined Heat and Power (CHP) systems generate both electricity and thermal energy from a single fuel source, which is typically natural gas. This is an efficient technology, and can generate considerable C02 savings in the right conditions. Micro-CHP has been developed specifically for the domestic market, and several major manufacturers are working towards making this readily available. However, at the time of writing (March 2009), no acceptable models are available for installation, and therefore this is not recommended as part of the energy strategy. This may; however be an appropriate technology in the future.

Advantages
Combined Heat and Power (CHP) systems generate both electricity and thermal energy from a single fuel source, which is typically natural gas. This is an efficient technology, and can generate considerable C02 savings in the right conditions.

Disadvantages
The technology is most efficient when operational for as many hours as possible per year, at as high an output as possible. A rough "rule of thumb" for this would be to operate the CHP unit for a minimum of 4,400 hours per year. This means that the system would ideally still be running at full capacity over the summer months, i.e. producing thermal energy during the hottest parts of the year, when thermal demand will be minimal.

Compliance analysis
CHP will not be used as it is not practical to use a district heating system on this site

Table 3.3 Summary of renewable energy technology considered for the site

Technology	Suitability	Comments
Photovoltaics	Yes	Inadequate surface for roof installation Can meet a significant portion of carbon saving requirements but does need additional technology to achieve 15% Expensive option payback period long
Solar Thermal	No	In adequate surface for roof installation and alone cannot meet the 10% requirement portion of carbon saving Requirements Inexpensive solution to meet hot water demand Payback period long
Micro Scale Wind Turbine	No	Insufficient wind resource for the site Visual aspects Site not suitable
Biomass	No	Can meet a significant portion of carbon saving Requirements Poor fuel supply and storage of pellets
GSHP	No	Vertical piping makes the installation costs prohibitive
ASHP	Yes	Can meet a significant portion of carbon saving requirements External unit means housing units are required Energy efficiency has improved with the development of this technology, payback period is relatively short
CHP	No	Requires high thermal load in summer to make effective District heating system would be required and is not practical

Summary

To adhere with Policy CSP2/CSP5 the following criteria will be satisfied:
• Achieve required carbon reduction with all units using renewable technology; in fact this is achieved on all dwellings.
• 15% CO2 emission rate over the Part L building regs 2010 of the overall site dwelling CO2 emission rate

Unite Types	% unit carbon Performance over 2010 building regs
1	21.5%
2	19.9%
3	16.2%
4	18.8%
5	19.9%
6	19.9%
7	15.2%
8	17.1%
9	17.1%
10	16%
11	16%
12	15.2%
13	15.2%
14	15.9%
15	20.2%
Com 1	17.1%
Com 2	17.1%
Com 3	17.1%
Com 4	17.1%
Com 5	17.1%
Com A1	15.3%
Com A2	13.6%

Total average saving on the CO2 emission rate over the whole development is in excess of 16.4%

Appendix 1: Modelling Assumptions

Standard Assessment Procedure (SAP) data sheets for all types' houses and for the purposes of this statement the building have all been calculated as in accordance with the site layout detailed at the start of this document.

100% of lighting requirements must be delivered via Low energy types

The boiler used is a Mitsubishi Ecodan 5kW with an 366%, however other ASHP with a minimum Sedbuk efficiency rating of 366% can be used.

Heating control will need to be control by both zone temperature and time

The renewable technology strategies in this report are based on 'worst case' assumptions. Unit specific SAPs data has been produced and all units will meet the existing requirements with the strategy CSP2/CSP5 Policy proposed within this report

PDFs Modelling

Attachments

Dwellings

Type 1-15 Part L compliance reports
Type 1-15 Sap 2009 Worksheets

Commercial Units
Types 1-5 , A1 and A2 Part L compliance reports

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Regulations Compliance Report

Approved Document L1A 2010 edition assessed by Stroma FSAP 2009 program, Version: 1.4.0.73
Printed on 02 May 2012 at 12:31:51

Project Information:

Assessed By: Mike Ovenden (STRO006697) **Building Type:** End-terrace House

Dwelling Details:

NEW DWELLING DESIGN STAGE

Site Reference : Plot 1 end terrace **Plot Reference:** Plot 1

Address : Plot 1, Penistone Coal Drops, St. Mary's Street, Penistone, Sheffield, S36 6DT

Client Details:

Name: Stephen Sharp

Address : Yourspace Studio Limited , 180 main road, west winch, king's lynn, PE330LJ

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

1 TER and DER

Fuel for main heating system: Grid electricity

Target Carbon Dioxide Emission Rate (TER)	28.63 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	22.49 kg/m²	OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.23 (max. 0.30)	0.23 (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	0.11 (max. 0.20)	0.11 (max. 0.35)	OK
Openings	1.91 (max. 2.00)	3.00 (max. 3.30)	OK

3 Design air permeability

Design air permeability at 50 pascals	6.00	
Maximum	10.0	OK

4 Heating efficiency

Main Heating system: Heat pumps with radiators or underfloor - electric
Mitsubishi ECODAN 5kW

Secondary heating system: None

5 Cylinder insulation

Hot water Storage:	Nominal cylinder loss: 2.37 kWh/day Permitted by DBSCG: 3.11 kWh/day	OK
Primary pipework insulated:	Yes	OK

6 Controls

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

7 Low energy lights

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

Regulations Compliance Report

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (North East England):	Not significant	**OK**
Based on:		
Overshading:	Average or unknown	
Windows facing: South	3.8m², Overhang twice as wide as window, ratio NaN	
Windows facing: South	7.14m², Overhang twice as wide as window, ratio NaN	
Roof windows facing: North	2m²	
Roof windows facing: South	0.8m²	
Ventilation rate:	8.00	
Blinds/curtains:	shutter closed 100% of daylight hours	

10 Key features

Roofs U-value	0.11 W/m²K

SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Mike Ovenden	**Stroma Number:**	STRO006697
Software Name:	Stroma FSAP 2009	**Software Version:**	Version: 1.4.0.73

Property Address: Plot 1 end terrace

Address : Plot 1, Penistone Coal Drops, St. Mary's Street, Penistone, Sheffield, S36 6DT

1. Overall dwelling dimensions:

	Area(m²)		Ave Height(m)		Volume(m³)	
Ground floor	39.42	(1a) x	2.6	(2a) =	102.49	(3a)
First floor	39.42	(1b) x	2.6	(2b) =	102.49	(3b)
Second floor	28.8	(1c) x	1.9	(2c) =	54.72	(3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	107.64	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		259.7	(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	1	+	0	+	0	=	1	x 20 =	20	(6b)
Number of intermittent fans							4	x 10 =	40	(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) =	60	÷ (5) =	0.23 (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				6 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.53 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides on which sheltered				0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =			1 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =			0.53 (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=	5.4	5.1	5.1	4.5	4.1	3.9	3.7	3.7	4.2	4.5	4.8	5.1

SAP WorkSheet: New dwelling design stage

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.35	1.27	1.27	1.12	1.02	0.98	0.92	0.92	1.05	1.12	1.2	1.27

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

0.72	0.68	0.68	0.6	0.54	0.52	0.49	0.49	0.56	0.6	0.64	0.68

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

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

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0

(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=	0.76	0.73	0.73	0.68	0.65	0.63	0.62	0.62	0.66	0.68	0.7	0.73

(24d)

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

(25)m=	0.76	0.73	0.73	0.68	0.65	0.63	0.62	0.62	0.66	0.68	0.7	0.73

(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			1.9	x	3	=	5.7			(26)
Windows Type 1			3.8	x	1/[1/(1.7)+ 0.04]	=	6.05			(27)
Windows Type 2			7.14	x	1/[1/(1.7)+ 0.04]	=	11.37			(27)
Rooflights Type 1			2	x	1/[1/(2) + 0.04]	=	4			(27b)
Rooflights Type 2			0.8	x	1/[1/(2) + 0.04]	=	1.6			(27b)
Floor			39.42	x	0.2	=	7.884			(28)
Walls	121.61	12.84	108.77	x	0.23	=	25.02			(29)
Roof	55.19	2.8	52.39	x	0.11	=	5.76			(30)
Total area of elements, m²			216.22							(31)
Party wall			57.71	x	0	=	0			(32)

** 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) = 66.96 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 15018.68 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (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 32.43 (36)

SAP WorkSheet: New dwelling design stage

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

Total fabric heat loss (33) + (36) = 99.4 (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=	64.87	62.49	62.49	58.14	55.55	54.34	53.19	53.19	56.17	58.14	60.25	62.49	(38)

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

(39)m=	164.27	161.89	161.89	157.54	154.94	153.73	152.59	152.59	155.57	157.54	159.65	161.89	

Average = Sum(39)$_{1...12}$ /12= 157.84 (39)

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

(40)m=	1.53	1.5	1.5	1.46	1.44	1.43	1.42	1.42	1.45	1.46	1.48	1.5	

Average = Sum(40)$_{1...12}$ /12= 1.47 (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 2.8 (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) + 36 100.7 (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=	110.77	106.74	102.71	98.68	94.66	90.63	90.63	94.66	98.68	102.71	106.74	110.77	

Total = Sum(44)$_{1...12}$ = 1208.37 (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=	164.66	144.01	148.61	129.56	124.31	107.27	99.4	114.07	115.43	134.52	146.84	159.46	

Total = Sum(45)$_{1...12}$ = 1588.15 (45)

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

(46)m=	24.7	21.6	22.29	19.43	18.65	16.09	14.91	17.11	17.31	20.18	22.03	23.92	(46)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (47)

Temperature factor from Table 2b 0 (48)

Energy lost from water storage, kWh/year (47) x (48) = 0 (49)

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

Cylinder volume (litres) including any solar storage within same 200 (50)

If community heating and no tank in dwelling, enter 110 litres in box (50)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in box (50)

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.01 (51)

Volume factor from Table 2a 0.84 (52)

Temperature factor from Table 2b 0.54 (53)

Energy lost from water storage, kWh/year ((50) x (51) x (52) x (53) = 1.05 (54)

Enter (49) or (54) in (55) 1.05 (55)

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

(56)m=	32.61	29.45	32.61	31.56	32.61	31.56	32.61	32.61	31.56	32.61	31.56	32.61	(56)

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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=	32.61	29.45	32.61	31.56	32.61	31.56	32.61	32.61	31.56	32.61	31.56	32.61	(57)

Primary circuit loss (annual) from Table 3 — 280 (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=	23.78	21.48	23.78	23.01	23.78	23.01	23.78	23.78	23.01	23.78	23.01	23.78	(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=	221.05	194.94	205	184.13	180.7	161.84	155.79	170.46	170	190.91	201.41	215.85	(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=	221.05	194.94	205	184.13	180.7	161.84	155.79	170.46	170	190.91	201.41	215.85	

Output from water heater (annual)$_{1...12}$ — 2252.09 (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=	99.86	88.63	94.52	86.73	86.45	79.32	78.16	83.04	82.04	89.84	92.48	98.13	(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=	167.99	167.99	167.99	167.99	167.99	167.99	167.99	167.99	167.99	167.99	167.99	167.99	(66)

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

(67)m=	64.84	57.59	46.83	35.46	26.5	22.38	24.18	31.43	42.18	53.56	62.51	66.64	(67)

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

(68)m=	400.18	404.33	393.87	371.59	343.47	317.04	299.38	295.23	305.69	327.97	356.09	382.52	(68)

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

(69)m=	54.6	54.6	54.6	54.6	54.6	54.6	54.6	54.6	54.6	54.6	54.6	54.6	(69)

Pumps and fans gains (Table 5a)

(70)m=	10	10	10	10	10	10	10	10	10	10	10	10	(70)

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

(71)m=	-112	-112	-112	-112	-112	-112	-112	-112	-112	-112	-112	-112	(71)

Water heating gains (Table 5)

(72)m=	134.22	131.89	127.05	120.46	116.19	110.17	105.06	111.61	113.94	120.75	128.45	131.9	(72)

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

(73)m=	719.83	714.41	688.35	648.11	606.76	570.18	549.22	558.87	582.41	622.88	667.65	701.66	(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)

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South	0.9x	0.77	x	3.8	x	47.32	x	0.63	x	0.7	=	54.96	(78)
South	0.9x	0.77	x	7.14	x	47.32	x	0.63	x	0.7	=	103.26	(78)
South	0.9x	0.77	x	3.8	x	77.18	x	0.63	x	0.7	=	89.64	(78)
South	0.9x	0.77	x	7.14	x	77.18	x	0.63	x	0.7	=	168.42	(78)
South	0.9x	0.77	x	3.8	x	94.25	x	0.63	x	0.7	=	109.45	(78)
South	0.9x	0.77	x	7.14	x	94.25	x	0.63	x	0.7	=	205.65	(78)
South	0.9x	0.77	x	3.8	x	105.11	x	0.63	x	0.7	=	122.07	(78)
South	0.9x	0.77	x	7.14	x	105.11	x	0.63	x	0.7	=	229.37	(78)
South	0.9x	0.77	x	3.8	x	108.55	x	0.63	x	0.7	=	126.06	(78)
South	0.9x	0.77	x	7.14	x	108.55	x	0.63	x	0.7	=	236.86	(78)
South	0.9x	0.77	x	3.8	x	108.9	x	0.63	x	0.7	=	126.47	(78)
South	0.9x	0.77	x	7.14	x	108.9	x	0.63	x	0.7	=	237.62	(78)
South	0.9x	0.77	x	3.8	x	107.14	x	0.63	x	0.7	=	124.42	(78)
South	0.9x	0.77	x	7.14	x	107.14	x	0.63	x	0.7	=	233.78	(78)
South	0.9x	0.77	x	3.8	x	103.88	x	0.63	x	0.7	=	120.64	(78)
South	0.9x	0.77	x	7.14	x	103.88	x	0.63	x	0.7	=	226.68	(78)
South	0.9x	0.77	x	3.8	x	99.99	x	0.63	x	0.7	=	116.12	(78)
South	0.9x	0.77	x	7.14	x	99.99	x	0.63	x	0.7	=	218.19	(78)
South	0.9x	0.77	x	3.8	x	85.29	x	0.63	x	0.7	=	99.05	(78)
South	0.9x	0.77	x	7.14	x	85.29	x	0.63	x	0.7	=	186.11	(78)
South	0.9x	0.77	x	3.8	x	56.07	x	0.63	x	0.7	=	65.11	(78)
South	0.9x	0.77	x	7.14	x	56.07	x	0.63	x	0.7	=	122.35	(78)
South	0.9x	0.77	x	3.8	x	40.89	x	0.63	x	0.7	=	47.49	(78)
South	0.9x	0.77	x	7.14	x	40.89	x	0.63	x	0.7	=	89.23	(78)
Rooflights	0.9x	1	x	2	x	10.73	x	0.63	x	0.7	=	8.51	(82)
Rooflights	0.9x	1	x	0.8	x	26	x	0.63	x	0.7	=	8.26	(82)
Rooflights	0.9x	1	x	2	x	20.36	x	0.63	x	0.7	=	16.16	(82)
Rooflights	0.9x	1	x	0.8	x	54	x	0.63	x	0.7	=	17.15	(82)
Rooflights	0.9x	1	x	2	x	33.31	x	0.63	x	0.7	=	26.44	(82)
Rooflights	0.9x	1	x	0.8	x	94	x	0.63	x	0.7	=	29.85	(82)
Rooflights	0.9x	1	x	2	x	54.64	x	0.63	x	0.7	=	43.37	(82)
Rooflights	0.9x	1	x	0.8	x	150	x	0.63	x	0.7	=	47.63	(82)
Rooflights	0.9x	1	x	2	x	75.22	x	0.63	x	0.7	=	59.71	(82)
Rooflights	0.9x	1	x	0.8	x	190	x	0.63	x	0.7	=	60.33	(82)
Rooflights	0.9x	1	x	2	x	84.09	x	0.63	x	0.7	=	66.75	(82)
Rooflights	0.9x	1	x	0.8	x	201	x	0.63	x	0.7	=	63.82	(82)
Rooflights	0.9x	1	x	2	x	79.12	x	0.63	x	0.7	=	62.81	(82)
Rooflights	0.9x	1	x	0.8	x	194	x	0.63	x	0.7	=	61.6	(82)
Rooflights	0.9x	1	x	2	x	61.56	x	0.63	x	0.7	=	48.87	(82)
Rooflights	0.9x	1	x	0.8	x	164	x	0.63	x	0.7	=	52.07	(82)
Rooflights	0.9x	1	x	2	x	41.09	x	0.63	x	0.7	=	32.61	(82)

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Rooflights 0.9x	1	x	0.8	x	116	x	0.63	x	0.7	=	36.83	(82)
Rooflights 0.9x	1	x	2	x	24.81	x	0.63	x	0.7	=	19.7	(82)
Rooflights 0.9x	1	x	0.8	x	68	x	0.63	x	0.7	=	21.59	(82)
Rooflights 0.9x	1	x	2	x	13.22	x	0.63	x	0.7	=	10.49	(82)
Rooflights 0.9x	1	x	0.8	x	33	x	0.63	x	0.7	=	10.48	(82)
Rooflights 0.9x	1	x	2	x	8.94	x	0.63	x	0.7	=	7.1	(82)
Rooflights 0.9x	1	x	0.8	x	21	x	0.63	x	0.7	=	6.67	(82)

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

(83)m=	174.99	291.36	371.39	442.44	482.96	494.66	482.61	448.27	403.76	326.45	208.43	150.48	(83)

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

(84)m=	894.83	1005.77	1059.74	1090.55	1089.72	1064.85	1031.82	1007.13	986.17	949.33	876.08	852.14	(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=	0.99	0.99	0.98	0.96	0.9	0.78	0.58	0.59	0.83	0.95	0.99	0.99	(86)

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

(87)m=	21	21	21	21	21	21	21	21	21	21	21	21	(87)

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

(88)m=	19.67	19.69	19.69	19.72	19.74	19.75	19.75	19.75	19.73	19.72	19.7	19.69	(88)

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

(89)m=	0.99	0.98	0.97	0.94	0.86	0.67	0.42	0.43	0.74	0.93	0.98	0.99	(89)

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

(90)m=	19.67	19.69	19.69	19.72	19.74	19.75	19.75	19.75	19.73	19.72	19.7	19.69	(90)

fLA = Living area ÷ (4) = 0.2 (91)

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

(92)m=	19.94	19.95	19.95	19.98	19.99	20	20	20	19.99	19.98	19.97	19.95	(92)

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

(93)m=	19.84	19.85	19.85	19.88	19.89	19.9	19.9	19.9	19.89	19.88	19.87	19.85	(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=	0.99	0.98	0.97	0.94	0.86	0.69	0.44	0.45	0.75	0.93	0.98	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	885.91	988.84	1027.09	1028.86	942.01	733.07	450.33	449.6	743.32	883.41	860.89	844.29	(95)

Monthly average external temperature from Table 8

(96)m=	4.5	5	6.8	8.7	11.7	14.6	16.9	16.9	14.3	10.8	7	4.9	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	2519.82	2404.5	2113.1	1760.79	1269.17	814.49	458.44	458.44	869.28	1429.96	2053.87	2420.69	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	1215.63	951.33	807.99	526.99	243.41	0	0	0	0	406.63	858.95	1172.85	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	6183.77	(98)
Space heating requirement in kWh/m²/year	57.45	(99)

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

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	324.13	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	1215.63	951.33	807.99	526.99	243.41	0	0	0	0	406.63	858.95	1172.85	
(211)m = {[(98)m x (204)] + (210)m } x 100 ÷ (206)	375.04	293.5	249.28	162.58	75.1	0	0	0	0	125.45	265	361.84	(211)

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 1907.78 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] + (214) m } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

	221.05	194.94	205	184.13	180.7	161.84	155.79	170.46	170	190.91	201.41	215.85	

Efficiency of water heater 112.5 (216)

(217)m=	112.5	112.5	112.5	112.5	112.5	112.5	112.5	112.5	112.5	112.5	112.5	112.5	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	196.49	173.28	182.22	163.67	160.63	143.86	138.48	151.52	151.11	169.7	179.03	191.87	

Total = Sum(219a)$_{1...12}$ = 2001.86 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		1907.78
Water heating fuel used		2001.86
Electricity for pumps, fans and electric keep-hot		
Total electricity for the above, kWh/year sum of (230a)…(230g) =		0 (231)
Electricity for lighting		458.02 (232)

10a. Fuel costs - individual heating systems:

	Fuel kWh/year	**Fuel Price** (Table 12)	**Fuel Cost** £/year
Space heating - main system 1	(211) x	11.46 x 0.01 =	218.63 (240)
Space heating - main system 2	(213) x	0 x 0.01 =	0 (241)
Space heating - secondary	(215) x	0 x 0.01 =	0 (242)

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Water heating cost (other fuel)	(219)	11.46	x 0.01 =	229.41	(247)
Pumps, fans and electric keep-hot	(231)	11.46	x 0.01 =	0	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a					
Energy for lighting	(232)	11.46	x 0.01 =	52.49	(250)
Additional standing charges (Table 12)				0	(251)
Appendix Q items: repeat lines (253) and (254) as needed					
Total energy cost	(245)...(247) + (250)…(254) =			500.53	(255)

11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.47	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.54	(257)
SAP rating (Section 12)		78.5	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

		Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211)	x		0.517	=	986.32	(261)
Space heating (secondary)	(215)	x		0	=	0	(263)
Water heating	(219)	x		0.517	=	1034.96	(264)
Space and water heating	(261) + (262) + (263) + (264) =					2021.28	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x		0.517	=	0	(267)
Electricity for lighting	(232)	x		0.517	=	236.79	(268)
Total CO2, kg/year			sum of (265)…(271) =			2258.08	(272)
CO2 emissions per m²			(272) ÷ (4) =			20.98	(273)
EI rating (section 14)						80	(274)

13a. Primary Energy

		Energy kWh/year		**Primary** factor		**P. Energy** kWh/year	
Space heating (main system 1)	(211)	x		2.92	=	5570.71	(261)
Space heating (secondary)	(215)	x		0	=	0	(263)
Energy for water heating	(219)	x		2.92	=	5845.42	(264)
Space and water heating	(261) + (262) + (263) + (264) =					11416.14	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x		2.92	=	0	(267)
Electricity for lighting	(232)	x		0	=	1337.41	(268)
'Total Primary Energy			sum of (265)…(271) =			12753.55	(272)
Primary energy kWh/m²/year			(272) ÷ (4) =			118.48	(273)

Regulations Compliance Report

Approved Document L1A 2010 edition assessed by Stroma FSAP 2009 program, Version: 1.4.0.73
Printed on 02 May 2012 at 12:31:44

Project Information:

Assessed By: Mike Ovenden (STRO006697) **Building Type:** Mid-terrace House

Dwelling Details:

NEW DWELLING DESIGN STAGE

Site Reference : Plot 2 mid terrace **Plot Reference:** Plot 2

Address : Plot 2, Penistone Coal Drops, St. Mary's Street, Penistone, Sheffield, S36 6DT

Client Details:

Name: Stephen Sharp

Address : Yourspace Studio Limited , 180 main road, west winch, king's lynn, PE330LJ

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

1 TER and DER

Fuel for main heating system: Grid electricity

Target Carbon Dioxide Emission Rate (TER)	25.04 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	20.07 kg/m²	OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.23 (max. 0.30)	0.23 (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	0.11 (max. 0.20)	0.11 (max. 0.35)	OK
Openings	1.91 (max. 2.00)	3.00 (max. 3.30)	OK

3 Design air permeability

Design air permeability at 50 pascals	6.00	
Maximum	10.0	OK

4 Heating efficiency

Main Heating system: Heat pumps with radiators or underfloor - electric
Mitsubishi ECODAN 5kW

Secondary heating system: None

5 Cylinder insulation

Hot water Storage:	Nominal cylinder loss: 2.37 kWh/day Permitted by DBSCG: 3.11 kWh/day	OK
Primary pipework insulated:	Yes	OK

6 Controls

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

7 Low energy lights

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

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8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (North East England):	Not significant	**OK**
Based on:		
Overshading:	Average or unknown	
Windows facing: South	3.8m², Overhang twice as wide as window, ratio NaN	
Windows facing: South	7.14m², Overhang twice as wide as window, ratio NaN	
Roof windows facing: North	2m²	
Roof windows facing: South	0.8m²	
Ventilation rate:	8.00	
Blinds/curtains:	shutter closed 100% of daylight hours	

10 Key features

Roofs U-value	0.11 W/m²K

SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Mike Ovenden	**Stroma Number:**	STRO006697
Software Name:	Stroma FSAP 2009	**Software Version:**	Version: 1.4.0.73

Property Address: Plot 2 mid terrace

Address : Plot 2, Penistone Coal Drops, St. Mary's Street, Penistone, Sheffield, S36 6DT

1. Overall dwelling dimensions:

	Area(m²)		Ave Height(m)		Volume(m³)	
Ground floor	39.42 (1a)	x	2.6 (2a)	=	102.49	(3a)
First floor	39.42 (1b)	x	2.6 (2b)	=	102.49	(3b)
Second floor	28.8 (1c)	x	1.9 (2c)	=	54.72	(3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	107.64	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	=	259.7	(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	1	+	0	+	0	=	1	x 20 =	20	(6b)
Number of intermittent fans							5	x 10 =	50	(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) =	70	÷ (5) =	0.27	(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			6	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.57	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides on which sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.48	(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=	5.4	5.1	5.1	4.5	4.1	3.9	3.7	3.7	4.2	4.5	4.8	5.1

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Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.35	1.27	1.27	1.12	1.02	0.98	0.92	0.92	1.05	1.12	1.2	1.27

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

0.65	0.62	0.62	0.54	0.5	0.47	0.45	0.45	0.51	0.54	0.58	0.62

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

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

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0

(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=	0.71	0.69	0.69	0.65	0.62	0.61	0.6	0.6	0.63	0.65	0.67	0.69

(24d)

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

(25)m=	0.71	0.69	0.69	0.65	0.62	0.61	0.6	0.6	0.63	0.65	0.67	0.69

(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			1.9	x	3	=	5.7			(26)
Windows Type 1			3.8	x	1/[1/(1.7)+ 0.04]	=	6.05			(27)
Windows Type 2			7.14	x	1/[1/(1.7)+ 0.04]	=	11.37			(27)
Rooflights Type 1			2	x	1/[1/(2) + 0.04]	=	4			(27b)
Rooflights Type 2			0.8	x	1/[1/(2) + 0.04]	=	1.6			(27b)
Floor			39.42	x	0.2	=	7.884			(28)
Walls	63.9	12.84	51.06	x	0.23	=	11.74			(29)
Roof	55.19	2.8	52.39	x	0.11	=	5.76			(30)
Total area of elements, m²			158.51							(31)
Party wall			115.42	x	0	=	0			(32)

** 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) = 53.69 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 13575.93 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (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 23.78 (36)

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

Total fabric heat loss (33) + (36) = 77.47 (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=	61.15	59.18	59.18	55.56	53.4	52.4	51.44	51.44	53.92	55.56	57.31	59.18	(38)

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

(39)m=	138.62	136.64	136.64	133.03	130.87	129.86	128.91	128.91	131.39	133.03	134.78	136.64	

Average = Sum(39)$_{1...12}$ /12= 133.28 (39)

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

(40)m=	1.29	1.27	1.27	1.24	1.22	1.21	1.2	1.2	1.22	1.24	1.25	1.27	

Average = Sum(40)$_{1...12}$ /12= 1.24 (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 2.8 (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) + 36 100.7 (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=	110.77	106.74	102.71	98.68	94.66	90.63	90.63	94.66	98.68	102.71	106.74	110.77	

Total = Sum(44)$_{1...12}$ = 1208.37 (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=	164.66	144.01	148.61	129.56	124.31	107.27	99.4	114.07	115.43	134.52	146.84	159.46	

Total = Sum(45)$_{1...12}$ = 1588.15 (45)

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

(46)m=	24.7	21.6	22.29	19.43	18.65	16.09	14.91	17.11	17.31	20.18	22.03	23.92	(46)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (47)

Temperature factor from Table 2b 0 (48)

Energy lost from water storage, kWh/year (47) x (48) = 0 (49)

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

Cylinder volume (litres) including any solar storage within same 200 (50)

If community heating and no tank in dwelling, enter 110 litres in box (50)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in box (50)

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.01 (51)

Volume factor from Table 2a 0.84 (52)

Temperature factor from Table 2b 0.54 (53)

Energy lost from water storage, kWh/year ((50) x (51) x (52) x (53) = 1.05 (54)

Enter (49) or (54) in (55) 1.05 (55)

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

(56)m=	32.61	29.45	32.61	31.56	32.61	31.56	32.61	32.61	31.56	32.61	31.56	32.61	(56)

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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=	32.61	29.45	32.61	31.56	32.61	31.56	32.61	32.61	31.56	32.61	31.56	32.61	(57)

Primary circuit loss (annual) from Table 3 — 280 (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=	23.78	21.48	23.78	23.01	23.78	23.01	23.78	23.78	23.01	23.78	23.01	23.78	(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=	221.05	194.94	205	184.13	180.7	161.84	155.79	170.46	170	190.91	201.41	215.85	(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=	221.05	194.94	205	184.13	180.7	161.84	155.79	170.46	170	190.91	201.41	215.85	

Output from water heater (annual)$_{1...12}$ — 2252.09 (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=	99.86	88.63	94.52	86.73	86.45	79.32	78.16	83.04	82.04	89.84	92.48	98.13	(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=	167.99	167.99	167.99	167.99	167.99	167.99	167.99	167.99	167.99	167.99	167.99	167.99	(66)

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

(67)m=	64.84	57.59	46.83	35.46	26.5	22.38	24.18	31.43	42.18	53.56	62.51	66.64	(67)

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

(68)m=	400.18	404.33	393.87	371.59	343.47	317.04	299.38	295.23	305.69	327.97	356.09	382.52	(68)

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

(69)m=	54.6	54.6	54.6	54.6	54.6	54.6	54.6	54.6	54.6	54.6	54.6	54.6	(69)

Pumps and fans gains (Table 5a)

(70)m=	10	10	10	10	10	10	10	10	10	10	10	10	(70)

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

(71)m=	-112	-112	-112	-112	-112	-112	-112	-112	-112	-112	-112	-112	(71)

Water heating gains (Table 5)

(72)m=	134.22	131.89	127.05	120.46	116.19	110.17	105.06	111.61	113.94	120.75	128.45	131.9	(72)

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

(73)m=	719.83	714.41	688.35	648.11	606.76	570.18	549.22	558.87	582.41	622.88	667.65	701.66	(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)

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South	0.9x	0.77	x	3.8	x	47.32	x	0.63	x	0.7	=	54.96	(78)
South	0.9x	0.77	x	7.14	x	47.32	x	0.63	x	0.7	=	103.26	(78)
South	0.9x	0.77	x	3.8	x	77.18	x	0.63	x	0.7	=	89.64	(78)
South	0.9x	0.77	x	7.14	x	77.18	x	0.63	x	0.7	=	168.42	(78)
South	0.9x	0.77	x	3.8	x	94.25	x	0.63	x	0.7	=	109.45	(78)
South	0.9x	0.77	x	7.14	x	94.25	x	0.63	x	0.7	=	205.65	(78)
South	0.9x	0.77	x	3.8	x	105.11	x	0.63	x	0.7	=	122.07	(78)
South	0.9x	0.77	x	7.14	x	105.11	x	0.63	x	0.7	=	229.37	(78)
South	0.9x	0.77	x	3.8	x	108.55	x	0.63	x	0.7	=	126.06	(78)
South	0.9x	0.77	x	7.14	x	108.55	x	0.63	x	0.7	=	236.86	(78)
South	0.9x	0.77	x	3.8	x	108.9	x	0.63	x	0.7	=	126.47	(78)
South	0.9x	0.77	x	7.14	x	108.9	x	0.63	x	0.7	=	237.62	(78)
South	0.9x	0.77	x	3.8	x	107.14	x	0.63	x	0.7	=	124.42	(78)
South	0.9x	0.77	x	7.14	x	107.14	x	0.63	x	0.7	=	233.78	(78)
South	0.9x	0.77	x	3.8	x	103.88	x	0.63	x	0.7	=	120.64	(78)
South	0.9x	0.77	x	7.14	x	103.88	x	0.63	x	0.7	=	226.68	(78)
South	0.9x	0.77	x	3.8	x	99.99	x	0.63	x	0.7	=	116.12	(78)
South	0.9x	0.77	x	7.14	x	99.99	x	0.63	x	0.7	=	218.19	(78)
South	0.9x	0.77	x	3.8	x	85.29	x	0.63	x	0.7	=	99.05	(78)
South	0.9x	0.77	x	7.14	x	85.29	x	0.63	x	0.7	=	186.11	(78)
South	0.9x	0.77	x	3.8	x	56.07	x	0.63	x	0.7	=	65.11	(78)
South	0.9x	0.77	x	7.14	x	56.07	x	0.63	x	0.7	=	122.35	(78)
South	0.9x	0.77	x	3.8	x	40.89	x	0.63	x	0.7	=	47.49	(78)
South	0.9x	0.77	x	7.14	x	40.89	x	0.63	x	0.7	=	89.23	(78)
Rooflights	0.9x	1	x	2	x	10.73	x	0.63	x	0.7	=	8.51	(82)
Rooflights	0.9x	1	x	0.8	x	26	x	0.63	x	0.7	=	8.26	(82)
Rooflights	0.9x	1	x	2	x	20.36	x	0.63	x	0.7	=	16.16	(82)
Rooflights	0.9x	1	x	0.8	x	54	x	0.63	x	0.7	=	17.15	(82)
Rooflights	0.9x	1	x	2	x	33.31	x	0.63	x	0.7	=	26.44	(82)
Rooflights	0.9x	1	x	0.8	x	94	x	0.63	x	0.7	=	29.85	(82)
Rooflights	0.9x	1	x	2	x	54.64	x	0.63	x	0.7	=	43.37	(82)
Rooflights	0.9x	1	x	0.8	x	150	x	0.63	x	0.7	=	47.63	(82)
Rooflights	0.9x	1	x	2	x	75.22	x	0.63	x	0.7	=	59.71	(82)
Rooflights	0.9x	1	x	0.8	x	190	x	0.63	x	0.7	=	60.33	(82)
Rooflights	0.9x	1	x	2	x	84.09	x	0.63	x	0.7	=	66.75	(82)
Rooflights	0.9x	1	x	0.8	x	201	x	0.63	x	0.7	=	63.82	(82)
Rooflights	0.9x	1	x	2	x	79.12	x	0.63	x	0.7	=	62.81	(82)
Rooflights	0.9x	1	x	0.8	x	194	x	0.63	x	0.7	=	61.6	(82)
Rooflights	0.9x	1	x	2	x	61.56	x	0.63	x	0.7	=	48.87	(82)
Rooflights	0.9x	1	x	0.8	x	164	x	0.63	x	0.7	=	52.07	(82)
Rooflights	0.9x	1	x	2	x	41.09	x	0.63	x	0.7	=	32.61	(82)

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Rooflights 0.9x	1	x	0.8	x	116	x	0.63	x	0.7	=	36.83	(82)
Rooflights 0.9x	1	x	2	x	24.81	x	0.63	x	0.7	=	19.7	(82)
Rooflights 0.9x	1	x	0.8	x	68	x	0.63	x	0.7	=	21.59	(82)
Rooflights 0.9x	1	x	2	x	13.22	x	0.63	x	0.7	=	10.49	(82)
Rooflights 0.9x	1	x	0.8	x	33	x	0.63	x	0.7	=	10.48	(82)
Rooflights 0.9x	1	x	2	x	8.94	x	0.63	x	0.7	=	7.1	(82)
Rooflights 0.9x	1	x	0.8	x	21	x	0.63	x	0.7	=	6.67	(82)

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

(83)m=	174.99	291.36	371.39	442.44	482.96	494.66	482.61	448.27	403.76	326.45	208.43	150.48	(83)

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

(84)m=	894.83	1005.77	1059.74	1090.55	1089.72	1064.85	1031.82	1007.13	986.17	949.33	876.08	852.14	(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=	0.99	0.99	0.97	0.95	0.87	0.71	0.5	0.51	0.78	0.94	0.99	0.99	(86)

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

(87)m=	21	21	21	21	21	21	21	21	21	21	21	21	(87)

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

(88)m=	19.85	19.87	19.87	19.89	19.91	19.92	19.92	19.92	19.91	19.89	19.88	19.87	(88)

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

(89)m=	0.99	0.98	0.96	0.93	0.82	0.62	0.38	0.38	0.69	0.91	0.98	0.99	(89)

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

(90)m=	19.85	19.87	19.87	19.89	19.91	19.92	19.92	19.92	19.91	19.89	19.88	19.87	(90)

fLA = Living area ÷ (4) = 0.2 (91)

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

(92)m=	20.08	20.1	20.1	20.12	20.13	20.14	20.14	20.14	20.13	20.12	20.11	20.1	(92)

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

(93)m=	19.98	20	20	20.02	20.03	20.04	20.04	20.04	20.03	20.02	20.01	20	(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=	0.99	0.98	0.96	0.93	0.83	0.63	0.39	0.4	0.7	0.91	0.98	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	885.39	986.67	1020.84	1013.38	902.24	670.06	402.31	402.03	690.78	866.7	858.9	843.86	(95)

Monthly average external temperature from Table 8

(96)m=	4.5	5	6.8	8.7	11.7	14.6	16.9	16.9	14.3	10.8	7	4.9	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	2146.43	2049.06	1803.11	1505.45	1090.07	705.87	404.92	404.92	752.4	1226.1	1753.02	2062.73	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	938.21	713.93	582.01	354.29	139.75	0	0	0	0	267.39	643.76	906.84	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	4546.18	(98)
Space heating requirement in kWh/m²/year	42.24	(99)

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

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	321.8	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	938.21	713.93	582.01	354.29	139.75	0	0	0	0	267.39	643.76	906.84	
(211)m = {[(98)m x (204)] + (210)m } x 100 ÷ (206)	291.55	221.85	180.86	110.1	43.43	0	0	0	0	83.09	200.05	281.8	(211)

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 1412.73 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] + (214) m } x 100 ÷ (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Output from water heater (calculated above)	221.05	194.94	205	184.13	180.7	161.84	155.79	170.46	170	190.91	201.41	215.85	
Efficiency of water heater													112.5 (216)
(217)m=	112.5	112.5	112.5	112.5	112.5	112.5	112.5	112.5	112.5	112.5	112.5	112.5	(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m													
(219)m=	196.49	173.28	182.22	163.67	160.63	143.86	138.48	151.52	151.11	169.7	179.03	191.87	

Total = Sum(219a)$_{1...12}$ = 2001.86 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		1412.73
Water heating fuel used		2001.86
Electricity for pumps, fans and electric keep-hot		
Total electricity for the above, kWh/year sum of (230a)…(230g) =		0 (231)
Electricity for lighting		458.02 (232)

10a. Fuel costs - individual heating systems:

	Fuel kWh/year	**Fuel Price** (Table 12)		**Fuel Cost** £/year
Space heating - main system 1	(211) x	11.46	x 0.01 =	161.9 (240)
Space heating - main system 2	(213) x	0	x 0.01 =	0 (241)
Space heating - secondary	(215) x	0	x 0.01 =	0 (242)

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Water heating cost (other fuel)	(219)	11.46	x 0.01 =	229.41	(247)
Pumps, fans and electric keep-hot	(231)	11.46	x 0.01 =	0	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a					
Energy for lighting	(232)	11.46	x 0.01 =	52.49	(250)
Additional standing charges (Table 12)				0	(251)
Appendix Q items: repeat lines (253) and (254) as needed					
Total energy cost	(245)...(247) + (250)...(254) =			443.8	(255)

11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.47	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.37	(257)
SAP rating (Section 12)		80.94	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

		Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211)	x	0.517	=	730.38	(261)
Space heating (secondary)	(215)	x	0	=	0	(263)
Water heating	(219)	x	0.517	=	1034.96	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1765.34	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.517	=	0	(267)
Electricity for lighting	(232)	x	0.517	=	236.79	(268)
Total CO2, kg/year	sum of (265)…(271) =				2002.14	(272)
CO2 emissions per m²	(272) ÷ (4) =				18.6	(273)
EI rating (section 14)					82	(274)

13a. Primary Energy

		Energy kWh/year		**Primary** factor		**P. Energy** kWh/year	
Space heating (main system 1)	(211)	x	2.92	=	4125.17	(261)
Space heating (secondary)	(215)	x	0	=	0	(263)
Energy for water heating	(219)	x	2.92	=	5845.42	(264)
Space and water heating	(261) + (262) + (263) + (264) =				9970.6	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	2.92	=	0	(267)
Electricity for lighting	(232)	x	0	=	1337.41	(268)
'Total Primary Energy	sum of (265)…(271) =				11308.01	(272)
Primary energy kWh/m²/year	(272) ÷ (4) =				105.05	(273)

Regulations Compliance Report

Approved Document L1A 2010 edition assessed by Stroma FSAP 2009 program, Version: 1.4.0.73
Printed on 02 May 2012 at 12:31:37

Project Information:

Assessed By: Mike Ovenden (STRO006697) **Building Type:** Mid-terrace House

Dwelling Details:

NEW DWELLING DESIGN STAGE

Site Reference : Plot 3 mid terrace **Plot Reference:** Plot 3

Address : Plot 3, Penistone Coal Drops, St. Mary's Street, Penistone, Sheffield, S36 6DT

Client Details:

Name: Stephen Sharp

Address : Yourspace Studio Limited , 180 main road, west winch, king's lynn, PE330LJ

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

1 TER and DER

Fuel for main heating system: Grid electricity

Target Carbon Dioxide Emission Rate (TER)	28.71 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	24.05 kg/m²	OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.23 (max. 0.30)	0.23 (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	0.14 (max. 0.20)	0.14 (max. 0.35)	OK
Openings	1.89 (max. 2.00)	3.00 (max. 3.30)	OK

3 Design air permeability

Design air permeability at 50 pascals	6.00	
Maximum	10.0	OK

4 Heating efficiency

Main Heating system:

Heat pumps with radiators or underfloor - electric
Mitsubishi ECODAN 5kW

Secondary heating system: None

5 Cylinder insulation

Hot water Storage:	Nominal cylinder loss: 2.37 kWh/day Permitted by DBSCG: 3.11 kWh/day	OK
Primary pipework insulated:	Yes	OK

6 Controls

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

7 Low energy lights

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

Regulations Compliance Report

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (North East England):	Not significant	**OK**
Based on:		
Overshading:	Average or unknown	
Windows facing: South	3.8m², Overhang twice as wide as window, ratio NaN	
Windows facing: South	7.14m², Overhang twice as wide as window, ratio NaN	
Ventilation rate:	8.00	
Blinds/curtains:	shutter closed 100% of daylight hours	

10 Key features

None

SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Mike Ovenden	**Stroma Number:**	STRO006697
Software Name:	Stroma FSAP 2009	**Software Version:**	Version: 1.4.0.73

Property Address: Plot 3 mid terrace

Address : Plot 3, Penistone Coal Drops, St. Mary's Street, Penistone, Sheffield, S36 6DT

1. Overall dwelling dimensions:

	Area(m²)		Ave Height(m)		Volume(m³)	
Ground floor	36.9	(1a) x	2.6	(2a) =	95.94	(3a)
First floor	36.9	(1b) x	2.6	(2b) =	95.94	(3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	73.8	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		191.88	(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	1	+	0	+	0	=	1	x 20 =	20	(6b)
Number of intermittent fans							3	x 10 =	30	(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) =	50	÷ (5) =	0.26 (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				6 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.56 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides on which sheltered				2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =			0.85 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =			0.48 (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=	5.4	5.1	5.1	4.5	4.1	3.9	3.7	3.7	4.2	4.5	4.8	5.1

SAP WorkSheet: New dwelling design stage

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.35	1.27	1.27	1.12	1.02	0.98	0.92	0.92	1.05	1.12	1.2	1.27

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

0.64	0.61	0.61	0.54	0.49	0.46	0.44	0.44	0.5	0.54	0.57	0.61

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

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

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0

(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=	0.71	0.68	0.68	0.64	0.62	0.61	0.6	0.6	0.63	0.64	0.66	0.68

(24d)

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

(25)m=	0.71	0.68	0.68	0.64	0.62	0.61	0.6	0.6	0.63	0.64	0.66	0.68

(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			1.9	x	3	=	5.7			(26)
Windows Type 1			3.8	x	1/[1/(1.7)+ 0.04]	=	6.05			(27)
Windows Type 2			7.14	x	1/[1/(1.7)+ 0.04]	=	11.37			(27)
Floor			36.9	x	0.2	=	7.380001			(28)
Walls	46.8	12.84	33.96	x	0.23	=	7.81			(29)
Roof	36.9	0	36.9	x	0.14	=	5.17			(30)
Total area of elements, m²			120.6							(31)
Party wall			85.28	x	0	=	0			(32)

** 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) = 43.47 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 10605.9 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (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 18.09 (36)

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

Total fabric heat loss (33) + (36) = 61.56 (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=	44.76	43.35	43.35	40.76	39.21	38.49	37.81	37.81	39.59	40.76	42.01	43.35	(38)

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

(39)m=	106.32	104.91	104.91	102.32	100.77	100.05	99.37	99.37	101.15	102.32	103.57	104.91	

Average = Sum(39)$_{1...12}$ /12= 102.5 (39)

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

(40)m=	1.44	1.42	1.42	1.39	1.37	1.36	1.35	1.35	1.37	1.39	1.4	1.42	

Average = Sum(40)$_{1...12}$ /12= 1.39 (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 89.65 (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=	98.62	95.03	91.44	87.86	84.27	80.69	80.69	84.27	87.86	91.44	95.03	98.62	

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

Total = Sum(44)$_{1...12}$ = 1075.8 (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=	146.59	128.21	132.3	115.34	110.68	95.5	88.5	101.55	102.77	119.77	130.73	141.97	

Total = Sum(45)$_{1...12}$ = 1413.92 (45)

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

(46)m=	21.99	19.23	19.85	17.3	16.6	14.33	13.27	15.23	15.42	17.96	19.61	21.3	(46)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (47)

Temperature factor from Table 2b 0 (48)

Energy lost from water storage, kWh/year (47) x (48) = 0 (49)

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

Cylinder volume (litres) including any solar storage within same 200 (50)

If community heating and no tank in dwelling, enter 110 litres in box (50)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in box (50)

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.01 (51)

Volume factor from Table 2a 0.84 (52)

Temperature factor from Table 2b 0.54 (53)

Energy lost from water storage, kWh/year ((50) x (51) x (52) x (53) = 1.05 (54)

Enter (49) or (54) in (55) 1.05 (55)

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

(56)m=	32.61	29.45	32.61	31.56	32.61	31.56	32.61	32.61	31.56	32.61	31.56	32.61	(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=	32.61	29.45	32.61	31.56	32.61	31.56	32.61	32.61	31.56	32.61	31.56	32.61	(57)

SAP WorkSheet: New dwelling design stage

Primary circuit loss (annual) from Table 3 | 280 | (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=	23.78	21.48	23.78	23.01	23.78	23.01	23.78	23.78	23.01	23.78	23.01	23.78	(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=	202.98	179.14	188.69	169.91	167.06	150.07	144.89	157.94	157.34	176.15	185.3	198.36	(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=	202.98	179.14	188.69	169.91	167.06	150.07	144.89	157.94	157.34	176.15	185.3	198.36	

Output from water heater (annual)$_{1...12}$ | 2077.85 | (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=	93.85	83.38	89.1	82.01	81.91	75.41	74.54	78.88	77.83	84.93	87.12	92.32	(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=	140.08	140.08	140.08	140.08	140.08	140.08	140.08	140.08	140.08	140.08	140.08	140.08	(66)

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

(67)m=	48.65	43.21	35.14	26.61	19.89	16.79	18.14	23.58	31.65	40.19	46.91	50.01	(67)

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

(68)m=	307.46	310.65	302.61	285.5	263.89	243.58	230.02	226.83	234.87	251.98	273.59	293.89	(68)

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

(69)m=	51.34	51.34	51.34	51.34	51.34	51.34	51.34	51.34	51.34	51.34	51.34	51.34	(69)

Pumps and fans gains (Table 5a)

(70)m=	10	10	10	10	10	10	10	10	10	10	10	10	(70)

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

(71)m=	-93.39	-93.39	-93.39	-93.39	-93.39	-93.39	-93.39	-93.39	-93.39	-93.39	-93.39	-93.39	(71)

Water heating gains (Table 5)

(72)m=	126.15	124.07	119.76	113.9	110.1	104.74	100.18	106.02	108.09	114.16	121.01	124.08	(72)

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

(73)m=	590.3	585.98	565.55	534.04	501.91	473.15	456.38	464.47	482.65	514.37	549.54	576.02	(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)	
South	0.9x 0.77	x	3.8	x	47.32	x	0.63	x	0.7	=	54.96	(78)
South	0.9x 0.77	x	7.14	x	47.32	x	0.63	x	0.7	=	103.26	(78)

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South	0.9x	0.77	x	3.8	x	77.18	x	0.63	x	0.7	=	89.64	(78)
South	0.9x	0.77	x	7.14	x	77.18	x	0.63	x	0.7	=	168.42	(78)
South	0.9x	0.77	x	3.8	x	94.25	x	0.63	x	0.7	=	109.45	(78)
South	0.9x	0.77	x	7.14	x	94.25	x	0.63	x	0.7	=	205.65	(78)
South	0.9x	0.77	x	3.8	x	105.11	x	0.63	x	0.7	=	122.07	(78)
South	0.9x	0.77	x	7.14	x	105.11	x	0.63	x	0.7	=	229.37	(78)
South	0.9x	0.77	x	3.8	x	108.55	x	0.63	x	0.7	=	126.06	(78)
South	0.9x	0.77	x	7.14	x	108.55	x	0.63	x	0.7	=	236.86	(78)
South	0.9x	0.77	x	3.8	x	108.9	x	0.63	x	0.7	=	126.47	(78)
South	0.9x	0.77	x	7.14	x	108.9	x	0.63	x	0.7	=	237.62	(78)
South	0.9x	0.77	x	3.8	x	107.14	x	0.63	x	0.7	=	124.42	(78)
South	0.9x	0.77	x	7.14	x	107.14	x	0.63	x	0.7	=	233.78	(78)
South	0.9x	0.77	x	3.8	x	103.88	x	0.63	x	0.7	=	120.64	(78)
South	0.9x	0.77	x	7.14	x	103.88	x	0.63	x	0.7	=	226.68	(78)
South	0.9x	0.77	x	3.8	x	99.99	x	0.63	x	0.7	=	116.12	(78)
South	0.9x	0.77	x	7.14	x	99.99	x	0.63	x	0.7	=	218.19	(78)
South	0.9x	0.77	x	3.8	x	85.29	x	0.63	x	0.7	=	99.05	(78)
South	0.9x	0.77	x	7.14	x	85.29	x	0.63	x	0.7	=	186.11	(78)
South	0.9x	0.77	x	3.8	x	56.07	x	0.63	x	0.7	=	65.11	(78)
South	0.9x	0.77	x	7.14	x	56.07	x	0.63	x	0.7	=	122.35	(78)
South	0.9x	0.77	x	3.8	x	40.89	x	0.63	x	0.7	=	47.49	(78)
South	0.9x	0.77	x	7.14	x	40.89	x	0.63	x	0.7	=	89.23	(78)

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

(83)m=	158.22	258.05	315.1	351.44	362.93	364.09	358.2	347.32	334.31	285.17	187.46	136.71	(83)

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

(84)m=	748.52	844.03	880.66	885.48	864.84	837.24	814.59	811.79	816.96	799.53	737	712.73	(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=	0.98	0.97	0.95	0.92	0.85	0.69	0.49	0.49	0.73	0.9	0.97	0.99	(86)

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

(87)m=	21	21	21	21	21	21	21	21	21	21	21	21	(87)

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

(88)m=	19.74	19.75	19.75	19.78	19.79	19.8	19.81	19.81	19.79	19.78	19.76	19.75	(88)

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

(89)m=	0.98	0.96	0.94	0.9	0.79	0.59	0.35	0.35	0.63	0.86	0.96	0.98	(89)

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

(90)m=	19.74	19.75	19.75	19.78	19.79	19.8	19.81	19.81	19.79	19.78	19.76	19.75	(90)

fLA = Living area ÷ (4) = 0.2 (91)

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

(92)m=	19.99	20	20	20.02	20.04	20.04	20.05	20.05	20.03	20.02	20.01	20	(92)

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

(93)m=	19.89	19.9	19.9	19.92	19.94	19.94	19.95	19.95	19.93	19.92	19.91	19.9	(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=	0.98	0.97	0.94	0.9	0.8	0.6	0.37	0.37	0.65	0.87	0.96	0.98	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	733.21	814.72	828.02	798.04	689.57	505.26	300.47	300.44	528.16	695.41	710.33	699.14	(95)
Monthly average external temperature from Table 8													
(96)m=	4.5	5	6.8	8.7	11.7	14.6	16.9	16.9	14.3	10.8	7	4.9	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1636.3	1563.29	1374.45	1148.33	829.95	534.47	302.84	302.84	569.73	933.46	1337.39	1573.78	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	671.9	503.04	406.54	252.2	104.45	0	0	0	0	177.11	451.48	650.73	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 3217.45 (98)

Space heating requirement in kWh/m²/year 43.6 (99)

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

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 317.5 (206)

Efficiency of secondary/supplementary heating system, % 0 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	671.9	503.04	406.54	252.2	104.45	0	0	0	0	177.11	451.48	650.73	
(211)m = {[(98)m x (204)] + (210)m } x 100 ÷ (206)													(211)
	211.62	158.44	128.04	79.43	32.9	0	0	0	0	55.78	142.2	204.95	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 1013.36 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] + (214) m } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10....12}$= 0 (215)

Water heating

Output from water heater (calculated above)

	202.98	179.14	188.69	169.91	167.06	150.07	144.89	157.94	157.34	176.15	185.3	198.36	

Efficiency of water heater 112.5 (216)

(217)m=	112.5	112.5	112.5	112.5	112.5	112.5	112.5	112.5	112.5	112.5	112.5	112.5	(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	180.43	159.24	167.73	151.04	148.5	133.4	128.79	140.39	139.86	156.58	164.71	176.32	

Total = Sum(219a)$_{1...12}$ = 1846.98 (219)

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Annual totals		kWh/year	kWh/year	
Space heating fuel used, main system 1			1013.36	
Water heating fuel used			1846.98	
Electricity for pumps, fans and electric keep-hot				
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		0	(231)
Electricity for lighting			343.7	(232)

10a. Fuel costs - individual heating systems:

	Fuel kWh/year		Fuel Price (Table 12)		Fuel Cost £/year	
Space heating - main system 1	(211) x		11.46	x 0.01 =	116.13	(240)
Space heating - main system 2	(213) x		0	x 0.01 =	0	(241)
Space heating - secondary	(215) x		0	x 0.01 =	0	(242)
Water heating cost (other fuel)	(219)		11.46	x 0.01 =	211.66	(247)
Pumps, fans and electric keep-hot	(231)		11.46	x 0.01 =	0	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a						
Energy for lighting	(232)		11.46	x 0.01 =	39.39	(250)
Additional standing charges (Table 12)					0	(251)
Appendix Q items: repeat lines (253) and (254) as needed						
Total energy cost	(245)...(247) + (250)…(254) =				367.18	(255)

11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)	0.47	(256)
Energy cost factor (ECF) [(255) x (256)] ÷ [(4) + 45.0] =	1.45	(257)
SAP rating (Section 12)	79.74	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.517	=	523.91	(261)
Space heating (secondary)	(215) x		0	=	0	(263)
Water heating	(219) x		0.517	=	954.89	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1478.8	(265)
Electricity for pumps, fans and electric keep-hot	(231) x		0.517	=	0	(267)
Electricity for lighting	(232) x		0.517	=	177.69	(268)
Total CO2, kg/year	sum of (265)…(271) =				1656.49	(272)
CO2 emissions per m²	(272) ÷ (4) =				22.45	(273)
EI rating (section 14)					81	(274)

13a. Primary Energy

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	Energy kWh/year		**Primary** factor		**P. Energy** kWh/year	
Space heating (main system 1)	(211)	x	2.92	=	2959.02	(261)
Space heating (secondary)	(215)	x	0	=	0	(263)
Energy for water heating	(219)	x	2.92	=	5393.19	(264)
Space and water heating	(261) + (262) + (263) + (264) =				8352.21	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	2.92	=	0	(267)
Electricity for lighting	(232)	x	0	=	1003.61	(268)
'Total Primary Energy			sum of (265)…(271) =		9355.82	(272)
Primary energy kWh/m²/year			(272) ÷ (4) =		126.77	(273)

Regulations Compliance Report

Approved Document L1A 2010 edition assessed by Stroma FSAP 2009 program, Version: 1.4.0.73
Printed on 02 May 2012 at 12:31:30

Project Information:

Assessed By: Mike Ovenden (STRO006697) **Building Type:** Mid-terrace House

Dwelling Details:

NEW DWELLING DESIGN STAGE

Site Reference : Plot 4 mid terrace **Plot Reference:** Plot 4

Address : Plot 4, Penistone Coal Drops, St. Mary's Street, Penistone, Sheffield, S36 6DT

Client Details:

Name: Stephen Sharp

Address : Yourspace Studio Limited , 180 main road, west winch, king's lynn, PE330LJ

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

1 TER and DER

Fuel for main heating system: Grid electricity

Target Carbon Dioxide Emission Rate (TER)	28.71 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	23.31 kg/m²	OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.23 (max. 0.30)	0.23 (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	0.14 (max. 0.20)	0.14 (max. 0.35)	OK
Openings	1.89 (max. 2.00)	3.00 (max. 3.30)	OK

3 Design air permeability

Design air permeability at 50 pascals	6.00	
Maximum	10.0	OK

4 Heating efficiency

Main Heating system:

Heat pumps with radiators or underfloor - electric
Mitsubishi ECODAN 5kW

Secondary heating system: None

5 Cylinder insulation

Hot water Storage:	Nominal cylinder loss: 2.37 kWh/day Permitted by DBSCG: 3.11 kWh/day	OK
Primary pipework insulated:	Yes	OK

6 Controls

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

7 Low energy lights

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

Regulations Compliance Report

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (North East England):	Not significant	**OK**
Based on:		
Overshading:	Average or unknown	
Windows facing: South	3.8m², Overhang twice as wide as window, ratio NaN	
Windows facing: South	7.14m², Overhang twice as wide as window, ratio NaN	
Ventilation rate:	8.00	
Blinds/curtains:	shutter closed 100% of daylight hours	

10 Key features

None

SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Mike Ovenden	**Stroma Number:**	STRO006697
Software Name:	Stroma FSAP 2009	**Software Version:**	Version: 1.4.0.73

Property Address: Plot 4 mid terrace

Address : Plot 4, Penistone Coal Drops, St. Mary's Street, Penistone, Sheffield, S36 6DT

1. Overall dwelling dimensions:

	Area(m²)		Ave Height(m)		Volume(m³)	
Ground floor	36.9	(1a) x	2.6	(2a) =	95.94	(3a)
First floor	36.9	(1b) x	2.6	(2b) =	95.94	(3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	73.8	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		191.88	(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	1	+	0	+	0	=	1	x 20 =	20	(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) = 20 ÷ (5) =	0.1	(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		6	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)		0.4	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides on which sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.34	(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=	5.4	5.1	5.1	4.5	4.1	3.9	3.7	3.7	4.2	4.5	4.8	5.1

SAP WorkSheet: New dwelling design stage

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.35	1.27	1.27	1.12	1.02	0.98	0.92	0.92	1.05	1.12	1.2	1.27

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

0.46	0.44	0.44	0.39	0.35	0.34	0.32	0.32	0.36	0.39	0.41	0.44

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

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

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0

(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=	0.61	0.6	0.6	0.57	0.56	0.56	0.55	0.55	0.57	0.57	0.59	0.6

(24d)

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

(25)m=	0.61	0.6	0.6	0.57	0.56	0.56	0.55	0.55	0.57	0.57	0.59	0.6

(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			1.9	x	3	=	5.7			(26)
Windows Type 1			3.8	x	1/[1/(1.7)+ 0.04]	=	6.05			(27)
Windows Type 2			7.14	x	1/[1/(1.7)+ 0.04]	=	11.37			(27)
Floor			36.9	x	0.2	=	7.380001			(28)
Walls	46.8	12.84	33.96	x	0.23	=	7.81			(29)
Roof	36.9	0	36.9	x	0.14	=	5.17			(30)
Total area of elements, m²			120.6							(31)
Party wall			85.28	x	0	=	0			(32)

** 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) = 43.47 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 10605.9 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (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 18.09 (36)

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

Total fabric heat loss (33) + (36) = 61.56 (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=	38.47	37.74	37.74	36.39	35.59	35.21	34.86	34.86	35.78	36.39	37.04	37.74	(38)

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

(39)m=	100.03	99.3	99.3	97.95	97.15	96.77	96.42	96.42	97.34	97.95	98.6	99.3	

Average = Sum(39)$_{1...12}$ /12= 98.04 (39)

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

(40)m=	1.36	1.35	1.35	1.33	1.32	1.31	1.31	1.31	1.32	1.33	1.34	1.35	

Average = Sum(40)$_{1...12}$ /12= 1.33 (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 89.65 (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=	98.62	95.03	91.44	87.86	84.27	80.69	80.69	84.27	87.86	91.44	95.03	98.62	

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

Total = Sum(44)$_{1...12}$ = 1075.8 (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=	146.59	128.21	132.3	115.34	110.68	95.5	88.5	101.55	102.77	119.77	130.73	141.97	

Total = Sum(45)$_{1...12}$ = 1413.92 (45)

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

(46)m=	21.99	19.23	19.85	17.3	16.6	14.33	13.27	15.23	15.42	17.96	19.61	21.3	(46)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (47)

Temperature factor from Table 2b 0 (48)

Energy lost from water storage, kWh/year (47) x (48) = 0 (49)

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

Cylinder volume (litres) including any solar storage within same 200 (50)

If community heating and no tank in dwelling, enter 110 litres in box (50)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in box (50)

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.01 (51)

Volume factor from Table 2a 0.84 (52)

Temperature factor from Table 2b 0.54 (53)

Energy lost from water storage, kWh/year ((50) x (51) x (52) x (53) = 1.05 (54)

Enter (49) or (54) in (55) 1.05 (55)

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

(56)m=	32.61	29.45	32.61	31.56	32.61	31.56	32.61	32.61	31.56	32.61	31.56	32.61	(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=	32.61	29.45	32.61	31.56	32.61	31.56	32.61	32.61	31.56	32.61	31.56	32.61	(57)

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Primary circuit loss (annual) from Table 3 | 280 | (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=	23.78	21.48	23.78	23.01	23.78	23.01	23.78	23.78	23.01	23.78	23.01	23.78	(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=	202.98	179.14	188.69	169.91	167.06	150.07	144.89	157.94	157.34	176.15	185.3	198.36	(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=	202.98	179.14	188.69	169.91	167.06	150.07	144.89	157.94	157.34	176.15	185.3	198.36	

Output from water heater (annual)$_{1...12}$ | 2077.85 | (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=	93.85	83.38	89.1	82.01	81.91	75.41	74.54	78.88	77.83	84.93	87.12	92.32	(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=	140.08	140.08	140.08	140.08	140.08	140.08	140.08	140.08	140.08	140.08	140.08	140.08	(66)

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

(67)m=	48.65	43.21	35.14	26.61	19.89	16.79	18.14	23.58	31.65	40.19	46.91	50.01	(67)

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

(68)m=	307.46	310.65	302.61	285.5	263.89	243.58	230.02	226.83	234.87	251.98	273.59	293.89	(68)

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

(69)m=	51.34	51.34	51.34	51.34	51.34	51.34	51.34	51.34	51.34	51.34	51.34	51.34	(69)

Pumps and fans gains (Table 5a)

(70)m=	10	10	10	10	10	10	10	10	10	10	10	10	(70)

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

(71)m=	-93.39	-93.39	-93.39	-93.39	-93.39	-93.39	-93.39	-93.39	-93.39	-93.39	-93.39	-93.39	(71)

Water heating gains (Table 5)

(72)m=	126.15	124.07	119.76	113.9	110.1	104.74	100.18	106.02	108.09	114.16	121.01	124.08	(72)

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

(73)m=	590.3	585.98	565.55	534.04	501.91	473.15	456.38	464.47	482.65	514.37	549.54	576.02	(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)	
South	0.9x 0.77	x	3.8	x	47.32	x	0.63	x	0.7	=	54.96	(78)
South	0.9x 0.77	x	7.14	x	47.32	x	0.63	x	0.7	=	103.26	(78)

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South	0.9x	0.77	x	3.8	x	77.18	x	0.63	x	0.7	=	89.64	(78)
South	0.9x	0.77	x	7.14	x	77.18	x	0.63	x	0.7	=	168.42	(78)
South	0.9x	0.77	x	3.8	x	94.25	x	0.63	x	0.7	=	109.45	(78)
South	0.9x	0.77	x	7.14	x	94.25	x	0.63	x	0.7	=	205.65	(78)
South	0.9x	0.77	x	3.8	x	105.11	x	0.63	x	0.7	=	122.07	(78)
South	0.9x	0.77	x	7.14	x	105.11	x	0.63	x	0.7	=	229.37	(78)
South	0.9x	0.77	x	3.8	x	108.55	x	0.63	x	0.7	=	126.06	(78)
South	0.9x	0.77	x	7.14	x	108.55	x	0.63	x	0.7	=	236.86	(78)
South	0.9x	0.77	x	3.8	x	108.9	x	0.63	x	0.7	=	126.47	(78)
South	0.9x	0.77	x	7.14	x	108.9	x	0.63	x	0.7	=	237.62	(78)
South	0.9x	0.77	x	3.8	x	107.14	x	0.63	x	0.7	=	124.42	(78)
South	0.9x	0.77	x	7.14	x	107.14	x	0.63	x	0.7	=	233.78	(78)
South	0.9x	0.77	x	3.8	x	103.88	x	0.63	x	0.7	=	120.64	(78)
South	0.9x	0.77	x	7.14	x	103.88	x	0.63	x	0.7	=	226.68	(78)
South	0.9x	0.77	x	3.8	x	99.99	x	0.63	x	0.7	=	116.12	(78)
South	0.9x	0.77	x	7.14	x	99.99	x	0.63	x	0.7	=	218.19	(78)
South	0.9x	0.77	x	3.8	x	85.29	x	0.63	x	0.7	=	99.05	(78)
South	0.9x	0.77	x	7.14	x	85.29	x	0.63	x	0.7	=	186.11	(78)
South	0.9x	0.77	x	3.8	x	56.07	x	0.63	x	0.7	=	65.11	(78)
South	0.9x	0.77	x	7.14	x	56.07	x	0.63	x	0.7	=	122.35	(78)
South	0.9x	0.77	x	3.8	x	40.89	x	0.63	x	0.7	=	47.49	(78)
South	0.9x	0.77	x	7.14	x	40.89	x	0.63	x	0.7	=	89.23	(78)

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

(83)m=	158.22	258.05	315.1	351.44	362.93	364.09	358.2	347.32	334.31	285.17	187.46	136.71	(83)

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

(84)m=	748.52	844.03	880.66	885.48	864.84	837.24	814.59	811.79	816.96	799.53	737	712.73	(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=	0.98	0.97	0.95	0.92	0.84	0.68	0.48	0.48	0.72	0.9	0.97	0.98	(86)

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

(87)m=	21	21	21	21	21	21	21	21	21	21	21	21	(87)

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

(88)m=	19.8	19.81	19.81	19.82	19.83	19.83	19.84	19.84	19.83	19.82	19.82	19.81	(88)

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

(89)m=	0.98	0.96	0.93	0.89	0.78	0.58	0.35	0.35	0.62	0.86	0.96	0.98	(89)

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

(90)m=	19.8	19.81	19.81	19.82	19.83	19.83	19.84	19.84	19.83	19.82	19.82	19.81	(90)

fLA = Living area ÷ (4) = 0.2 (91)

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

(92)m=	20.04	20.05	20.05	20.06	20.07	20.07	20.07	20.07	20.06	20.06	20.05	20.05	(92)

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

(93)m=	19.94	19.95	19.95	19.96	19.97	19.97	19.97	19.97	19.96	19.96	19.95	19.95	(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=	0.98	0.96	0.94	0.89	0.79	0.59	0.36	0.36	0.63	0.86	0.96	0.98	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	732.46	812.91	824.14	792.43	680.75	495.16	294.32	294.29	517.02	688.84	708.85	698.56	(95)
Monthly average external temperature from Table 8													
(96)m=	4.5	5	6.8	8.7	11.7	14.6	16.9	16.9	14.3	10.8	7	4.9	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1544.71	1484.31	1305.57	1102.88	803.04	519.61	296.23	296.23	551.4	897.18	1277.3	1494.24	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	604.31	451.18	358.19	223.52	90.98	0	0	0	0	155.01	409.28	591.99	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2884.46 (98)

Space heating requirement in kWh/m²/year 39.08 (99)

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

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 316.67 (206)

Efficiency of secondary/supplementary heating system, % 0 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	604.31	451.18	358.19	223.52	90.98	0	0	0	0	155.01	409.28	591.99	
(211)m = {[(98)m x (204)] + (210)m } x 100 ÷ (206)													(211)
	190.83	142.47	113.11	70.58	28.73	0	0	0	0	48.95	129.24	186.94	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 910.86 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] + (214) m } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10....12}$= 0 (215)

Water heating

Output from water heater (calculated above)

	202.98	179.14	188.69	169.91	167.06	150.07	144.89	157.94	157.34	176.15	185.3	198.36	

Efficiency of water heater 112.5 (216)

(217)m=	112.5	112.5	112.5	112.5	112.5	112.5	112.5	112.5	112.5	112.5	112.5	112.5	(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	180.43	159.24	167.73	151.04	148.5	133.4	128.79	140.39	139.86	156.58	164.71	176.32	

Total = Sum(219a)$_{1...12}$ = 1846.98 (219)

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Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			910.86	
Water heating fuel used			1846.98	
Electricity for pumps, fans and electric keep-hot				
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		0	(231)
Electricity for lighting			343.7	(232)

10a. Fuel costs - individual heating systems:

	Fuel kWh/year		**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211)	x	11.46	x 0.01 =	104.38	(240)
Space heating - main system 2	(213)	x	0	x 0.01 =	0	(241)
Space heating - secondary	(215)	x	0	x 0.01 =	0	(242)
Water heating cost (other fuel)	(219)		11.46	x 0.01 =	211.66	(247)
Pumps, fans and electric keep-hot	(231)		11.46	x 0.01 =	0	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a						
Energy for lighting	(232)		11.46	x 0.01 =	39.39	(250)
Additional standing charges (Table 12)					0	(251)
Appendix Q items: repeat lines (253) and (254) as needed						
Total energy cost	(245)...(247) + (250)…(254) =				355.44	(255)

11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.47	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.41	(257)
SAP rating (Section 12)		80.38	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211)	x	0.517	=	470.91	(261)
Space heating (secondary)	(215)	x	0	=	0	(263)
Water heating	(219)	x	0.517	=	954.89	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1425.8	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.517	=	0	(267)
Electricity for lighting	(232)	x	0.517	=	177.69	(268)
Total CO2, kg/year	sum of (265)…(271) =				1603.5	(272)
CO2 emissions per m²	(272) ÷ (4) =				21.73	(273)
EI rating (section 14)					82	(274)

13a. Primary Energy

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	Energy kWh/year		**Primary** factor		**P. Energy** kWh/year	
Space heating (main system 1)	(211)	x	2.92	=	2659.71	(261)
Space heating (secondary)	(215)	x	0	=	0	(263)
Energy for water heating	(219)	x	2.92	=	5393.19	(264)
Space and water heating	(261) + (262) + (263) + (264) =				8052.9	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	2.92	=	0	(267)
Electricity for lighting	(232)	x	0	=	1003.61	(268)
'Total Primary Energy			sum of (265)…(271) =		9056.51	(272)
Primary energy kWh/m²/year			(272) ÷ (4) =		122.72	(273)

Regulations Compliance Report

Approved Document L1A 2010 edition assessed by Stroma FSAP 2009 program, Version: 1.4.0.73
Printed on 02 May 2012 at 12:31:23

Project Information:

Assessed By: Mike Ovenden (STRO006697) **Building Type:** Mid-terrace House

Dwelling Details:

NEW DWELLING DESIGN STAGE

Site Reference : Plot 5 mid terrace **Plot Reference:** Plot 5

Address : Plot 5, Penistone Coal Drops, St. Mary's Street, Penistone, Sheffield, S36 6DT

Client Details:

Name: Stephen Sharp

Address : Yourspace Studio Limited , 180 main road, west winch, king's lynn, PE330LJ

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

1 TER and DER

Fuel for main heating system: Grid electricity

Target Carbon Dioxide Emission Rate (TER)	25.04 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	20.07 kg/m²	OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.23 (max. 0.30)	0.23 (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	0.11 (max. 0.20)	0.11 (max. 0.35)	OK
Openings	1.91 (max. 2.00)	3.00 (max. 3.30)	OK

3 Design air permeability

Design air permeability at 50 pascals	6.00	
Maximum	10.0	OK

4 Heating efficiency

Main Heating system: Heat pumps with radiators or underfloor - electric
Mitsubishi ECODAN 5kW

Secondary heating system: None

5 Cylinder insulation

Hot water Storage:	Nominal cylinder loss: 2.37 kWh/day Permitted by DBSCG: 3.11 kWh/day	OK
Primary pipework insulated:	Yes	OK

6 Controls

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

7 Low energy lights

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

Regulations Compliance Report

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (North East England):	Not significant	**OK**
Based on:		
Overshading:	Average or unknown	
Windows facing: South	3.8m², Overhang twice as wide as window, ratio NaN	
Windows facing: South	7.14m², Overhang twice as wide as window, ratio NaN	
Roof windows facing: North	2m²	
Roof windows facing: South	0.8m²	
Ventilation rate:	8.00	
Blinds/curtains:	shutter closed 100% of daylight hours	

10 Key features

Roofs U-value	0.11 W/m²K

SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Mike Ovenden	**Stroma Number:**	STRO006697
Software Name:	Stroma FSAP 2009	**Software Version:**	Version: 1.4.0.73

Property Address: Plot 5 mid terrace

Address : Plot 5, Penistone Coal Drops, St. Mary's Street, Penistone, Sheffield, S36 6DT

1. Overall dwelling dimensions:

	Area(m²)		Ave Height(m)		Volume(m³)	
Ground floor	39.42 (1a)	x	2.6 (2a)	=	102.49	(3a)
First floor	39.42 (1b)	x	2.6 (2b)	=	102.49	(3b)
Second floor	28.8 (1c)	x	1.9 (2c)	=	54.72	(3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	107.64 (4)					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	=	259.7	(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	1	+	0	+	0	=	1	x 20 =	20	(6b)
Number of intermittent fans							5	x 10 =	50	(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) =	70	÷ (5) =	0.27	(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			6	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.57	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides on which sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.48	(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=	5.4	5.1	5.1	4.5	4.1	3.9	3.7	3.7	4.2	4.5	4.8	5.1

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Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.35	1.27	1.27	1.12	1.02	0.98	0.92	0.92	1.05	1.12	1.2	1.27

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

0.65	0.62	0.62	0.54	0.5	0.47	0.45	0.45	0.51	0.54	0.58	0.62

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

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

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0

(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=	0.71	0.69	0.69	0.65	0.62	0.61	0.6	0.6	0.63	0.65	0.67	0.69

(24d)

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

(25)m=	0.71	0.69	0.69	0.65	0.62	0.61	0.6	0.6	0.63	0.65	0.67	0.69

(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			1.9	x	3	=	5.7			(26)
Windows Type 1			3.8	x	1/[1/(1.7)+ 0.04]	=	6.05			(27)
Windows Type 2			7.14	x	1/[1/(1.7)+ 0.04]	=	11.37			(27)
Rooflights Type 1			2	x	1/[1/(2) + 0.04]	=	4			(27b)
Rooflights Type 2			0.8	x	1/[1/(2) + 0.04]	=	1.6			(27b)
Floor			39.42	x	0.2	=	7.884			(28)
Walls	63.9	12.84	51.06	x	0.23	=	11.74			(29)
Roof	55.19	2.8	52.39	x	0.11	=	5.76			(30)
Total area of elements, m²			158.51							(31)
Party wall			115.42	x	0	=	0			(32)

** 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) = 53.69 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 13575.93 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (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 23.78 (36)

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

Total fabric heat loss (33) + (36) = 77.47 (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=	61.15	59.18	59.18	55.56	53.4	52.4	51.44	51.44	53.92	55.56	57.31	59.18	(38)

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

(39)m=	138.62	136.64	136.64	133.03	130.87	129.86	128.91	128.91	131.39	133.03	134.78	136.64	

Average = Sum(39)$_{1...12}$ /12= 133.28 (39)

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

(40)m=	1.29	1.27	1.27	1.24	1.22	1.21	1.2	1.2	1.22	1.24	1.25	1.27	

Average = Sum(40)$_{1...12}$ /12= 1.24 (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 2.8 (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) + 36 100.7 (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=	110.77	106.74	102.71	98.68	94.66	90.63	90.63	94.66	98.68	102.71	106.74	110.77	

Total = Sum(44)$_{1...12}$ = 1208.37 (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=	164.66	144.01	148.61	129.56	124.31	107.27	99.4	114.07	115.43	134.52	146.84	159.46	

Total = Sum(45)$_{1...12}$ = 1588.15 (45)

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

(46)m=	24.7	21.6	22.29	19.43	18.65	16.09	14.91	17.11	17.31	20.18	22.03	23.92	(46)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (47)

Temperature factor from Table 2b 0 (48)

Energy lost from water storage, kWh/year (47) x (48) = 0 (49)

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

Cylinder volume (litres) including any solar storage within same 200 (50)

If community heating and no tank in dwelling, enter 110 litres in box (50)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in box (50)

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.01 (51)

Volume factor from Table 2a 0.84 (52)

Temperature factor from Table 2b 0.54 (53)

Energy lost from water storage, kWh/year ((50) x (51) x (52) x (53) = 1.05 (54)

Enter (49) or (54) in (55) 1.05 (55)

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

(56)m=	32.61	29.45	32.61	31.56	32.61	31.56	32.61	32.61	31.56	32.61	31.56	32.61	(56)

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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=	32.61	29.45	32.61	31.56	32.61	31.56	32.61	32.61	31.56	32.61	31.56	32.61	(57)

Primary circuit loss (annual) from Table 3 — 280 (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=	23.78	21.48	23.78	23.01	23.78	23.01	23.78	23.78	23.01	23.78	23.01	23.78	(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=	221.05	194.94	205	184.13	180.7	161.84	155.79	170.46	170	190.91	201.41	215.85	(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=	221.05	194.94	205	184.13	180.7	161.84	155.79	170.46	170	190.91	201.41	215.85	

Output from water heater (annual)$_{1...12}$ — 2252.09 (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=	99.86	88.63	94.52	86.73	86.45	79.32	78.16	83.04	82.04	89.84	92.48	98.13	(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=	167.99	167.99	167.99	167.99	167.99	167.99	167.99	167.99	167.99	167.99	167.99	167.99	(66)

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

(67)m=	64.84	57.59	46.83	35.46	26.5	22.38	24.18	31.43	42.18	53.56	62.51	66.64	(67)

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

(68)m=	400.18	404.33	393.87	371.59	343.47	317.04	299.38	295.23	305.69	327.97	356.09	382.52	(68)

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

(69)m=	54.6	54.6	54.6	54.6	54.6	54.6	54.6	54.6	54.6	54.6	54.6	54.6	(69)

Pumps and fans gains (Table 5a)

(70)m=	10	10	10	10	10	10	10	10	10	10	10	10	(70)

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

(71)m=	-112	-112	-112	-112	-112	-112	-112	-112	-112	-112	-112	-112	(71)

Water heating gains (Table 5)

(72)m=	134.22	131.89	127.05	120.46	116.19	110.17	105.06	111.61	113.94	120.75	128.45	131.9	(72)

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

(73)m=	719.83	714.41	688.35	648.11	606.76	570.18	549.22	558.87	582.41	622.88	667.65	701.66	(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)

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South	0.9x	0.77	x	3.8	x	47.32	x	0.63	x	0.7	=	54.96	(78)
South	0.9x	0.77	x	7.14	x	47.32	x	0.63	x	0.7	=	103.26	(78)
South	0.9x	0.77	x	3.8	x	77.18	x	0.63	x	0.7	=	89.64	(78)
South	0.9x	0.77	x	7.14	x	77.18	x	0.63	x	0.7	=	168.42	(78)
South	0.9x	0.77	x	3.8	x	94.25	x	0.63	x	0.7	=	109.45	(78)
South	0.9x	0.77	x	7.14	x	94.25	x	0.63	x	0.7	=	205.65	(78)
South	0.9x	0.77	x	3.8	x	105.11	x	0.63	x	0.7	=	122.07	(78)
South	0.9x	0.77	x	7.14	x	105.11	x	0.63	x	0.7	=	229.37	(78)
South	0.9x	0.77	x	3.8	x	108.55	x	0.63	x	0.7	=	126.06	(78)
South	0.9x	0.77	x	7.14	x	108.55	x	0.63	x	0.7	=	236.86	(78)
South	0.9x	0.77	x	3.8	x	108.9	x	0.63	x	0.7	=	126.47	(78)
South	0.9x	0.77	x	7.14	x	108.9	x	0.63	x	0.7	=	237.62	(78)
South	0.9x	0.77	x	3.8	x	107.14	x	0.63	x	0.7	=	124.42	(78)
South	0.9x	0.77	x	7.14	x	107.14	x	0.63	x	0.7	=	233.78	(78)
South	0.9x	0.77	x	3.8	x	103.88	x	0.63	x	0.7	=	120.64	(78)
South	0.9x	0.77	x	7.14	x	103.88	x	0.63	x	0.7	=	226.68	(78)
South	0.9x	0.77	x	3.8	x	99.99	x	0.63	x	0.7	=	116.12	(78)
South	0.9x	0.77	x	7.14	x	99.99	x	0.63	x	0.7	=	218.19	(78)
South	0.9x	0.77	x	3.8	x	85.29	x	0.63	x	0.7	=	99.05	(78)
South	0.9x	0.77	x	7.14	x	85.29	x	0.63	x	0.7	=	186.11	(78)
South	0.9x	0.77	x	3.8	x	56.07	x	0.63	x	0.7	=	65.11	(78)
South	0.9x	0.77	x	7.14	x	56.07	x	0.63	x	0.7	=	122.35	(78)
South	0.9x	0.77	x	3.8	x	40.89	x	0.63	x	0.7	=	47.49	(78)
South	0.9x	0.77	x	7.14	x	40.89	x	0.63	x	0.7	=	89.23	(78)
Rooflights	0.9x	1	x	2	x	10.73	x	0.63	x	0.7	=	8.51	(82)
Rooflights	0.9x	1	x	0.8	x	26	x	0.63	x	0.7	=	8.26	(82)
Rooflights	0.9x	1	x	2	x	20.36	x	0.63	x	0.7	=	16.16	(82)
Rooflights	0.9x	1	x	0.8	x	54	x	0.63	x	0.7	=	17.15	(82)
Rooflights	0.9x	1	x	2	x	33.31	x	0.63	x	0.7	=	26.44	(82)
Rooflights	0.9x	1	x	0.8	x	94	x	0.63	x	0.7	=	29.85	(82)
Rooflights	0.9x	1	x	2	x	54.64	x	0.63	x	0.7	=	43.37	(82)
Rooflights	0.9x	1	x	0.8	x	150	x	0.63	x	0.7	=	47.63	(82)
Rooflights	0.9x	1	x	2	x	75.22	x	0.63	x	0.7	=	59.71	(82)
Rooflights	0.9x	1	x	0.8	x	190	x	0.63	x	0.7	=	60.33	(82)
Rooflights	0.9x	1	x	2	x	84.09	x	0.63	x	0.7	=	66.75	(82)
Rooflights	0.9x	1	x	0.8	x	201	x	0.63	x	0.7	=	63.82	(82)
Rooflights	0.9x	1	x	2	x	79.12	x	0.63	x	0.7	=	62.81	(82)
Rooflights	0.9x	1	x	0.8	x	194	x	0.63	x	0.7	=	61.6	(82)
Rooflights	0.9x	1	x	2	x	61.56	x	0.63	x	0.7	=	48.87	(82)
Rooflights	0.9x	1	x	0.8	x	164	x	0.63	x	0.7	=	52.07	(82)
Rooflights	0.9x	1	x	2	x	41.09	x	0.63	x	0.7	=	32.61	(82)

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Rooflights 0.9x	1	x	0.8	x	116	x	0.63	x	0.7	=	36.83	(82)
Rooflights 0.9x	1	x	2	x	24.81	x	0.63	x	0.7	=	19.7	(82)
Rooflights 0.9x	1	x	0.8	x	68	x	0.63	x	0.7	=	21.59	(82)
Rooflights 0.9x	1	x	2	x	13.22	x	0.63	x	0.7	=	10.49	(82)
Rooflights 0.9x	1	x	0.8	x	33	x	0.63	x	0.7	=	10.48	(82)
Rooflights 0.9x	1	x	2	x	8.94	x	0.63	x	0.7	=	7.1	(82)
Rooflights 0.9x	1	x	0.8	x	21	x	0.63	x	0.7	=	6.67	(82)

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

(83)m=	174.99	291.36	371.39	442.44	482.96	494.66	482.61	448.27	403.76	326.45	208.43	150.48	(83)

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

(84)m=	894.83	1005.77	1059.74	1090.55	1089.72	1064.85	1031.82	1007.13	986.17	949.33	876.08	852.14	(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=	0.99	0.99	0.97	0.95	0.87	0.71	0.5	0.51	0.78	0.94	0.99	0.99	(86)

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

(87)m=	21	21	21	21	21	21	21	21	21	21	21	21	(87)

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

(88)m=	19.85	19.87	19.87	19.89	19.91	19.92	19.92	19.92	19.91	19.89	19.88	19.87	(88)

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

(89)m=	0.99	0.98	0.96	0.93	0.82	0.62	0.38	0.38	0.69	0.91	0.98	0.99	(89)

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

(90)m=	19.85	19.87	19.87	19.89	19.91	19.92	19.92	19.92	19.91	19.89	19.88	19.87	(90)

fLA = Living area ÷ (4) = 0.2 (91)

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

(92)m=	20.08	20.1	20.1	20.12	20.13	20.14	20.14	20.14	20.13	20.12	20.11	20.1	(92)

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

(93)m=	19.98	20	20	20.02	20.03	20.04	20.04	20.04	20.03	20.02	20.01	20	(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=	0.99	0.98	0.96	0.93	0.83	0.63	0.39	0.4	0.7	0.91	0.98	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	885.39	986.67	1020.84	1013.38	902.24	670.06	402.31	402.03	690.78	866.7	858.9	843.86	(95)

Monthly average external temperature from Table 8

(96)m=	4.5	5	6.8	8.7	11.7	14.6	16.9	16.9	14.3	10.8	7	4.9	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	2146.43	2049.06	1803.11	1505.45	1090.07	705.87	404.92	404.92	752.4	1226.1	1753.02	2062.73	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	938.21	713.93	582.01	354.29	139.75	0	0	0	0	267.39	643.76	906.84	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	4546.18	(98)
Space heating requirement in kWh/m²/year	42.24	(99)

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

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	321.8	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	938.21	713.93	582.01	354.29	139.75	0	0	0	0	267.39	643.76	906.84	
(211)m = {[(98)m x (204)] + (210)m } x 100 ÷ (206)	291.55	221.85	180.86	110.1	43.43	0	0	0	0	83.09	200.05	281.8	(211)

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 1412.73 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] + (214) m } x 100 ÷ (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Output from water heater (calculated above)	221.05	194.94	205	184.13	180.7	161.84	155.79	170.46	170	190.91	201.41	215.85	
Efficiency of water heater													112.5 (216)
(217)m=	112.5	112.5	112.5	112.5	112.5	112.5	112.5	112.5	112.5	112.5	112.5	112.5	(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m													
(219)m=	196.49	173.28	182.22	163.67	160.63	143.86	138.48	151.52	151.11	169.7	179.03	191.87	

Total = Sum(219a)$_{1...12}$ = 2001.86 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		1412.73
Water heating fuel used		2001.86
Electricity for pumps, fans and electric keep-hot		
Total electricity for the above, kWh/year sum of (230a)…(230g) =		0 (231)
Electricity for lighting		458.02 (232)

10a. Fuel costs - individual heating systems:

	Fuel kWh/year	**Fuel Price** (Table 12)		**Fuel Cost** £/year
Space heating - main system 1	(211) x	11.46	x 0.01 =	161.9 (240)
Space heating - main system 2	(213) x	0	x 0.01 =	0 (241)
Space heating - secondary	(215) x	0	x 0.01 =	0 (242)

SAP WorkSheet: New dwelling design stage

Water heating cost (other fuel)	(219)	11.46	x 0.01 =	229.41	(247)
Pumps, fans and electric keep-hot	(231)	11.46	x 0.01 =	0	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a					
Energy for lighting	(232)	11.46	x 0.01 =	52.49	(250)
Additional standing charges (Table 12)				0	(251)
Appendix Q items: repeat lines (253) and (254) as needed					
Total energy cost	(245)...(247) + (250)...(254) =			443.8	(255)

11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.47	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.37	(257)
SAP rating (Section 12)		80.94	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

		Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211)	x	0.517	=	730.38	(261)
Space heating (secondary)	(215)	x	0	=	0	(263)
Water heating	(219)	x	0.517	=	1034.96	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1765.34	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.517	=	0	(267)
Electricity for lighting	(232)	x	0.517	=	236.79	(268)
Total CO2, kg/year	sum of (265)…(271) =				2002.14	(272)
CO2 emissions per m²	(272) ÷ (4) =				18.6	(273)
EI rating (section 14)					82	(274)

13a. Primary Energy

		Energy kWh/year		**Primary** factor		**P. Energy** kWh/year	
Space heating (main system 1)	(211)	x	2.92	=	4125.17	(261)
Space heating (secondary)	(215)	x	0	=	0	(263)
Energy for water heating	(219)	x	2.92	=	5845.42	(264)
Space and water heating	(261) + (262) + (263) + (264) =				9970.6	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	2.92	=	0	(267)
Electricity for lighting	(232)	x	0	=	1337.41	(268)
'Total Primary Energy	sum of (265)…(271) =				11308.01	(272)
Primary energy kWh/m²/year	(272) ÷ (4) =				105.05	(273)

Regulations Compliance Report

Approved Document L1A 2010 edition assessed by Stroma FSAP 2009 program, Version: 1.4.0.73
Printed on 02 May 2012 at 12:31:16

Project Information:

Assessed By: Mike Ovenden (STRO006697) **Building Type:** Mid-terrace House

Dwelling Details:

NEW DWELLING DESIGN STAGE

Site Reference : Plot 6 mid terrace **Plot Reference:** Plot 6

Address : Plot 6, Penistone Coal Drops, St. Mary's Street, Penistone, Sheffield, S36 6DT

Client Details:

Name: Stephen Sharp

Address : Yourspace Studio Limited , 180 main road, west winch, king's lynn, PE330LJ

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

1 TER and DER

Fuel for main heating system: Grid electricity

Target Carbon Dioxide Emission Rate (TER)	25.04 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	20.07 kg/m²	OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.23 (max. 0.30)	0.23 (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	0.11 (max. 0.20)	0.11 (max. 0.35)	OK
Openings	1.91 (max. 2.00)	3.00 (max. 3.30)	OK

3 Design air permeability

Design air permeability at 50 pascals	6.00	
Maximum	10.0	OK

4 Heating efficiency

Main Heating system: Heat pumps with radiators or underfloor - electric
Mitsubishi ECODAN 5kW

Secondary heating system: None

5 Cylinder insulation

Hot water Storage:	Nominal cylinder loss: 2.37 kWh/day Permitted by DBSCG: 3.11 kWh/day	OK
Primary pipework insulated:	Yes	OK

6 Controls

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

7 Low energy lights

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

Regulations Compliance Report

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (North East England):	Not significant	**OK**
Based on:		
Overshading:	Average or unknown	
Windows facing: South	3.8m², Overhang twice as wide as window, ratio NaN	
Windows facing: South	7.14m², Overhang twice as wide as window, ratio NaN	
Roof windows facing: North	2m²	
Roof windows facing: South	0.8m²	
Ventilation rate:	8.00	
Blinds/curtains:	shutter closed 100% of daylight hours	

10 Key features

Roofs U-value	0.11 W/m²K

SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Mike Ovenden	**Stroma Number:**	STRO006697
Software Name:	Stroma FSAP 2009	**Software Version:**	Version: 1.4.0.73

Property Address: Plot 6 mid terrace

Address : Plot 6, Penistone Coal Drops, St. Mary's Street, Penistone, Sheffield, S36 6DT

1. Overall dwelling dimensions:

	Area(m²)		Ave Height(m)		Volume(m³)	
Ground floor	39.42	(1a) x	2.6	(2a) =	102.49	(3a)
First floor	39.42	(1b) x	2.6	(2b) =	102.49	(3b)
Second floor	28.8	(1c) x	1.9	(2c) =	54.72	(3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	107.64	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		259.7	(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	1	+	0	+	0	=	1	x 20 =	20	(6b)
Number of intermittent fans							5	x 10 =	50	(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) =	70	÷ (5) =	0.27 (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				6 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.57 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides on which sheltered				2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =			0.85 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =			0.48 (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=	5.4	5.1	5.1	4.5	4.1	3.9	3.7	3.7	4.2	4.5	4.8	5.1

SAP WorkSheet: New dwelling design stage

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.35	1.27	1.27	1.12	1.02	0.98	0.92	0.92	1.05	1.12	1.2	1.27

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

0.65	0.62	0.62	0.54	0.5	0.47	0.45	0.45	0.51	0.54	0.58	0.62

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

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

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0

(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=	0.71	0.69	0.69	0.65	0.62	0.61	0.6	0.6	0.63	0.65	0.67	0.69

(24d)

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

(25)m=	0.71	0.69	0.69	0.65	0.62	0.61	0.6	0.6	0.63	0.65	0.67	0.69

(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			1.9	x	3	=	5.7			(26)
Windows Type 1			3.8	x	1/[1/(1.7)+ 0.04]	=	6.05			(27)
Windows Type 2			7.14	x	1/[1/(1.7)+ 0.04]	=	11.37			(27)
Rooflights Type 1			2	x	1/[1/(2) + 0.04]	=	4			(27b)
Rooflights Type 2			0.8	x	1/[1/(2) + 0.04]	=	1.6			(27b)
Floor			39.42	x	0.2	=	7.884			(28)
Walls	63.9	12.84	51.06	x	0.23	=	11.74			(29)
Roof	55.19	2.8	52.39	x	0.11	=	5.76			(30)
Total area of elements, m²			158.51							(31)
Party wall			115.42	x	0	=	0			(32)

** 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) = 53.69 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 13575.93 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (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 23.78 (36)

SAP WorkSheet: New dwelling design stage

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

Total fabric heat loss (33) + (36) = 77.47 (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=	61.15	59.18	59.18	55.56	53.4	52.4	51.44	51.44	53.92	55.56	57.31	59.18	(38)

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

(39)m=	138.62	136.64	136.64	133.03	130.87	129.86	128.91	128.91	131.39	133.03	134.78	136.64	

Average = Sum(39)$_{1...12}$ /12= 133.28 (39)

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

(40)m=	1.29	1.27	1.27	1.24	1.22	1.21	1.2	1.2	1.22	1.24	1.25	1.27	

Average = Sum(40)$_{1...12}$ /12= 1.24 (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 2.8 (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) + 36 100.7 (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=	110.77	106.74	102.71	98.68	94.66	90.63	90.63	94.66	98.68	102.71	106.74	110.77	

Total = Sum(44)$_{1...12}$ = 1208.37 (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=	164.66	144.01	148.61	129.56	124.31	107.27	99.4	114.07	115.43	134.52	146.84	159.46	

Total = Sum(45)$_{1...12}$ = 1588.15 (45)

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

(46)m=	24.7	21.6	22.29	19.43	18.65	16.09	14.91	17.11	17.31	20.18	22.03	23.92	(46)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (47)

Temperature factor from Table 2b 0 (48)

Energy lost from water storage, kWh/year (47) x (48) = 0 (49)

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

Cylinder volume (litres) including any solar storage within same 200 (50)

If community heating and no tank in dwelling, enter 110 litres in box (50)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in box (50)

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.01 (51)

Volume factor from Table 2a 0.84 (52)

Temperature factor from Table 2b 0.54 (53)

Energy lost from water storage, kWh/year ((50) x (51) x (52) x (53) = 1.05 (54)

Enter (49) or (54) in (55) 1.05 (55)

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

(56)m=	32.61	29.45	32.61	31.56	32.61	31.56	32.61	32.61	31.56	32.61	31.56	32.61	(56)

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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=	32.61	29.45	32.61	31.56	32.61	31.56	32.61	32.61	31.56	32.61	31.56	32.61	(57)

Primary circuit loss (annual) from Table 3 — 280 (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=	23.78	21.48	23.78	23.01	23.78	23.01	23.78	23.78	23.01	23.78	23.01	23.78	(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=	221.05	194.94	205	184.13	180.7	161.84	155.79	170.46	170	190.91	201.41	215.85	(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=	221.05	194.94	205	184.13	180.7	161.84	155.79	170.46	170	190.91	201.41	215.85	

Output from water heater (annual)$_{1...12}$ — 2252.09 (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=	99.86	88.63	94.52	86.73	86.45	79.32	78.16	83.04	82.04	89.84	92.48	98.13	(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=	167.99	167.99	167.99	167.99	167.99	167.99	167.99	167.99	167.99	167.99	167.99	167.99	(66)

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

(67)m=	64.84	57.59	46.83	35.46	26.5	22.38	24.18	31.43	42.18	53.56	62.51	66.64	(67)

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

(68)m=	400.18	404.33	393.87	371.59	343.47	317.04	299.38	295.23	305.69	327.97	356.09	382.52	(68)

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

(69)m=	54.6	54.6	54.6	54.6	54.6	54.6	54.6	54.6	54.6	54.6	54.6	54.6	(69)

Pumps and fans gains (Table 5a)

(70)m=	10	10	10	10	10	10	10	10	10	10	10	10	(70)

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

(71)m=	-112	-112	-112	-112	-112	-112	-112	-112	-112	-112	-112	-112	(71)

Water heating gains (Table 5)

(72)m=	134.22	131.89	127.05	120.46	116.19	110.17	105.06	111.61	113.94	120.75	128.45	131.9	(72)

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

(73)m=	719.83	714.41	688.35	648.11	606.76	570.18	549.22	558.87	582.41	622.88	667.65	701.66	(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

South	0.9x	0.77	x	3.8	x	47.32	x	0.63	x	0.7	=	54.96	(78)
South	0.9x	0.77	x	7.14	x	47.32	x	0.63	x	0.7	=	103.26	(78)
South	0.9x	0.77	x	3.8	x	77.18	x	0.63	x	0.7	=	89.64	(78)
South	0.9x	0.77	x	7.14	x	77.18	x	0.63	x	0.7	=	168.42	(78)
South	0.9x	0.77	x	3.8	x	94.25	x	0.63	x	0.7	=	109.45	(78)
South	0.9x	0.77	x	7.14	x	94.25	x	0.63	x	0.7	=	205.65	(78)
South	0.9x	0.77	x	3.8	x	105.11	x	0.63	x	0.7	=	122.07	(78)
South	0.9x	0.77	x	7.14	x	105.11	x	0.63	x	0.7	=	229.37	(78)
South	0.9x	0.77	x	3.8	x	108.55	x	0.63	x	0.7	=	126.06	(78)
South	0.9x	0.77	x	7.14	x	108.55	x	0.63	x	0.7	=	236.86	(78)
South	0.9x	0.77	x	3.8	x	108.9	x	0.63	x	0.7	=	126.47	(78)
South	0.9x	0.77	x	7.14	x	108.9	x	0.63	x	0.7	=	237.62	(78)
South	0.9x	0.77	x	3.8	x	107.14	x	0.63	x	0.7	=	124.42	(78)
South	0.9x	0.77	x	7.14	x	107.14	x	0.63	x	0.7	=	233.78	(78)
South	0.9x	0.77	x	3.8	x	103.88	x	0.63	x	0.7	=	120.64	(78)
South	0.9x	0.77	x	7.14	x	103.88	x	0.63	x	0.7	=	226.68	(78)
South	0.9x	0.77	x	3.8	x	99.99	x	0.63	x	0.7	=	116.12	(78)
South	0.9x	0.77	x	7.14	x	99.99	x	0.63	x	0.7	=	218.19	(78)
South	0.9x	0.77	x	3.8	x	85.29	x	0.63	x	0.7	=	99.05	(78)
South	0.9x	0.77	x	7.14	x	85.29	x	0.63	x	0.7	=	186.11	(78)
South	0.9x	0.77	x	3.8	x	56.07	x	0.63	x	0.7	=	65.11	(78)
South	0.9x	0.77	x	7.14	x	56.07	x	0.63	x	0.7	=	122.35	(78)
South	0.9x	0.77	x	3.8	x	40.89	x	0.63	x	0.7	=	47.49	(78)
South	0.9x	0.77	x	7.14	x	40.89	x	0.63	x	0.7	=	89.23	(78)
Rooflights	0.9x	1	x	2	x	10.73	x	0.63	x	0.7	=	8.51	(82)
Rooflights	0.9x	1	x	0.8	x	26	x	0.63	x	0.7	=	8.26	(82)
Rooflights	0.9x	1	x	2	x	20.36	x	0.63	x	0.7	=	16.16	(82)
Rooflights	0.9x	1	x	0.8	x	54	x	0.63	x	0.7	=	17.15	(82)
Rooflights	0.9x	1	x	2	x	33.31	x	0.63	x	0.7	=	26.44	(82)
Rooflights	0.9x	1	x	0.8	x	94	x	0.63	x	0.7	=	29.85	(82)
Rooflights	0.9x	1	x	2	x	54.64	x	0.63	x	0.7	=	43.37	(82)
Rooflights	0.9x	1	x	0.8	x	150	x	0.63	x	0.7	=	47.63	(82)
Rooflights	0.9x	1	x	2	x	75.22	x	0.63	x	0.7	=	59.71	(82)
Rooflights	0.9x	1	x	0.8	x	190	x	0.63	x	0.7	=	60.33	(82)
Rooflights	0.9x	1	x	2	x	84.09	x	0.63	x	0.7	=	66.75	(82)
Rooflights	0.9x	1	x	0.8	x	201	x	0.63	x	0.7	=	63.82	(82)
Rooflights	0.9x	1	x	2	x	79.12	x	0.63	x	0.7	=	62.81	(82)
Rooflights	0.9x	1	x	0.8	x	194	x	0.63	x	0.7	=	61.6	(82)
Rooflights	0.9x	1	x	2	x	61.56	x	0.63	x	0.7	=	48.87	(82)
Rooflights	0.9x	1	x	0.8	x	164	x	0.63	x	0.7	=	52.07	(82)
Rooflights	0.9x	1	x	2	x	41.09	x	0.63	x	0.7	=	32.61	(82)

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Rooflights 0.9x	1	x	0.8	x	116	x	0.63	x	0.7	=	36.83	(82)
Rooflights 0.9x	1	x	2	x	24.81	x	0.63	x	0.7	=	19.7	(82)
Rooflights 0.9x	1	x	0.8	x	68	x	0.63	x	0.7	=	21.59	(82)
Rooflights 0.9x	1	x	2	x	13.22	x	0.63	x	0.7	=	10.49	(82)
Rooflights 0.9x	1	x	0.8	x	33	x	0.63	x	0.7	=	10.48	(82)
Rooflights 0.9x	1	x	2	x	8.94	x	0.63	x	0.7	=	7.1	(82)
Rooflights 0.9x	1	x	0.8	x	21	x	0.63	x	0.7	=	6.67	(82)

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

(83)m=	174.99	291.36	371.39	442.44	482.96	494.66	482.61	448.27	403.76	326.45	208.43	150.48	(83)

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

(84)m=	894.83	1005.77	1059.74	1090.55	1089.72	1064.85	1031.82	1007.13	986.17	949.33	876.08	852.14	(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=	0.99	0.99	0.97	0.95	0.87	0.71	0.5	0.51	0.78	0.94	0.99	0.99	(86)

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

(87)m=	21	21	21	21	21	21	21	21	21	21	21	21	(87)

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

(88)m=	19.85	19.87	19.87	19.89	19.91	19.92	19.92	19.92	19.91	19.89	19.88	19.87	(88)

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

(89)m=	0.99	0.98	0.96	0.93	0.82	0.62	0.38	0.38	0.69	0.91	0.98	0.99	(89)

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

(90)m=	19.85	19.87	19.87	19.89	19.91	19.92	19.92	19.92	19.91	19.89	19.88	19.87	(90)

fLA = Living area ÷ (4) = 0.2 (91)

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

(92)m=	20.08	20.1	20.1	20.12	20.13	20.14	20.14	20.14	20.13	20.12	20.11	20.1	(92)

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

(93)m=	19.98	20	20	20.02	20.03	20.04	20.04	20.04	20.03	20.02	20.01	20	(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=	0.99	0.98	0.96	0.93	0.83	0.63	0.39	0.4	0.7	0.91	0.98	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	885.39	986.67	1020.84	1013.38	902.24	670.06	402.31	402.03	690.78	866.7	858.9	843.86	(95)

Monthly average external temperature from Table 8

(96)m=	4.5	5	6.8	8.7	11.7	14.6	16.9	16.9	14.3	10.8	7	4.9	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	2146.43	2049.06	1803.11	1505.45	1090.07	705.87	404.92	404.92	752.4	1226.1	1753.02	2062.73	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	938.21	713.93	582.01	354.29	139.75	0	0	0	0	267.39	643.76	906.84	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	4546.18	(98)
Space heating requirement in kWh/m²/year	42.24	(99)

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

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	321.8	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	938.21	713.93	582.01	354.29	139.75	0	0	0	0	267.39	643.76	906.84	
(211)m = {[(98)m x (204)] + (210)m } x 100 ÷ (206)	291.55	221.85	180.86	110.1	43.43	0	0	0	0	83.09	200.05	281.8	(211)

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 1412.73 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] + (214) m } x 100 ÷ (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Output from water heater (calculated above)	221.05	194.94	205	184.13	180.7	161.84	155.79	170.46	170	190.91	201.41	215.85	
Efficiency of water heater													112.5 (216)
(217)m=	112.5	112.5	112.5	112.5	112.5	112.5	112.5	112.5	112.5	112.5	112.5	112.5	(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m													
(219)m=	196.49	173.28	182.22	163.67	160.63	143.86	138.48	151.52	151.11	169.7	179.03	191.87	

Total = Sum(219a)$_{1...12}$ = 2001.86 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		1412.73
Water heating fuel used		2001.86
Electricity for pumps, fans and electric keep-hot		
Total electricity for the above, kWh/year sum of (230a)…(230g) =		0 (231)
Electricity for lighting		458.02 (232)

10a. Fuel costs - individual heating systems:

	Fuel kWh/year	**Fuel Price** (Table 12)		**Fuel Cost** £/year
Space heating - main system 1	(211) x	11.46	x 0.01 =	161.9 (240)
Space heating - main system 2	(213) x	0	x 0.01 =	0 (241)
Space heating - secondary	(215) x	0	x 0.01 =	0 (242)

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Water heating cost (other fuel)	(219)	11.46	x 0.01 =	229.41	(247)
Pumps, fans and electric keep-hot	(231)	11.46	x 0.01 =	0	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a					
Energy for lighting	(232)	11.46	x 0.01 =	52.49	(250)
Additional standing charges (Table 12)				0	(251)
Appendix Q items: repeat lines (253) and (254) as needed					
Total energy cost	(245)...(247) + (250)...(254) =			443.8	(255)

11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.47	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.37	(257)
SAP rating (Section 12)		80.94	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

		Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211)	x	0.517	=	730.38	(261)
Space heating (secondary)	(215)	x	0	=	0	(263)
Water heating	(219)	x	0.517	=	1034.96	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1765.34	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.517	=	0	(267)
Electricity for lighting	(232)	x	0.517	=	236.79	(268)
Total CO2, kg/year	sum of (265)…(271) =				2002.14	(272)
CO2 emissions per m²	(272) ÷ (4) =				18.6	(273)
EI rating (section 14)					82	(274)

13a. Primary Energy

		Energy kWh/year		**Primary** factor		**P. Energy** kWh/year	
Space heating (main system 1)	(211)	x	2.92	=	4125.17	(261)
Space heating (secondary)	(215)	x	0	=	0	(263)
Energy for water heating	(219)	x	2.92	=	5845.42	(264)
Space and water heating	(261) + (262) + (263) + (264) =				9970.6	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	2.92	=	0	(267)
Electricity for lighting	(232)	x	0	=	1337.41	(268)
'Total Primary Energy	sum of (265)…(271) =				11308.01	(272)
Primary energy kWh/m²/year	(272) ÷ (4) =				105.05	(273)

Regulations Compliance Report

Approved Document L1A 2010 edition assessed by Stroma FSAP 2009 program, Version: 1.4.0.73
Printed on 02 May 2012 at 12:31:08

Project Information:

Assessed By: Mike Ovenden (STRO006697) **Building Type:** Mid-terrace House

Dwelling Details:

NEW DWELLING DESIGN STAGE

Site Reference : Plot 7 mid terrace **Plot Reference:** Plot 7

Address : Plot 7, Penistone Coal Drops, St. Mary's Street, Penistone, Sheffield, S36 6DT

Client Details:

Name: Stephen Sharp

Address : Yourspace Studio Limited , 180 main road, west winch, king's lynn, PE330LJ

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

1 TER and DER

Fuel for main heating system: Grid electricity

Target Carbon Dioxide Emission Rate (TER)	28.71 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	24.35 kg/m²	OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.23 (max. 0.30)	0.23 (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	0.14 (max. 0.20)	0.14 (max. 0.35)	OK
Openings	1.89 (max. 2.00)	3.00 (max. 3.30)	OK

3 Design air permeability

Design air permeability at 50 pascals	6.00	
Maximum	10.0	OK

4 Heating efficiency

Main Heating system: Heat pumps with radiators or underfloor - electric
Mitsubishi ECODAN 5kW

Secondary heating system: None

5 Cylinder insulation

Hot water Storage:	Nominal cylinder loss: 2.37 kWh/day Permitted by DBSCG: 3.11 kWh/day	OK
Primary pipework insulated:	Yes	OK

6 Controls

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

7 Low energy lights

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

Regulations Compliance Report

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (North East England):	Not significant	**OK**
Based on:		
Overshading:	Average or unknown	
Windows facing: South	3.8m², Overhang twice as wide as window, ratio NaN	
Windows facing: South	7.14m², Overhang twice as wide as window, ratio NaN	
Ventilation rate:	8.00	
Blinds/curtains:	shutter closed 100% of daylight hours	

10 Key features

None

SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Mike Ovenden	**Stroma Number:**	STRO006697
Software Name:	Stroma FSAP 2009	**Software Version:**	Version: 1.4.0.73

Property Address: Plot 7 mid terrace

Address : Plot 7, Penistone Coal Drops, St. Mary's Street, Penistone, Sheffield, S36 6DT

1. Overall dwelling dimensions:

	Area(m²)		Ave Height(m)		Volume(m³)	
Ground floor	36.9	(1a) x	2.6	(2a) =	95.94	(3a)
First floor	36.9	(1b) x	2.6	(2b) =	95.94	(3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	73.8	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		191.88	(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	1	+	0	+	0	=	1	x 20 =	20	(6b)
Number of intermittent fans							4	x 10 =	40	(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) =	60	÷ (5) =	0.31 (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				6 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.61 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides on which sheltered				2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =			0.85 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =			0.52 (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=	5.4	5.1	5.1	4.5	4.1	3.9	3.7	3.7	4.2	4.5	4.8	5.1

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Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.35	1.27	1.27	1.12	1.02	0.98	0.92	0.92	1.05	1.12	1.2	1.27

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

0.7	0.66	0.66	0.59	0.53	0.51	0.48	0.48	0.55	0.59	0.62	0.66

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

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

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0

(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=	0.75	0.72	0.72	0.67	0.64	0.63	0.62	0.62	0.65	0.67	0.7	0.72

(24d)

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

(25)m=	0.75	0.72	0.72	0.67	0.64	0.63	0.62	0.62	0.65	0.67	0.7	0.72

(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			1.9	x	3	=	5.7			(26)
Windows Type 1			3.8	x	1/[1/(1.7)+ 0.04]	=	6.05			(27)
Windows Type 2			7.14	x	1/[1/(1.7)+ 0.04]	=	11.37			(27)
Floor			36.9	x	0.2	=	7.380001			(28)
Walls	46.8	12.84	33.96	x	0.23	=	7.81			(29)
Roof	36.9	0	36.9	x	0.14	=	5.17			(30)
Total area of elements, m²			120.6							(31)
Party wall			85.28	x	0	=	0			(32)

** 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) = 43.47 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 10605.9 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (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 18.09 (36)

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

Total fabric heat loss (33) + (36) = 61.56 (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=	47.31	45.62	45.62	42.53	40.68	39.82	39.01	39.01	41.13	42.53	44.03	45.62	(38)

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

(39)m=	108.87	107.18	107.18	104.09	102.24	101.38	100.57	100.57	102.69	104.09	105.59	107.18	

Average = Sum(39)$_{1...12}$ /12= 104.3 (39)

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

(40)m=	1.48	1.45	1.45	1.41	1.39	1.37	1.36	1.36	1.39	1.41	1.43	1.45	

Average = Sum(40)$_{1...12}$ /12= 1.41 (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 89.65 (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=	98.62	95.03	91.44	87.86	84.27	80.69	80.69	84.27	87.86	91.44	95.03	98.62	

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

Total = Sum(44)$_{1...12}$ = 1075.8 (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=	146.59	128.21	132.3	115.34	110.68	95.5	88.5	101.55	102.77	119.77	130.73	141.97	

Total = Sum(45)$_{1...12}$ = 1413.92 (45)

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

(46)m=	21.99	19.23	19.85	17.3	16.6	14.33	13.27	15.23	15.42	17.96	19.61	21.3	(46)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (47)

Temperature factor from Table 2b 0 (48)

Energy lost from water storage, kWh/year (47) x (48) = 0 (49)

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

Cylinder volume (litres) including any solar storage within same 200 (50)

If community heating and no tank in dwelling, enter 110 litres in box (50)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in box (50)

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.01 (51)

Volume factor from Table 2a 0.84 (52)

Temperature factor from Table 2b 0.54 (53)

Energy lost from water storage, kWh/year ((50) x (51) x (52) x (53) = 1.05 (54)

Enter (49) or (54) in (55) 1.05 (55)

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

(56)m=	32.61	29.45	32.61	31.56	32.61	31.56	32.61	32.61	31.56	32.61	31.56	32.61	(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=	32.61	29.45	32.61	31.56	32.61	31.56	32.61	32.61	31.56	32.61	31.56	32.61	(57)

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Primary circuit loss (annual) from Table 3 | 280 | (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=	23.78	21.48	23.78	23.01	23.78	23.01	23.78	23.78	23.01	23.78	23.01	23.78	(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=	202.98	179.14	188.69	169.91	167.06	150.07	144.89	157.94	157.34	176.15	185.3	198.36	(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=	202.98	179.14	188.69	169.91	167.06	150.07	144.89	157.94	157.34	176.15	185.3	198.36	

Output from water heater (annual)$_{1...12}$ | 2077.85 | (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=	93.85	83.38	89.1	82.01	81.91	75.41	74.54	78.88	77.83	84.93	87.12	92.32	(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=	140.08	140.08	140.08	140.08	140.08	140.08	140.08	140.08	140.08	140.08	140.08	140.08	(66)

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

(67)m=	48.65	43.21	35.14	26.61	19.89	16.79	18.14	23.58	31.65	40.19	46.91	50.01	(67)

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

(68)m=	307.46	310.65	302.61	285.5	263.89	243.58	230.02	226.83	234.87	251.98	273.59	293.89	(68)

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

(69)m=	51.34	51.34	51.34	51.34	51.34	51.34	51.34	51.34	51.34	51.34	51.34	51.34	(69)

Pumps and fans gains (Table 5a)

(70)m=	10	10	10	10	10	10	10	10	10	10	10	10	(70)

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

(71)m=	-93.39	-93.39	-93.39	-93.39	-93.39	-93.39	-93.39	-93.39	-93.39	-93.39	-93.39	-93.39	(71)

Water heating gains (Table 5)

(72)m=	126.15	124.07	119.76	113.9	110.1	104.74	100.18	106.02	108.09	114.16	121.01	124.08	(72)

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

(73)m=	590.3	585.98	565.55	534.04	501.91	473.15	456.38	464.47	482.65	514.37	549.54	576.02	(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)	
South	0.9x 0.77	x	3.8	x	47.32	x	0.63	x	0.7	=	54.96	(78)
South	0.9x 0.77	x	7.14	x	47.32	x	0.63	x	0.7	=	103.26	(78)

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South	0.9x	0.77	x	3.8	x	77.18	x	0.63	x	0.7	=	89.64	(78)
South	0.9x	0.77	x	7.14	x	77.18	x	0.63	x	0.7	=	168.42	(78)
South	0.9x	0.77	x	3.8	x	94.25	x	0.63	x	0.7	=	109.45	(78)
South	0.9x	0.77	x	7.14	x	94.25	x	0.63	x	0.7	=	205.65	(78)
South	0.9x	0.77	x	3.8	x	105.11	x	0.63	x	0.7	=	122.07	(78)
South	0.9x	0.77	x	7.14	x	105.11	x	0.63	x	0.7	=	229.37	(78)
South	0.9x	0.77	x	3.8	x	108.55	x	0.63	x	0.7	=	126.06	(78)
South	0.9x	0.77	x	7.14	x	108.55	x	0.63	x	0.7	=	236.86	(78)
South	0.9x	0.77	x	3.8	x	108.9	x	0.63	x	0.7	=	126.47	(78)
South	0.9x	0.77	x	7.14	x	108.9	x	0.63	x	0.7	=	237.62	(78)
South	0.9x	0.77	x	3.8	x	107.14	x	0.63	x	0.7	=	124.42	(78)
South	0.9x	0.77	x	7.14	x	107.14	x	0.63	x	0.7	=	233.78	(78)
South	0.9x	0.77	x	3.8	x	103.88	x	0.63	x	0.7	=	120.64	(78)
South	0.9x	0.77	x	7.14	x	103.88	x	0.63	x	0.7	=	226.68	(78)
South	0.9x	0.77	x	3.8	x	99.99	x	0.63	x	0.7	=	116.12	(78)
South	0.9x	0.77	x	7.14	x	99.99	x	0.63	x	0.7	=	218.19	(78)
South	0.9x	0.77	x	3.8	x	85.29	x	0.63	x	0.7	=	99.05	(78)
South	0.9x	0.77	x	7.14	x	85.29	x	0.63	x	0.7	=	186.11	(78)
South	0.9x	0.77	x	3.8	x	56.07	x	0.63	x	0.7	=	65.11	(78)
South	0.9x	0.77	x	7.14	x	56.07	x	0.63	x	0.7	=	122.35	(78)
South	0.9x	0.77	x	3.8	x	40.89	x	0.63	x	0.7	=	47.49	(78)
South	0.9x	0.77	x	7.14	x	40.89	x	0.63	x	0.7	=	89.23	(78)

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

(83)m=	158.22	258.05	315.1	351.44	362.93	364.09	358.2	347.32	334.31	285.17	187.46	136.71	(83)

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

(84)m=	748.52	844.03	880.66	885.48	864.84	837.24	814.59	811.79	816.96	799.53	737	712.73	(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=	0.98	0.97	0.95	0.93	0.85	0.7	0.49	0.49	0.74	0.91	0.97	0.99	(86)

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

(87)m=	21	21	21	21	21	21	21	21	21	21	21	21	(87)

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

(88)m=	19.71	19.73	19.73	19.76	19.78	19.79	19.8	19.8	19.77	19.76	19.74	19.73	(88)

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

(89)m=	0.98	0.96	0.94	0.9	0.79	0.59	0.35	0.36	0.64	0.87	0.96	0.98	(89)

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

(90)m=	19.71	19.73	19.73	19.76	19.78	19.79	19.8	19.8	19.77	19.76	19.74	19.73	(90)

fLA = Living area ÷ (4) = 0.2 (91)

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

(92)m=	19.97	19.98	19.98	20.01	20.02	20.03	20.04	20.04	20.02	20.01	20	19.98	(92)

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

(93)m=	19.87	19.88	19.88	19.91	19.92	19.93	19.94	19.94	19.92	19.91	19.9	19.88	(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=	0.98	0.97	0.94	0.9	0.8	0.61	0.37	0.37	0.65	0.87	0.96	0.98	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	733.46	815.33	829.37	800.07	692.88	509.18	302.91	302.88	532.44	697.8	710.85	699.33	(95)
Monthly average external temperature from Table 8													
(96)m=	4.5	5	6.8	8.7	11.7	14.6	16.9	16.9	14.3	10.8	7	4.9	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1673.28	1595.18	1402.25	1166.67	840.81	540.46	305.48	305.48	577.11	948.09	1361.66	1605.89	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	699.22	524.05	426.23	263.96	110.06	0	0	0	0	186.22	468.58	674.48	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 3352.8 (98)

Space heating requirement in kWh/m²/year 45.43 (99)

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

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 317.82 (206)

Efficiency of secondary/supplementary heating system, % 0 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	699.22	524.05	426.23	263.96	110.06	0	0	0	0	186.22	468.58	674.48	
(211)m = {[(98)m x (204)] + (210)m } x 100 ÷ (206)													(211)
	220.01	164.89	134.11	83.05	34.63	0	0	0	0	58.59	147.44	212.22	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 1054.94 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] + (214) m } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10....12}$= 0 (215)

Water heating

Output from water heater (calculated above)

	202.98	179.14	188.69	169.91	167.06	150.07	144.89	157.94	157.34	176.15	185.3	198.36

Efficiency of water heater 112.5 (216)

(217)m=	112.5	112.5	112.5	112.5	112.5	112.5	112.5	112.5	112.5	112.5	112.5	112.5	(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	180.43	159.24	167.73	151.04	148.5	133.4	128.79	140.39	139.86	156.58	164.71	176.32	

Total = Sum(219a)$_{1...12}$ = 1846.98 (219)

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Annual totals		kWh/year	kWh/year	
Space heating fuel used, main system 1			1054.94	
Water heating fuel used			1846.98	
Electricity for pumps, fans and electric keep-hot				
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		0	(231)
Electricity for lighting			343.7	(232)

10a. Fuel costs - individual heating systems:

	Fuel kWh/year		Fuel Price (Table 12)		Fuel Cost £/year	
Space heating - main system 1	(211) x		11.46	x 0.01 =	120.9	(240)
Space heating - main system 2	(213) x		0	x 0.01 =	0	(241)
Space heating - secondary	(215) x		0	x 0.01 =	0	(242)
Water heating cost (other fuel)	(219)		11.46	x 0.01 =	211.66	(247)
Pumps, fans and electric keep-hot	(231)		11.46	x 0.01 =	0	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a						
Energy for lighting	(232)		11.46	x 0.01 =	39.39	(250)
Additional standing charges (Table 12)					0	(251)
Appendix Q items: repeat lines (253) and (254) as needed						
Total energy cost	(245)...(247) + (250)…(254) =				371.95	(255)

11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)	0.47	(256)
Energy cost factor (ECF) [(255) x (256)] ÷ [(4) + 45.0] =	1.47	(257)
SAP rating (Section 12)	79.47	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.517	=	545.4	(261)
Space heating (secondary)	(215) x		0	=	0	(263)
Water heating	(219) x		0.517	=	954.89	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1500.29	(265)
Electricity for pumps, fans and electric keep-hot	(231) x		0.517	=	0	(267)
Electricity for lighting	(232) x		0.517	=	177.69	(268)
Total CO2, kg/year	sum of (265)…(271) =				1677.99	(272)
CO2 emissions per m²	(272) ÷ (4) =				22.74	(273)
EI rating (section 14)					81	(274)

13a. Primary Energy

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	Energy kWh/year		**Primary** factor		**P. Energy** kWh/year	
Space heating (main system 1)	(211)	x	2.92	=	3080.43	(261)
Space heating (secondary)	(215)	x	0	=	0	(263)
Energy for water heating	(219)	x	2.92	=	5393.19	(264)
Space and water heating	(261) + (262) + (263) + (264) =				8473.61	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	2.92	=	0	(267)
Electricity for lighting	(232)	x	0	=	1003.61	(268)
'Total Primary Energy			sum of (265)…(271) =		9477.22	(272)
Primary energy kWh/m²/year			(272) ÷ (4) =		128.42	(273)

Regulations Compliance Report

Approved Document L1A 2010 edition assessed by Stroma FSAP 2009 program, Version: 1.4.0.73
Printed on 02 May 2012 at 12:31:02

Project Information:

Assessed By: Mike Ovenden (STRO006697) **Building Type:** End-terrace House

Dwelling Details:

NEW DWELLING DESIGN STAGE

Site Reference : Plot 8 end terrace **Plot Reference:** Plot 8

Address : Plot 8, Penistone Coal Drops, St. Mary's Street, Penistone, Sheffield, S36 6DT

Client Details:

Name: Stephen Sharp

Address : Yourspace Studio Limited , 180 main road, west winch, king's lynn, PE330LJ

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

1 TER and DER

Fuel for main heating system: Grid electricity

Target Carbon Dioxide Emission Rate (TER)	32.5 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	26.93 kg/m²	OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.23 (max. 0.30)	0.23 (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	0.14 (max. 0.20)	0.14 (max. 0.35)	OK
Openings	1.89 (max. 2.00)	3.00 (max. 3.30)	OK

3 Design air permeability

Design air permeability at 50 pascals	6.00	
Maximum	10.0	OK

4 Heating efficiency

Main Heating system:

Heat pumps with radiators or underfloor - electric
Mitsubishi ECODAN 5kW

Secondary heating system: None

5 Cylinder insulation

Hot water Storage:	Nominal cylinder loss: 2.37 kWh/day Permitted by DBSCG: 3.11 kWh/day	OK
Primary pipework insulated:	Yes	OK

6 Controls

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

7 Low energy lights

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

Regulations Compliance Report

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (North East England):	Not significant	**OK**
Based on:		
Overshading:	Average or unknown	
Windows facing: South	3.8m², Overhang twice as wide as window, ratio NaN	
Windows facing: South	7.14m², Overhang twice as wide as window, ratio NaN	
Ventilation rate:	8.00	
Blinds/curtains:	shutter closed 100% of daylight hours	

10 Key features

None

SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Mike Ovenden	**Stroma Number:**	STRO006697
Software Name:	Stroma FSAP 2009	**Software Version:**	Version: 1.4.0.73

Property Address: Plot 8 end terrace

Address : Plot 8, Penistone Coal Drops, St. Mary's Street, Penistone, Sheffield, S36 6DT

1. Overall dwelling dimensions:

	Area(m²)		Ave Height(m)		Volume(m³)	
Ground floor	36.9 (1a)	x	2.6 (2a)	=	95.94	(3a)
First floor	36.9 (1b)	x	2.6 (2b)	=	95.94	(3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	73.8 (4)					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		191.88	(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	1	+	0	+	0	=	1	x 20 =	20	(6b)
Number of intermittent fans							4	x 10 =	40	(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) =	60	÷ (5) =	0.31	(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			6	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.61	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides on which sheltered			1	(19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.92	(20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.57	(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=	5.4	5.1	5.1	4.5	4.1	3.9	3.7	3.7	4.2	4.5	4.8	5.1

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Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.35	1.27	1.27	1.12	1.02	0.98	0.92	0.92	1.05	1.12	1.2	1.27

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

0.77	0.72	0.72	0.64	0.58	0.55	0.52	0.52	0.6	0.64	0.68	0.72

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

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

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0

(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=	0.79	0.76	0.76	0.7	0.67	0.65	0.64	0.64	0.68	0.7	0.73	0.76

(24d)

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

(25)m=	0.79	0.76	0.76	0.7	0.67	0.65	0.64	0.64	0.68	0.7	0.73	0.76

(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			1.9	x	3	=	5.7			(26)
Windows Type 1			3.8	x	1/[1/(1.7)+ 0.04]	=	6.05			(27)
Windows Type 2			7.14	x	1/[1/(1.7)+ 0.04]	=	11.37			(27)
Floor			36.9	x	0.2	=	7.380001			(28)
Walls	89.44	12.84	76.6	x	0.23	=	17.62			(29)
Roof	36.9	0	36.9	x	0.14	=	5.17			(30)
Total area of elements, m²			163.24							(31)
Party wall			42.64	x	0	=	0			(32)

** 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) = 53.28 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 11671.9 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (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 24.49 (36)

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

Total fabric heat loss (33) + (36) = 77.76 (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

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(38)m=	50.19	48.19	48.19	44.53	42.34	41.33	40.36	40.36	42.87	44.53	46.3	48.19	(38)

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

(39)m=	127.96	125.96	125.96	122.29	120.11	119.09	118.13	118.13	120.64	122.29	124.07	125.96	

Average = Sum(39)$_{1...12}$ /12= 122.55 (39)

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

(40)m=	1.73	1.71	1.71	1.66	1.63	1.61	1.6	1.6	1.63	1.66	1.68	1.71	

Average = Sum(40)$_{1...12}$ /12= 1.66 (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 89.65 (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=	98.62	95.03	91.44	87.86	84.27	80.69	80.69	84.27	87.86	91.44	95.03	98.62	

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

Total = Sum(44)$_{1...12}$ = 1075.8 (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=	146.59	128.21	132.3	115.34	110.68	95.5	88.5	101.55	102.77	119.77	130.73	141.97	

Total = Sum(45)$_{1...12}$ = 1413.92 (45)

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

(46)m=	21.99	19.23	19.85	17.3	16.6	14.33	13.27	15.23	15.42	17.96	19.61	21.3	(46)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (47)

Temperature factor from Table 2b 0 (48)

Energy lost from water storage, kWh/year (47) x (48) = 0 (49)

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

Cylinder volume (litres) including any solar storage within same 200 (50)

If community heating and no tank in dwelling, enter 110 litres in box (50)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in box (50)

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.01 (51)

Volume factor from Table 2a 0.84 (52)

Temperature factor from Table 2b 0.54 (53)

Energy lost from water storage, kWh/year ((50) x (51) x (52) x (53) = 1.05 (54)

Enter (49) or (54) in (55) 1.05 (55)

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

(56)m=	32.61	29.45	32.61	31.56	32.61	31.56	32.61	32.61	31.56	32.61	31.56	32.61	(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=	32.61	29.45	32.61	31.56	32.61	31.56	32.61	32.61	31.56	32.61	31.56	32.61	(57)

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Primary circuit loss (annual) from Table 3 | 280 | (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=	23.78	21.48	23.78	23.01	23.78	23.01	23.78	23.78	23.01	23.78	23.01	23.78	(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=	202.98	179.14	188.69	169.91	167.06	150.07	144.89	157.94	157.34	176.15	185.3	198.36	(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=	202.98	179.14	188.69	169.91	167.06	150.07	144.89	157.94	157.34	176.15	185.3	198.36	

Output from water heater (annual)$_{1...12}$ | 2077.85 | (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=	93.85	83.38	89.1	82.01	81.91	75.41	74.54	78.88	77.83	84.93	87.12	92.32	(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=	140.08	140.08	140.08	140.08	140.08	140.08	140.08	140.08	140.08	140.08	140.08	140.08	(66)

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

(67)m=	48.65	43.21	35.14	26.61	19.89	16.79	18.14	23.58	31.65	40.19	46.91	50.01	(67)

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

(68)m=	307.46	310.65	302.61	285.5	263.89	243.58	230.02	226.83	234.87	251.98	273.59	293.89	(68)

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

(69)m=	51.34	51.34	51.34	51.34	51.34	51.34	51.34	51.34	51.34	51.34	51.34	51.34	(69)

Pumps and fans gains (Table 5a)

(70)m=	10	10	10	10	10	10	10	10	10	10	10	10	(70)

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

(71)m=	-93.39	-93.39	-93.39	-93.39	-93.39	-93.39	-93.39	-93.39	-93.39	-93.39	-93.39	-93.39	(71)

Water heating gains (Table 5)

(72)m=	126.15	124.07	119.76	113.9	110.1	104.74	100.18	106.02	108.09	114.16	121.01	124.08	(72)

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

(73)m=	590.3	585.98	565.55	534.04	501.91	473.15	456.38	464.47	482.65	514.37	549.54	576.02	(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)	
South	0.9x 0.77	x	3.8	x	47.32	x	0.63	x	0.7	=	54.96	(78)
South	0.9x 0.77	x	7.14	x	47.32	x	0.63	x	0.7	=	103.26	(78)

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South	0.9x	0.77	x	3.8	x	77.18	x	0.63	x	0.7	=	89.64	(78)
South	0.9x	0.77	x	7.14	x	77.18	x	0.63	x	0.7	=	168.42	(78)
South	0.9x	0.77	x	3.8	x	94.25	x	0.63	x	0.7	=	109.45	(78)
South	0.9x	0.77	x	7.14	x	94.25	x	0.63	x	0.7	=	205.65	(78)
South	0.9x	0.77	x	3.8	x	105.11	x	0.63	x	0.7	=	122.07	(78)
South	0.9x	0.77	x	7.14	x	105.11	x	0.63	x	0.7	=	229.37	(78)
South	0.9x	0.77	x	3.8	x	108.55	x	0.63	x	0.7	=	126.06	(78)
South	0.9x	0.77	x	7.14	x	108.55	x	0.63	x	0.7	=	236.86	(78)
South	0.9x	0.77	x	3.8	x	108.9	x	0.63	x	0.7	=	126.47	(78)
South	0.9x	0.77	x	7.14	x	108.9	x	0.63	x	0.7	=	237.62	(78)
South	0.9x	0.77	x	3.8	x	107.14	x	0.63	x	0.7	=	124.42	(78)
South	0.9x	0.77	x	7.14	x	107.14	x	0.63	x	0.7	=	233.78	(78)
South	0.9x	0.77	x	3.8	x	103.88	x	0.63	x	0.7	=	120.64	(78)
South	0.9x	0.77	x	7.14	x	103.88	x	0.63	x	0.7	=	226.68	(78)
South	0.9x	0.77	x	3.8	x	99.99	x	0.63	x	0.7	=	116.12	(78)
South	0.9x	0.77	x	7.14	x	99.99	x	0.63	x	0.7	=	218.19	(78)
South	0.9x	0.77	x	3.8	x	85.29	x	0.63	x	0.7	=	99.05	(78)
South	0.9x	0.77	x	7.14	x	85.29	x	0.63	x	0.7	=	186.11	(78)
South	0.9x	0.77	x	3.8	x	56.07	x	0.63	x	0.7	=	65.11	(78)
South	0.9x	0.77	x	7.14	x	56.07	x	0.63	x	0.7	=	122.35	(78)
South	0.9x	0.77	x	3.8	x	40.89	x	0.63	x	0.7	=	47.49	(78)
South	0.9x	0.77	x	7.14	x	40.89	x	0.63	x	0.7	=	89.23	(78)

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

(83)m=	158.22	258.05	315.1	351.44	362.93	364.09	358.2	347.32	334.31	285.17	187.46	136.71	(83)

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

(84)m=	748.52	844.03	880.66	885.48	864.84	837.24	814.59	811.79	816.96	799.53	737	712.73	(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=	0.99	0.98	0.96	0.94	0.88	0.76	0.56	0.56	0.79	0.92	0.98	0.99	(86)

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

(87)m=	21	21	21	21	21	21	21	21	21	21	21	21	(87)

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

(88)m=	19.52	19.54	19.54	19.58	19.6	19.61	19.62	19.62	19.59	19.58	19.56	19.54	(88)

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

(89)m=	0.98	0.97	0.95	0.92	0.83	0.64	0.39	0.39	0.69	0.89	0.97	0.98	(89)

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

(90)m=	19.52	19.54	19.54	19.58	19.6	19.61	19.62	19.62	19.59	19.58	19.56	19.54	(90)

fLA = Living area ÷ (4) = 0.2 (91)

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

(92)m=	19.82	19.83	19.83	19.86	19.88	19.89	19.9	19.9	19.88	19.86	19.85	19.83	(92)

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

(93)m=	19.72	19.73	19.73	19.76	19.78	19.79	19.8	19.8	19.78	19.76	19.75	19.73	(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=	0.98	0.97	0.95	0.92	0.84	0.66	0.41	0.41	0.7	0.9	0.97	0.98	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	734.57	818.72	837.03	814.97	723.55	553.13	335.15	335.08	573.3	715.7	714.01	700.29	(95)
Monthly average external temperature from Table 8													
(96)m=	4.5	5	6.8	8.7	11.7	14.6	16.9	16.9	14.3	10.8	7	4.9	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1947.4	1855.89	1629.17	1352.92	970.45	617.82	342.02	342.02	660.57	1096.1	1581.74	1868.48	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	902.35	696.97	589.35	387.32	183.69	0	0	0	0	283.02	624.77	869.14	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 4536.61 (98)

Space heating requirement in kWh/m²/year 61.47 (99)

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

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 320.52 (206)

Efficiency of secondary/supplementary heating system, % 0 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	902.35	696.97	589.35	387.32	183.69	0	0	0	0	283.02	624.77	869.14	
(211)m = {[(98)m x (204)] + (210)m } x 100 ÷ (206)													(211)
	281.52	217.45	183.87	120.84	57.31	0	0	0	0	88.3	194.92	271.16	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 1415.39 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] + (214) m } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10....12}$= 0 (215)

Water heating

Output from water heater (calculated above)

	202.98	179.14	188.69	169.91	167.06	150.07	144.89	157.94	157.34	176.15	185.3	198.36	

Efficiency of water heater 112.5 (216)

(217)m=	112.5	112.5	112.5	112.5	112.5	112.5	112.5	112.5	112.5	112.5	112.5	112.5	(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	180.43	159.24	167.73	151.04	148.5	133.4	128.79	140.39	139.86	156.58	164.71	176.32	

Total = Sum(219a)$_{1...12}$ = 1846.98 (219)

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Annual totals		kWh/year	kWh/year	
Space heating fuel used, main system 1			1415.39	
Water heating fuel used			1846.98	
Electricity for pumps, fans and electric keep-hot				
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		0	(231)
Electricity for lighting			343.7	(232)

10a. Fuel costs - individual heating systems:

	Fuel kWh/year		Fuel Price (Table 12)		Fuel Cost £/year	
Space heating - main system 1	(211) x		11.46	x 0.01 =	162.2	(240)
Space heating - main system 2	(213) x		0	x 0.01 =	0	(241)
Space heating - secondary	(215) x		0	x 0.01 =	0	(242)
Water heating cost (other fuel)	(219)		11.46	x 0.01 =	211.66	(247)
Pumps, fans and electric keep-hot	(231)		11.46	x 0.01 =	0	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a						
Energy for lighting	(232)		11.46	x 0.01 =	39.39	(250)
Additional standing charges (Table 12)					0	(251)
Appendix Q items: repeat lines (253) and (254) as needed						
Total energy cost	(245)...(247) + (250)…(254) =				413.26	(255)

11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)	0.47	(256)
Energy cost factor (ECF) [(255) x (256)] ÷ [(4) + 45.0] =	1.63	(257)
SAP rating (Section 12)	77.19	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.517	=	731.76	(261)
Space heating (secondary)	(215) x		0	=	0	(263)
Water heating	(219) x		0.517	=	954.89	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1686.65	(265)
Electricity for pumps, fans and electric keep-hot	(231) x		0.517	=	0	(267)
Electricity for lighting	(232) x		0.517	=	177.69	(268)
Total CO2, kg/year	sum of (265)…(271) =				1864.34	(272)
CO2 emissions per m²	(272) ÷ (4) =				25.26	(273)
EI rating (section 14)					79	(274)

13a. Primary Energy

SAP WorkSheet: New dwelling design stage

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x		2.92	=	4132.93	(261)
Space heating (secondary)	(215) x		0	=	0	(263)
Energy for water heating	(219) x		2.92	=	5393.19	(264)
Space and water heating	(261) + (262) + (263) + (264) =				9526.12	(265)
Electricity for pumps, fans and electric keep-hot	(231) x		2.92	=	0	(267)
Electricity for lighting	(232) x		0	=	1003.61	(268)
'Total Primary Energy		sum of (265)…(271) =			10529.73	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			142.68	(273)

Regulations Compliance Report

Approved Document L1A 2010 edition assessed by Stroma FSAP 2009 program, Version: 1.4.0.73
Printed on 02 May 2012 at 12:30:55

Project Information:

Assessed By: Mike Ovenden (STRO006697) **Building Type:** End-terrace House

Dwelling Details:

NEW DWELLING DESIGN STAGE

Site Reference : Plot 9 end terrace **Plot Reference:** Plot 9

Address : Plot 9, Penistone Coal Drops, St. Mary's Street, Penistone, Sheffield, S36 6DT

Client Details:

Name: Stephen Sharp

Address : Yourspace Studio Limited , 180 main road, west winch, king's lynn, PE330LJ

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

1 TER and DER

Fuel for main heating system: Grid electricity

Target Carbon Dioxide Emission Rate (TER)	32.5 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	26.93 kg/m²	OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.23 (max. 0.30)	0.23 (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	0.14 (max. 0.20)	0.14 (max. 0.35)	OK
Openings	1.89 (max. 2.00)	3.00 (max. 3.30)	OK

3 Design air permeability

Design air permeability at 50 pascals	6.00	
Maximum	10.0	OK

4 Heating efficiency

Main Heating system: Heat pumps with radiators or underfloor - electric
Mitsubishi ECODAN 5kW

Secondary heating system: None

5 Cylinder insulation

Hot water Storage:	Nominal cylinder loss: 2.37 kWh/day Permitted by DBSCG: 3.11 kWh/day	OK
Primary pipework insulated:	Yes	OK

6 Controls

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

7 Low energy lights

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

Regulations Compliance Report

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (North East England):	Not significant	**OK**
Based on:		
Overshading:	Average or unknown	
Windows facing: South	3.8m², Overhang twice as wide as window, ratio NaN	
Windows facing: South	7.14m², Overhang twice as wide as window, ratio NaN	
Ventilation rate:	8.00	
Blinds/curtains:	shutter closed 100% of daylight hours	

10 Key features

None

SAP WorkSheet: New dwelling design stage

Gecko Low Carbon Consultancy

User Details:

Assessor Name:	Mike Ovenden	**Stroma Number:**	STRO006697
Software Name:	Stroma FSAP 2009	**Software Version:**	Version: 1.4.0.73

Property Address: Plot 9 end terrace

Address : Plot 9, Penistone Coal Drops, St. Mary's Street, Penistone, Sheffield, S36 6DT

1. Overall dwelling dimensions:

	Area(m²)		Ave Height(m)		Volume(m³)	
Ground floor	36.9 (1a)	x	2.6 (2a)	=	95.94	(3a)
First floor	36.9 (1b)	x	2.6 (2b)	=	95.94	(3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	73.8 (4)					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		191.88	(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	1	+	0	+	0	=	1	x 20 =	20	(6b)
Number of intermittent fans							4	x 10 =	40	(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) =	60	÷ (5) =	0.31	(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			6	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.61	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides on which sheltered			1	(19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.92	(20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.57	(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=	5.4	5.1	5.1	4.5	4.1	3.9	3.7	3.7	4.2	4.5	4.8	5.1

SAP WorkSheet: New dwelling design stage

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.35	1.27	1.27	1.12	1.02	0.98	0.92	0.92	1.05	1.12	1.2	1.27

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

0.77	0.72	0.72	0.64	0.58	0.55	0.52	0.52	0.6	0.64	0.68	0.72

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

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

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0

(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=	0.79	0.76	0.76	0.7	0.67	0.65	0.64	0.64	0.68	0.7	0.73	0.76

(24d)

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

(25)m=	0.79	0.76	0.76	0.7	0.67	0.65	0.64	0.64	0.68	0.7	0.73	0.76

(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			1.9	x	3	=	5.7			(26)
Windows Type 1			3.8	x	1/[1/(1.7)+ 0.04]	=	6.05			(27)
Windows Type 2			7.14	x	1/[1/(1.7)+ 0.04]	=	11.37			(27)
Floor			36.9	x	0.2	=	7.380001			(28)
Walls	89.44	12.84	76.6	x	0.23	=	17.62			(29)
Roof	36.9	0	36.9	x	0.14	=	5.17			(30)
Total area of elements, m²			163.24							(31)
Party wall			42.64	x	0	=	0			(32)

** 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) = 53.28 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 11671.9 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (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 24.49 (36)

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

Total fabric heat loss (33) + (36) = 77.76 (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=	50.19	48.19	48.19	44.53	42.34	41.33	40.36	40.36	42.87	44.53	46.3	48.19	(38)

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

(39)m=	127.96	125.96	125.96	122.29	120.11	119.09	118.13	118.13	120.64	122.29	124.07	125.96	

Average = Sum(39)$_{1...12}$ /12= 122.55 (39)

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

(40)m=	1.73	1.71	1.71	1.66	1.63	1.61	1.6	1.6	1.63	1.66	1.68	1.71	

Average = Sum(40)$_{1...12}$ /12= 1.66 (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 89.65 (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=	98.62	95.03	91.44	87.86	84.27	80.69	80.69	84.27	87.86	91.44	95.03	98.62	

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

Total = Sum(44)$_{1...12}$ = 1075.8 (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=	146.59	128.21	132.3	115.34	110.68	95.5	88.5	101.55	102.77	119.77	130.73	141.97	

Total = Sum(45)$_{1...12}$ = 1413.92 (45)

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

(46)m=	21.99	19.23	19.85	17.3	16.6	14.33	13.27	15.23	15.42	17.96	19.61	21.3	(46)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (47)

Temperature factor from Table 2b 0 (48)

Energy lost from water storage, kWh/year (47) x (48) = 0 (49)

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

Cylinder volume (litres) including any solar storage within same 200 (50)

If community heating and no tank in dwelling, enter 110 litres in box (50)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in box (50)

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.01 (51)

Volume factor from Table 2a 0.84 (52)

Temperature factor from Table 2b 0.54 (53)

Energy lost from water storage, kWh/year ((50) x (51) x (52) x (53) = 1.05 (54)

Enter (49) or (54) in (55) 1.05 (55)

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

(56)m=	32.61	29.45	32.61	31.56	32.61	31.56	32.61	32.61	31.56	32.61	31.56	32.61	(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=	32.61	29.45	32.61	31.56	32.61	31.56	32.61	32.61	31.56	32.61	31.56	32.61	(57)

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Primary circuit loss (annual) from Table 3 | 280 | (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=	23.78	21.48	23.78	23.01	23.78	23.01	23.78	23.78	23.01	23.78	23.01	23.78	(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=	202.98	179.14	188.69	169.91	167.06	150.07	144.89	157.94	157.34	176.15	185.3	198.36	(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=	202.98	179.14	188.69	169.91	167.06	150.07	144.89	157.94	157.34	176.15	185.3	198.36	

Output from water heater (annual)$_{1...12}$ | 2077.85 | (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=	93.85	83.38	89.1	82.01	81.91	75.41	74.54	78.88	77.83	84.93	87.12	92.32	(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=	140.08	140.08	140.08	140.08	140.08	140.08	140.08	140.08	140.08	140.08	140.08	140.08	(66)

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

(67)m=	48.65	43.21	35.14	26.61	19.89	16.79	18.14	23.58	31.65	40.19	46.91	50.01	(67)

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

(68)m=	307.46	310.65	302.61	285.5	263.89	243.58	230.02	226.83	234.87	251.98	273.59	293.89	(68)

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

(69)m=	51.34	51.34	51.34	51.34	51.34	51.34	51.34	51.34	51.34	51.34	51.34	51.34	(69)

Pumps and fans gains (Table 5a)

(70)m=	10	10	10	10	10	10	10	10	10	10	10	10	(70)

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

(71)m=	-93.39	-93.39	-93.39	-93.39	-93.39	-93.39	-93.39	-93.39	-93.39	-93.39	-93.39	-93.39	(71)

Water heating gains (Table 5)

(72)m=	126.15	124.07	119.76	113.9	110.1	104.74	100.18	106.02	108.09	114.16	121.01	124.08	(72)

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

(73)m=	590.3	585.98	565.55	534.04	501.91	473.15	456.38	464.47	482.65	514.37	549.54	576.02	(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)	
South	0.9x 0.77	x	3.8	x	47.32	x	0.63	x	0.7	=	54.96	(78)
South	0.9x 0.77	x	7.14	x	47.32	x	0.63	x	0.7	=	103.26	(78)

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South	0.9x	0.77	x	3.8	x	77.18	x	0.63	x	0.7	=	89.64	(78)
South	0.9x	0.77	x	7.14	x	77.18	x	0.63	x	0.7	=	168.42	(78)
South	0.9x	0.77	x	3.8	x	94.25	x	0.63	x	0.7	=	109.45	(78)
South	0.9x	0.77	x	7.14	x	94.25	x	0.63	x	0.7	=	205.65	(78)
South	0.9x	0.77	x	3.8	x	105.11	x	0.63	x	0.7	=	122.07	(78)
South	0.9x	0.77	x	7.14	x	105.11	x	0.63	x	0.7	=	229.37	(78)
South	0.9x	0.77	x	3.8	x	108.55	x	0.63	x	0.7	=	126.06	(78)
South	0.9x	0.77	x	7.14	x	108.55	x	0.63	x	0.7	=	236.86	(78)
South	0.9x	0.77	x	3.8	x	108.9	x	0.63	x	0.7	=	126.47	(78)
South	0.9x	0.77	x	7.14	x	108.9	x	0.63	x	0.7	=	237.62	(78)
South	0.9x	0.77	x	3.8	x	107.14	x	0.63	x	0.7	=	124.42	(78)
South	0.9x	0.77	x	7.14	x	107.14	x	0.63	x	0.7	=	233.78	(78)
South	0.9x	0.77	x	3.8	x	103.88	x	0.63	x	0.7	=	120.64	(78)
South	0.9x	0.77	x	7.14	x	103.88	x	0.63	x	0.7	=	226.68	(78)
South	0.9x	0.77	x	3.8	x	99.99	x	0.63	x	0.7	=	116.12	(78)
South	0.9x	0.77	x	7.14	x	99.99	x	0.63	x	0.7	=	218.19	(78)
South	0.9x	0.77	x	3.8	x	85.29	x	0.63	x	0.7	=	99.05	(78)
South	0.9x	0.77	x	7.14	x	85.29	x	0.63	x	0.7	=	186.11	(78)
South	0.9x	0.77	x	3.8	x	56.07	x	0.63	x	0.7	=	65.11	(78)
South	0.9x	0.77	x	7.14	x	56.07	x	0.63	x	0.7	=	122.35	(78)
South	0.9x	0.77	x	3.8	x	40.89	x	0.63	x	0.7	=	47.49	(78)
South	0.9x	0.77	x	7.14	x	40.89	x	0.63	x	0.7	=	89.23	(78)

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

(83)m=	158.22	258.05	315.1	351.44	362.93	364.09	358.2	347.32	334.31	285.17	187.46	136.71	(83)

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

(84)m=	748.52	844.03	880.66	885.48	864.84	837.24	814.59	811.79	816.96	799.53	737	712.73	(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=	0.99	0.98	0.96	0.94	0.88	0.76	0.56	0.56	0.79	0.92	0.98	0.99	(86)

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

(87)m=	21	21	21	21	21	21	21	21	21	21	21	21	(87)

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

(88)m=	19.52	19.54	19.54	19.58	19.6	19.61	19.62	19.62	19.59	19.58	19.56	19.54	(88)

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

(89)m=	0.98	0.97	0.95	0.92	0.83	0.64	0.39	0.39	0.69	0.89	0.97	0.98	(89)

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

(90)m=	19.52	19.54	19.54	19.58	19.6	19.61	19.62	19.62	19.59	19.58	19.56	19.54	(90)

fLA = Living area ÷ (4) = 0.2 (91)

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

(92)m=	19.82	19.83	19.83	19.86	19.88	19.89	19.9	19.9	19.88	19.86	19.85	19.83	(92)

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

(93)m=	19.72	19.73	19.73	19.76	19.78	19.79	19.8	19.8	19.78	19.76	19.75	19.73	(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=	0.98	0.97	0.95	0.92	0.84	0.66	0.41	0.41	0.7	0.9	0.97	0.98	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	734.57	818.72	837.03	814.97	723.55	553.13	335.15	335.08	573.3	715.7	714.01	700.29	(95)
Monthly average external temperature from Table 8													
(96)m=	4.5	5	6.8	8.7	11.7	14.6	16.9	16.9	14.3	10.8	7	4.9	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1947.4	1855.89	1629.17	1352.92	970.45	617.82	342.02	342.02	660.57	1096.1	1581.74	1868.48	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	902.35	696.97	589.35	387.32	183.69	0	0	0	0	283.02	624.77	869.14	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 4536.61 (98)

Space heating requirement in kWh/m²/year 61.47 (99)

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

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 320.52 (206)

Efficiency of secondary/supplementary heating system, % 0 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	902.35	696.97	589.35	387.32	183.69	0	0	0	0	283.02	624.77	869.14	
(211)m = {[(98)m x (204)] + (210)m } x 100 ÷ (206)													(211)
	281.52	217.45	183.87	120.84	57.31	0	0	0	0	88.3	194.92	271.16	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 1415.39 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] + (214) m } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10....12}$= 0 (215)

Water heating

Output from water heater (calculated above)

	202.98	179.14	188.69	169.91	167.06	150.07	144.89	157.94	157.34	176.15	185.3	198.36	

Efficiency of water heater 112.5 (216)

(217)m=	112.5	112.5	112.5	112.5	112.5	112.5	112.5	112.5	112.5	112.5	112.5	112.5	(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	180.43	159.24	167.73	151.04	148.5	133.4	128.79	140.39	139.86	156.58	164.71	176.32	

Total = Sum(219a)$_{1...12}$ = 1846.98 (219)

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Annual totals		kWh/year	kWh/year	
Space heating fuel used, main system 1			1415.39	
Water heating fuel used			1846.98	
Electricity for pumps, fans and electric keep-hot				
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		0	(231)
Electricity for lighting			343.7	(232)

10a. Fuel costs - individual heating systems:

	Fuel kWh/year		Fuel Price (Table 12)		Fuel Cost £/year	
Space heating - main system 1	(211) x		11.46	x 0.01 =	162.2	(240)
Space heating - main system 2	(213) x		0	x 0.01 =	0	(241)
Space heating - secondary	(215) x		0	x 0.01 =	0	(242)
Water heating cost (other fuel)	(219)		11.46	x 0.01 =	211.66	(247)
Pumps, fans and electric keep-hot	(231)		11.46	x 0.01 =	0	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a						
Energy for lighting	(232)		11.46	x 0.01 =	39.39	(250)
Additional standing charges (Table 12)					0	(251)
Appendix Q items: repeat lines (253) and (254) as needed						
Total energy cost	(245)...(247) + (250)…(254) =				413.26	(255)

11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)	0.47	(256)
Energy cost factor (ECF) [(255) x (256)] ÷ [(4) + 45.0] =	1.63	(257)
SAP rating (Section 12)	77.19	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.517	=	731.76	(261)
Space heating (secondary)	(215) x		0	=	0	(263)
Water heating	(219) x		0.517	=	954.89	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1686.65	(265)
Electricity for pumps, fans and electric keep-hot	(231) x		0.517	=	0	(267)
Electricity for lighting	(232) x		0.517	=	177.69	(268)
Total CO2, kg/year	sum of (265)…(271) =				1864.34	(272)
CO2 emissions per m²	(272) ÷ (4) =				25.26	(273)
EI rating (section 14)					79	(274)

13a. Primary Energy

SAP WorkSheet: New dwelling design stage

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x		2.92	=	4132.93	(261)
Space heating (secondary)	(215) x		0	=	0	(263)
Energy for water heating	(219) x		2.92	=	5393.19	(264)
Space and water heating	(261) + (262) + (263) + (264) =				9526.12	(265)
Electricity for pumps, fans and electric keep-hot	(231) x		2.92	=	0	(267)
Electricity for lighting	(232) x		0	=	1003.61	(268)
'Total Primary Energy		sum of (265)…(271) =			10529.73	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			142.68	(273)

Regulations Compliance Report

Approved Document L1A 2010 edition assessed by Stroma FSAP 2009 program, Version: 1.4.0.73
Printed on 02 May 2012 at 12:30:48

Project Information:

Assessed By: Mike Ovenden (STRO006697) **Building Type:** Mid-terrace House

Dwelling Details:

NEW DWELLING DESIGN STAGE

Site Reference : Plot 10 mid terrace **Plot Reference:** Plot 10

Address : Plot 10, Penistone Coal Drops, St. Mary's Street, Penistone, Sheffield, S36 6DT

Client Details:

Name: Stephen Sharp

Address : Yourspace Studio Limited , 180 main road, west winch, king's lynn, PE330LJ

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

1 TER and DER

Fuel for main heating system: Grid electricity

Target Carbon Dioxide Emission Rate (TER)	24.95 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	20.95 kg/m²	OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.23 (max. 0.30)	0.23 (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	0.14 (max. 0.20)	0.14 (max. 0.35)	OK
Openings	1.92 (max. 2.00)	3.00 (max. 3.30)	OK

3 Design air permeability

Design air permeability at 50 pascals	6.00	
Maximum	10.0	OK

4 Heating efficiency

Main Heating system: Heat pumps with radiators or underfloor - electric
Mitsubishi ECODAN 5kW

Secondary heating system: None

5 Cylinder insulation

Hot water Storage:	Nominal cylinder loss: 2.37 kWh/day Permitted by DBSCG: 3.11 kWh/day	OK
Primary pipework insulated:	Yes	OK

6 Controls

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

7 Low energy lights

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

Regulations Compliance Report

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (North East England):	Not significant	**OK**
Based on:		
Overshading:	Average or unknown	
Windows facing: South	3.8m², Overhang twice as wide as window, ratio NaN	
Windows facing: North	7.14m², Overhang twice as wide as window, ratio NaN	
Roof windows facing: South	1.4m²	
Roof windows facing: North	2.8m²	
Ventilation rate:	8.00	
Blinds/curtains:	shutter closed 100% of daylight hours	

10 Key features

None

SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Mike Ovenden	**Stroma Number:**	STRO006697
Software Name:	Stroma FSAP 2009	**Software Version:**	Version: 1.4.0.73

Property Address: Plot 10 mid terrace

Address : Plot 10, Penistone Coal Drops, St. Mary's Street, Penistone, Sheffield, S36 6DT

1. Overall dwelling dimensions:

	Area(m²)		Ave Height(m)		Volume(m³)	
Ground floor	39.6	(1a) x	2.6	(2a) =	102.96	(3a)
First floor	39.6	(1b) x	2.6	(2b) =	102.96	(3b)
Second floor	28.35	(1c) x	1.9	(2c) =	53.87	(3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	107.55	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		259.78	(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	1	+	0	+	0	=	1	x 20 =	20	(6b)
Number of intermittent fans							5	x 10 =	50	(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) =	70	÷ (5) =	0.27 (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				6 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.57 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides on which sheltered				2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =			0.85 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =			0.48 (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=	5.4	5.1	5.1	4.5	4.1	3.9	3.7	3.7	4.2	4.5	4.8	5.1

SAP WorkSheet: New dwelling design stage

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.35	1.27	1.27	1.12	1.02	0.98	0.92	0.92	1.05	1.12	1.2	1.27

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

0.65	0.62	0.62	0.54	0.5	0.47	0.45	0.45	0.51	0.54	0.58	0.62

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

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

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0

(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=	0.71	0.69	0.69	0.65	0.62	0.61	0.6	0.6	0.63	0.65	0.67	0.69

(24d)

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

(25)m=	0.71	0.69	0.69	0.65	0.62	0.61	0.6	0.6	0.63	0.65	0.67	0.69

(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			1.9	x	3	=	5.7			(26)
Windows Type 1			3.8	x	1/[1/(1.7)+ 0.04]	=	6.05			(27)
Windows Type 2			7.14	x	1/[1/(1.7)+ 0.04]	=	11.37			(27)
Rooflights Type 1			1.4	x	1/[1/(2) + 0.04]	=	2.8			(27b)
Rooflights Type 2			2.8	x	1/[1/(2) + 0.04]	=	5.6			(27b)
Floor			39.6	x	0.2	=	7.92			(28)
Walls	63.9	12.84	51.06	x	0.23	=	11.74			(29)
Roof	55.44	4.2	51.24	x	0.14	=	7.17			(30)
Total area of elements, m²			158.94							(31)
Party wall			115.46	x	0	=	0			(32)

** 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) = 57.73 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 13587.06 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (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 23.84 (36)

SAP WorkSheet: New dwelling design stage

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

Total fabric heat loss (33) + (36) = 81.57 (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=	61.17	59.19	59.19	55.57	53.42	52.41	51.46	51.46	53.94	55.57	57.33	59.19	(38)

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

(39)m=	142.74	140.76	140.76	137.14	134.99	133.98	133.03	133.03	135.51	137.14	138.9	140.76	

Average = Sum(39)$_{1...12}$ /12= 137.39 (39)

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

(40)m=	1.33	1.31	1.31	1.28	1.26	1.25	1.24	1.24	1.26	1.28	1.29	1.31	

Average = Sum(40)$_{1...12}$ /12= 1.28 (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 2.8 (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) + 36 100.68 (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=	110.75	106.72	102.7	98.67	94.64	90.61	90.61	94.64	98.67	102.7	106.72	110.75	

Total = Sum(44)$_{1...12}$ = 1208.2 (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=	164.63	143.99	148.58	129.54	124.3	107.26	99.39	114.05	115.41	134.5	146.82	159.44	

Total = Sum(45)$_{1...12}$ = 1587.93 (45)

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

(46)m=	24.7	21.6	22.29	19.43	18.64	16.09	14.91	17.11	17.31	20.18	22.02	23.92	(46)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (47)

Temperature factor from Table 2b 0 (48)

Energy lost from water storage, kWh/year (47) x (48) = 0 (49)

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

Cylinder volume (litres) including any solar storage within same 200 (50)

If community heating and no tank in dwelling, enter 110 litres in box (50)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in box (50)

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.01 (51)

Volume factor from Table 2a 0.84 (52)

Temperature factor from Table 2b 0.54 (53)

Energy lost from water storage, kWh/year ((50) x (51) x (52) x (53) = 1.05 (54)

Enter (49) or (54) in (55) 1.05 (55)

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

(56)m=	32.61	29.45	32.61	31.56	32.61	31.56	32.61	32.61	31.56	32.61	31.56	32.61	(56)

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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=	32.61	29.45	32.61	31.56	32.61	31.56	32.61	32.61	31.56	32.61	31.56	32.61	(57)

Primary circuit loss (annual) from Table 3 — 280 (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=	23.78	21.48	23.78	23.01	23.78	23.01	23.78	23.78	23.01	23.78	23.01	23.78	(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=	221.02	194.92	204.97	184.11	180.69	161.83	155.78	170.44	169.98	190.89	201.39	215.83	(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=	221.02	194.92	204.97	184.11	180.69	161.83	155.78	170.44	169.98	190.89	201.39	215.83	

Output from water heater (annual)$_{1...12}$ — 2251.86 (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=	99.85	88.62	94.52	86.73	86.44	79.32	78.16	83.03	82.03	89.83	92.47	98.12	(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=	167.96	167.96	167.96	167.96	167.96	167.96	167.96	167.96	167.96	167.96	167.96	167.96	(66)

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

(67)m=	63.25	56.18	45.69	34.59	25.85	21.83	23.58	30.66	41.15	52.25	60.98	65.01	(67)

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

(68)m=	399.98	404.13	393.67	371.41	343.3	316.88	299.23	295.08	305.54	327.81	355.92	382.33	(68)

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

(69)m=	54.6	54.6	54.6	54.6	54.6	54.6	54.6	54.6	54.6	54.6	54.6	54.6	(69)

Pumps and fans gains (Table 5a)

(70)m=	10	10	10	10	10	10	10	10	10	10	10	10	(70)

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

(71)m=	-111.97	-111.97	-111.97	-111.97	-111.97	-111.97	-111.97	-111.97	-111.97	-111.97	-111.97	-111.97	(71)

Water heating gains (Table 5)

(72)m=	134.21	131.88	127.04	120.46	116.18	110.17	105.05	111.6	113.93	120.74	128.44	131.89	(72)

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

(73)m=	718.02	712.77	686.98	647.03	605.92	569.46	548.45	557.93	581.2	621.38	665.91	699.81	(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	7.14	x	10.73	x	0.63	x	0.7	=	23.41	(74)
North	0.9x	0.77	x	7.14	x	20.36	x	0.63	x	0.7	=	44.42	(74)
North	0.9x	0.77	x	7.14	x	33.31	x	0.63	x	0.7	=	72.68	(74)
North	0.9x	0.77	x	7.14	x	54.64	x	0.63	x	0.7	=	119.23	(74)
North	0.9x	0.77	x	7.14	x	75.22	x	0.63	x	0.7	=	164.13	(74)
North	0.9x	0.77	x	7.14	x	84.09	x	0.63	x	0.7	=	183.49	(74)
North	0.9x	0.77	x	7.14	x	79.12	x	0.63	x	0.7	=	172.64	(74)
North	0.9x	0.77	x	7.14	x	61.56	x	0.63	x	0.7	=	134.34	(74)
North	0.9x	0.77	x	7.14	x	41.09	x	0.63	x	0.7	=	89.65	(74)
North	0.9x	0.77	x	7.14	x	24.81	x	0.63	x	0.7	=	54.15	(74)
North	0.9x	0.77	x	7.14	x	13.22	x	0.63	x	0.7	=	28.84	(74)
North	0.9x	0.77	x	7.14	x	8.94	x	0.63	x	0.7	=	19.52	(74)
South	0.9x	0.77	x	3.8	x	47.32	x	0.63	x	0.7	=	54.96	(78)
South	0.9x	0.77	x	3.8	x	77.18	x	0.63	x	0.7	=	89.64	(78)
South	0.9x	0.77	x	3.8	x	94.25	x	0.63	x	0.7	=	109.45	(78)
South	0.9x	0.77	x	3.8	x	105.11	x	0.63	x	0.7	=	122.07	(78)
South	0.9x	0.77	x	3.8	x	108.55	x	0.63	x	0.7	=	126.06	(78)
South	0.9x	0.77	x	3.8	x	108.9	x	0.63	x	0.7	=	126.47	(78)
South	0.9x	0.77	x	3.8	x	107.14	x	0.63	x	0.7	=	124.42	(78)
South	0.9x	0.77	x	3.8	x	103.88	x	0.63	x	0.7	=	120.64	(78)
South	0.9x	0.77	x	3.8	x	99.99	x	0.63	x	0.7	=	116.12	(78)
South	0.9x	0.77	x	3.8	x	85.29	x	0.63	x	0.7	=	99.05	(78)
South	0.9x	0.77	x	3.8	x	56.07	x	0.63	x	0.7	=	65.11	(78)
South	0.9x	0.77	x	3.8	x	40.89	x	0.63	x	0.7	=	47.49	(78)
Rooflights	0.9x	1	x	1.4	x	26	x	0.63	x	0.7	=	14.45	(82)
Rooflights	0.9x	1	x	2.8	x	10.73	x	0.63	x	0.7	=	11.92	(82)
Rooflights	0.9x	1	x	1.4	x	54	x	0.63	x	0.7	=	30.01	(82)
Rooflights	0.9x	1	x	2.8	x	20.36	x	0.63	x	0.7	=	22.63	(82)
Rooflights	0.9x	1	x	1.4	x	94	x	0.63	x	0.7	=	52.23	(82)
Rooflights	0.9x	1	x	2.8	x	33.31	x	0.63	x	0.7	=	37.02	(82)
Rooflights	0.9x	1	x	1.4	x	150	x	0.63	x	0.7	=	83.35	(82)
Rooflights	0.9x	1	x	2.8	x	54.64	x	0.63	x	0.7	=	60.72	(82)
Rooflights	0.9x	1	x	1.4	x	190	x	0.63	x	0.7	=	105.58	(82)
Rooflights	0.9x	1	x	2.8	x	75.22	x	0.63	x	0.7	=	83.59	(82)
Rooflights	0.9x	1	x	1.4	x	201	x	0.63	x	0.7	=	111.69	(82)
Rooflights	0.9x	1	x	2.8	x	84.09	x	0.63	x	0.7	=	93.45	(82)
Rooflights	0.9x	1	x	1.4	x	194	x	0.63	x	0.7	=	107.8	(82)
Rooflights	0.9x	1	x	2.8	x	79.12	x	0.63	x	0.7	=	87.93	(82)
Rooflights	0.9x	1	x	1.4	x	164	x	0.63	x	0.7	=	91.13	(82)
Rooflights	0.9x	1	x	2.8	x	61.56	x	0.63	x	0.7	=	68.42	(82)
Rooflights	0.9x	1	x	1.4	x	116	x	0.63	x	0.7	=	64.46	(82)

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Rooflights 0.9x	1	x	2.8	x	41.09	x	0.63	x	0.7	=	45.66	(82)
Rooflights 0.9x	1	x	1.4	x	68	x	0.63	x	0.7	=	37.78	(82)
Rooflights 0.9x	1	x	2.8	x	24.81	x	0.63	x	0.7	=	27.58	(82)
Rooflights 0.9x	1	x	1.4	x	33	x	0.63	x	0.7	=	18.34	(82)
Rooflights 0.9x	1	x	2.8	x	13.22	x	0.63	x	0.7	=	14.69	(82)
Rooflights 0.9x	1	x	1.4	x	21	x	0.63	x	0.7	=	11.67	(82)
Rooflights 0.9x	1	x	2.8	x	8.94	x	0.63	x	0.7	=	9.94	(82)

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

(83)m=	104.73	186.69	271.38	385.37	479.35	515.09	492.79	414.53	315.89	218.56	126.98	88.61	(83)

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

(84)m=	822.75	899.46	958.36	1032.4	1085.27	1084.55	1041.24	972.45	897.09	839.94	792.9	788.42	(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=	0.99	0.99	0.98	0.96	0.88	0.72	0.51	0.54	0.83	0.96	0.99	0.99	(86)

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

(87)m=	21	21	21	21	21	21	21	21	21	21	21	21	(87)

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

(88)m=	19.82	19.84	19.84	19.86	19.88	19.89	19.89	19.89	19.87	19.86	19.85	19.84	(88)

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

(89)m=	0.99	0.99	0.97	0.94	0.83	0.62	0.38	0.41	0.75	0.94	0.99	0.99	(89)

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

(90)m=	19.82	19.84	19.84	19.86	19.88	19.89	19.89	19.89	19.87	19.86	19.85	19.84	(90)

fLA = Living area ÷ (4) = 0.15 (91)

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

(92)m=	19.99	20.01	20.01	20.03	20.04	20.05	20.06	20.06	20.04	20.03	20.02	20.01	(92)

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

(93)m=	19.89	19.91	19.91	19.93	19.94	19.95	19.96	19.96	19.94	19.93	19.92	19.91	(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=	0.99	0.99	0.97	0.94	0.83	0.63	0.39	0.41	0.75	0.94	0.99	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	816.46	888.35	934.13	972.72	905.48	678.69	403.56	402.63	674.65	791.27	782.32	782.75	(95)

Monthly average external temperature from Table 8

(96)m=	4.5	5	6.8	8.7	11.7	14.6	16.9	16.9	14.3	10.8	7	4.9	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	2197.44	2098.34	1844.97	1540.07	1112.69	716.7	406.43	406.43	764.22	1252.07	1794.35	2112.41	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	1027.45	813.11	677.66	408.5	154.16	0	0	0	0	342.84	728.66	989.27	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	5141.65	(98)
Space heating requirement in kWh/m²/year	47.81	(99)

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

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	322.25	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	1027.45	813.11	677.66	408.5	154.16	0	0	0	0	342.84	728.66	989.27	
(211)m = {[(98)m x (204)] + (210)m } x 100 ÷ (206)	318.84	252.32	210.29	126.77	47.84	0	0	0	0	106.39	226.12	306.99	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	1595.56	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] + (214) m } x 100 ÷ (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

Water heating

Output from water heater (calculated above)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	221.02	194.92	204.97	184.11	180.69	161.83	155.78	170.44	169.98	190.89	201.39	215.83

Efficiency of water heater	112.5	(216)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(217)m=	112.5	112.5	112.5	112.5	112.5	112.5	112.5	112.5	112.5	112.5	112.5	112.5

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(219)m=	196.47	173.26	182.2	163.65	160.61	143.85	138.47	151.5	151.1	169.68	179.02	191.85

Total = Sum(219a)$_{1...12}$ =	2001.66	(219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		1595.56
Water heating fuel used		2001.66
Electricity for pumps, fans and electric keep-hot		
Total electricity for the above, kWh/year sum of (230a)…(230g) =		0 (231)
Electricity for lighting		446.79 (232)

10a. Fuel costs - individual heating systems:

	Fuel kWh/year	**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211) x	11.46	x 0.01 =	182.85	(240)
Space heating - main system 2	(213) x	0	x 0.01 =	0	(241)
Space heating - secondary	(215) x	0	x 0.01 =	0	(242)

SAP WorkSheet: New dwelling design stage

Water heating cost (other fuel)	(219)	11.46	x 0.01 =	229.39	(247)
Pumps, fans and electric keep-hot	(231)	11.46	x 0.01 =	0	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a					
Energy for lighting	(232)	11.46	x 0.01 =	51.2	(250)
Additional standing charges (Table 12)				0	(251)
Appendix Q items: repeat lines (253) and (254) as needed					
Total energy cost	(245)...(247) + (250)…(254) =			463.44	(255)

11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.47	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.43	(257)
SAP rating (Section 12)		80.08	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

		Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211)	x		0.517	=	824.9	(261)
Space heating (secondary)	(215)	x		0	=	0	(263)
Water heating	(219)	x		0.517	=	1034.86	(264)
Space and water heating	(261) + (262) + (263) + (264) =					1859.76	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x		0.517	=	0	(267)
Electricity for lighting	(232)	x		0.517	=	230.99	(268)
Total CO2, kg/year			sum of (265)…(271) =			2090.75	(272)
CO2 emissions per m²			(272) ÷ (4) =			19.44	(273)
EI rating (section 14)						82	(274)

13a. Primary Energy

		Energy kWh/year		**Primary** factor		**P. Energy** kWh/year	
Space heating (main system 1)	(211)	x		2.92	=	4659.03	(261)
Space heating (secondary)	(215)	x		0	=	0	(263)
Energy for water heating	(219)	x		2.92	=	5844.84	(264)
Space and water heating	(261) + (262) + (263) + (264) =					10503.87	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x		2.92	=	0	(267)
Electricity for lighting	(232)	x		0	=	1304.63	(268)
'Total Primary Energy			sum of (265)…(271) =			11808.5	(272)
Primary energy kWh/m²/year			(272) ÷ (4) =			109.8	(273)

Regulations Compliance Report

Approved Document L1A 2010 edition assessed by Stroma FSAP 2009 program, Version: 1.4.0.73
Printed on 02 May 2012 at 12:30:40

Project Information:

Assessed By: Mike Ovenden (STRO006697) **Building Type:** Mid-terrace House

Dwelling Details:

NEW DWELLING DESIGN STAGE

Site Reference : Plot 11 mid terrace **Plot Reference:** Plot 11

Address : Plot 11, Penistone Coal Drops, St. Mary's Street, Penistone, Sheffield, S36 6DT

Client Details:

Name: Stephen Sharp

Address : Yourspace Studio Limited , 180 main road, west winch, king's lynn, PE330LJ

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

1 TER and DER

Fuel for main heating system: Grid electricity

Target Carbon Dioxide Emission Rate (TER)	24.95 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	20.95 kg/m²	OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.23 (max. 0.30)	0.23 (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	0.14 (max. 0.20)	0.14 (max. 0.35)	OK
Openings	1.92 (max. 2.00)	3.00 (max. 3.30)	OK

3 Design air permeability

Design air permeability at 50 pascals	6.00	
Maximum	10.0	OK

4 Heating efficiency

Main Heating system: Heat pumps with radiators or underfloor - electric
Mitsubishi ECODAN 5kW

Secondary heating system: None

5 Cylinder insulation

Hot water Storage:	Nominal cylinder loss: 2.37 kWh/day Permitted by DBSCG: 3.11 kWh/day	OK
Primary pipework insulated:	Yes	OK

6 Controls

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

7 Low energy lights

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

Regulations Compliance Report

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (North East England):	Not significant	**OK**
Based on:		
Overshading:	Average or unknown	
Windows facing: South	3.8m², Overhang twice as wide as window, ratio NaN	
Windows facing: North	7.14m², Overhang twice as wide as window, ratio NaN	
Roof windows facing: South	1.4m²	
Roof windows facing: North	2.8m²	
Ventilation rate:	8.00	
Blinds/curtains:	shutter closed 100% of daylight hours	

10 Key features

None

SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Mike Ovenden	**Stroma Number:**	STRO006697
Software Name:	Stroma FSAP 2009	**Software Version:**	Version: 1.4.0.73

Property Address: Plot 11 mid terrace

Address : Plot 11, Penistone Coal Drops, St. Mary's Street, Penistone, Sheffield, S36 6DT

1. Overall dwelling dimensions:

	Area(m²)		Ave Height(m)		Volume(m³)	
Ground floor	39.6	(1a) x	2.6	(2a) =	102.96	(3a)
First floor	39.6	(1b) x	2.6	(2b) =	102.96	(3b)
Second floor	28.35	(1c) x	1.9	(2c) =	53.87	(3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	107.55	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		259.78	(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	1	+	0	+	0	=	1	x 20 =	20	(6b)
Number of intermittent fans							5	x 10 =	50	(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) =	70	÷ (5) =	0.27 (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				6 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.57 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides on which sheltered				2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =			0.85 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =			0.48 (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=	5.4	5.1	5.1	4.5	4.1	3.9	3.7	3.7	4.2	4.5	4.8	5.1

SAP WorkSheet: New dwelling design stage

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.35	1.27	1.27	1.12	1.02	0.98	0.92	0.92	1.05	1.12	1.2	1.27

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

0.65	0.62	0.62	0.54	0.5	0.47	0.45	0.45	0.51	0.54	0.58	0.62

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

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

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0

(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=	0.71	0.69	0.69	0.65	0.62	0.61	0.6	0.6	0.63	0.65	0.67	0.69

(24d)

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

(25)m=	0.71	0.69	0.69	0.65	0.62	0.61	0.6	0.6	0.63	0.65	0.67	0.69

(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			1.9	x	3	=	5.7			(26)
Windows Type 1			3.8	x	1/[1/(1.7)+ 0.04]	=	6.05			(27)
Windows Type 2			7.14	x	1/[1/(1.7)+ 0.04]	=	11.37			(27)
Rooflights Type 1			1.4	x	1/[1/(2) + 0.04]	=	2.8			(27b)
Rooflights Type 2			2.8	x	1/[1/(2) + 0.04]	=	5.6			(27b)
Floor			39.6	x	0.2	=	7.92			(28)
Walls	63.9	12.84	51.06	x	0.23	=	11.74			(29)
Roof	55.44	4.2	51.24	x	0.14	=	7.17			(30)
Total area of elements, m²			158.94							(31)
Party wall			115.46	x	0	=	0			(32)

** 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) = 57.73 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 13587.06 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (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 23.84 (36)

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

Total fabric heat loss (33) + (36) = 81.57 (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=	61.17	59.19	59.19	55.57	53.42	52.41	51.46	51.46	53.94	55.57	57.33	59.19	(38)

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

(39)m=	142.74	140.76	140.76	137.14	134.99	133.98	133.03	133.03	135.51	137.14	138.9	140.76	

Average = Sum(39)$_{1...12}$ /12= 137.39 (39)

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

(40)m=	1.33	1.31	1.31	1.28	1.26	1.25	1.24	1.24	1.26	1.28	1.29	1.31	

Average = Sum(40)$_{1...12}$ /12= 1.28 (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 2.8 (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) + 36 100.68 (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=	110.75	106.72	102.7	98.67	94.64	90.61	90.61	94.64	98.67	102.7	106.72	110.75	

Total = Sum(44)$_{1...12}$ = 1208.2 (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=	164.63	143.99	148.58	129.54	124.3	107.26	99.39	114.05	115.41	134.5	146.82	159.44	

Total = Sum(45)$_{1...12}$ = 1587.93 (45)

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

(46)m=	24.7	21.6	22.29	19.43	18.64	16.09	14.91	17.11	17.31	20.18	22.02	23.92	(46)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (47)

Temperature factor from Table 2b 0 (48)

Energy lost from water storage, kWh/year (47) x (48) = 0 (49)

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

Cylinder volume (litres) including any solar storage within same 200 (50)

If community heating and no tank in dwelling, enter 110 litres in box (50)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in box (50)

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.01 (51)

Volume factor from Table 2a 0.84 (52)

Temperature factor from Table 2b 0.54 (53)

Energy lost from water storage, kWh/year ((50) x (51) x (52) x (53) = 1.05 (54)

Enter (49) or (54) in (55) 1.05 (55)

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

(56)m=	32.61	29.45	32.61	31.56	32.61	31.56	32.61	32.61	31.56	32.61	31.56	32.61	(56)

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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=	32.61	29.45	32.61	31.56	32.61	31.56	32.61	32.61	31.56	32.61	31.56	32.61	(57)

Primary circuit loss (annual) from Table 3 — 280 (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=	23.78	21.48	23.78	23.01	23.78	23.01	23.78	23.78	23.01	23.78	23.01	23.78	(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=	221.02	194.92	204.97	184.11	180.69	161.83	155.78	170.44	169.98	190.89	201.39	215.83	(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=	221.02	194.92	204.97	184.11	180.69	161.83	155.78	170.44	169.98	190.89	201.39	215.83	

Output from water heater (annual)$_{1...12}$ — 2251.86 (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=	99.85	88.62	94.52	86.73	86.44	79.32	78.16	83.03	82.03	89.83	92.47	98.12	(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=	167.96	167.96	167.96	167.96	167.96	167.96	167.96	167.96	167.96	167.96	167.96	167.96	(66)

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

(67)m=	63.25	56.18	45.69	34.59	25.85	21.83	23.58	30.66	41.15	52.25	60.98	65.01	(67)

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

(68)m=	399.98	404.13	393.67	371.41	343.3	316.88	299.23	295.08	305.54	327.81	355.92	382.33	(68)

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

(69)m=	54.6	54.6	54.6	54.6	54.6	54.6	54.6	54.6	54.6	54.6	54.6	54.6	(69)

Pumps and fans gains (Table 5a)

(70)m=	10	10	10	10	10	10	10	10	10	10	10	10	(70)

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

(71)m=	-111.97	-111.97	-111.97	-111.97	-111.97	-111.97	-111.97	-111.97	-111.97	-111.97	-111.97	-111.97	(71)

Water heating gains (Table 5)

(72)m=	134.21	131.88	127.04	120.46	116.18	110.17	105.05	111.6	113.93	120.74	128.44	131.89	(72)

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

(73)m=	718.02	712.77	686.98	647.03	605.92	569.46	548.45	557.93	581.2	621.38	665.91	699.81	(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)

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North	0.9x	0.77	x	7.14	x	10.73	x	0.63	x	0.7	=	23.41	(74)
North	0.9x	0.77	x	7.14	x	20.36	x	0.63	x	0.7	=	44.42	(74)
North	0.9x	0.77	x	7.14	x	33.31	x	0.63	x	0.7	=	72.68	(74)
North	0.9x	0.77	x	7.14	x	54.64	x	0.63	x	0.7	=	119.23	(74)
North	0.9x	0.77	x	7.14	x	75.22	x	0.63	x	0.7	=	164.13	(74)
North	0.9x	0.77	x	7.14	x	84.09	x	0.63	x	0.7	=	183.49	(74)
North	0.9x	0.77	x	7.14	x	79.12	x	0.63	x	0.7	=	172.64	(74)
North	0.9x	0.77	x	7.14	x	61.56	x	0.63	x	0.7	=	134.34	(74)
North	0.9x	0.77	x	7.14	x	41.09	x	0.63	x	0.7	=	89.65	(74)
North	0.9x	0.77	x	7.14	x	24.81	x	0.63	x	0.7	=	54.15	(74)
North	0.9x	0.77	x	7.14	x	13.22	x	0.63	x	0.7	=	28.84	(74)
North	0.9x	0.77	x	7.14	x	8.94	x	0.63	x	0.7	=	19.52	(74)
South	0.9x	0.77	x	3.8	x	47.32	x	0.63	x	0.7	=	54.96	(78)
South	0.9x	0.77	x	3.8	x	77.18	x	0.63	x	0.7	=	89.64	(78)
South	0.9x	0.77	x	3.8	x	94.25	x	0.63	x	0.7	=	109.45	(78)
South	0.9x	0.77	x	3.8	x	105.11	x	0.63	x	0.7	=	122.07	(78)
South	0.9x	0.77	x	3.8	x	108.55	x	0.63	x	0.7	=	126.06	(78)
South	0.9x	0.77	x	3.8	x	108.9	x	0.63	x	0.7	=	126.47	(78)
South	0.9x	0.77	x	3.8	x	107.14	x	0.63	x	0.7	=	124.42	(78)
South	0.9x	0.77	x	3.8	x	103.88	x	0.63	x	0.7	=	120.64	(78)
South	0.9x	0.77	x	3.8	x	99.99	x	0.63	x	0.7	=	116.12	(78)
South	0.9x	0.77	x	3.8	x	85.29	x	0.63	x	0.7	=	99.05	(78)
South	0.9x	0.77	x	3.8	x	56.07	x	0.63	x	0.7	=	65.11	(78)
South	0.9x	0.77	x	3.8	x	40.89	x	0.63	x	0.7	=	47.49	(78)
Rooflights	0.9x	1	x	1.4	x	26	x	0.63	x	0.7	=	14.45	(82)
Rooflights	0.9x	1	x	2.8	x	10.73	x	0.63	x	0.7	=	11.92	(82)
Rooflights	0.9x	1	x	1.4	x	54	x	0.63	x	0.7	=	30.01	(82)
Rooflights	0.9x	1	x	2.8	x	20.36	x	0.63	x	0.7	=	22.63	(82)
Rooflights	0.9x	1	x	1.4	x	94	x	0.63	x	0.7	=	52.23	(82)
Rooflights	0.9x	1	x	2.8	x	33.31	x	0.63	x	0.7	=	37.02	(82)
Rooflights	0.9x	1	x	1.4	x	150	x	0.63	x	0.7	=	83.35	(82)
Rooflights	0.9x	1	x	2.8	x	54.64	x	0.63	x	0.7	=	60.72	(82)
Rooflights	0.9x	1	x	1.4	x	190	x	0.63	x	0.7	=	105.58	(82)
Rooflights	0.9x	1	x	2.8	x	75.22	x	0.63	x	0.7	=	83.59	(82)
Rooflights	0.9x	1	x	1.4	x	201	x	0.63	x	0.7	=	111.69	(82)
Rooflights	0.9x	1	x	2.8	x	84.09	x	0.63	x	0.7	=	93.45	(82)
Rooflights	0.9x	1	x	1.4	x	194	x	0.63	x	0.7	=	107.8	(82)
Rooflights	0.9x	1	x	2.8	x	79.12	x	0.63	x	0.7	=	87.93	(82)
Rooflights	0.9x	1	x	1.4	x	164	x	0.63	x	0.7	=	91.13	(82)
Rooflights	0.9x	1	x	2.8	x	61.56	x	0.63	x	0.7	=	68.42	(82)
Rooflights	0.9x	1	x	1.4	x	116	x	0.63	x	0.7	=	64.46	(82)

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Rooflights 0.9x	1	x	2.8	x	41.09	x	0.63	x	0.7	=	45.66	(82)
Rooflights 0.9x	1	x	1.4	x	68	x	0.63	x	0.7	=	37.78	(82)
Rooflights 0.9x	1	x	2.8	x	24.81	x	0.63	x	0.7	=	27.58	(82)
Rooflights 0.9x	1	x	1.4	x	33	x	0.63	x	0.7	=	18.34	(82)
Rooflights 0.9x	1	x	2.8	x	13.22	x	0.63	x	0.7	=	14.69	(82)
Rooflights 0.9x	1	x	1.4	x	21	x	0.63	x	0.7	=	11.67	(82)
Rooflights 0.9x	1	x	2.8	x	8.94	x	0.63	x	0.7	=	9.94	(82)

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

(83)m=	104.73	186.69	271.38	385.37	479.35	515.09	492.79	414.53	315.89	218.56	126.98	88.61	(83)

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

(84)m=	822.75	899.46	958.36	1032.4	1085.27	1084.55	1041.24	972.45	897.09	839.94	792.9	788.42	(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=	0.99	0.99	0.98	0.96	0.88	0.72	0.51	0.54	0.83	0.96	0.99	0.99	(86)

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

(87)m=	21	21	21	21	21	21	21	21	21	21	21	21	(87)

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

(88)m=	19.82	19.84	19.84	19.86	19.88	19.89	19.89	19.89	19.87	19.86	19.85	19.84	(88)

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

(89)m=	0.99	0.99	0.97	0.94	0.83	0.62	0.38	0.41	0.75	0.94	0.99	0.99	(89)

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

(90)m=	19.82	19.84	19.84	19.86	19.88	19.89	19.89	19.89	19.87	19.86	19.85	19.84	(90)

fLA = Living area ÷ (4) = 0.15 (91)

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

(92)m=	19.99	20.01	20.01	20.03	20.04	20.05	20.06	20.06	20.04	20.03	20.02	20.01	(92)

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

(93)m=	19.89	19.91	19.91	19.93	19.94	19.95	19.96	19.96	19.94	19.93	19.92	19.91	(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=	0.99	0.99	0.97	0.94	0.83	0.63	0.39	0.41	0.75	0.94	0.99	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	816.46	888.35	934.13	972.72	905.48	678.69	403.56	402.63	674.65	791.27	782.32	782.75	(95)

Monthly average external temperature from Table 8

(96)m=	4.5	5	6.8	8.7	11.7	14.6	16.9	16.9	14.3	10.8	7	4.9	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	2197.44	2098.34	1844.97	1540.07	1112.69	716.7	406.43	406.43	764.22	1252.07	1794.35	2112.41	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	1027.45	813.11	677.66	408.5	154.16	0	0	0	0	342.84	728.66	989.27	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	5141.65	(98)
Space heating requirement in kWh/m²/year	47.81	(99)

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

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	322.25	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	1027.45	813.11	677.66	408.5	154.16	0	0	0	0	342.84	728.66	989.27	
(211)m = {[(98)m x (204)] + (210)m } x 100 ÷ (206)	318.84	252.32	210.29	126.77	47.84	0	0	0	0	106.39	226.12	306.99	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	1595.56	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] + (214) m } x 100 ÷ (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

Water heating

Output from water heater (calculated above)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	221.02	194.92	204.97	184.11	180.69	161.83	155.78	170.44	169.98	190.89	201.39	215.83

Efficiency of water heater	112.5	(216)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(217)m=	112.5	112.5	112.5	112.5	112.5	112.5	112.5	112.5	112.5	112.5	112.5	112.5

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(219)m=	196.47	173.26	182.2	163.65	160.61	143.85	138.47	151.5	151.1	169.68	179.02	191.85

Total = Sum(219a)$_{1...12}$ =	2001.66	(219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		1595.56
Water heating fuel used		2001.66
Electricity for pumps, fans and electric keep-hot		
Total electricity for the above, kWh/year sum of (230a)…(230g) =		0 (231)
Electricity for lighting		446.79 (232)

10a. Fuel costs - individual heating systems:

	Fuel kWh/year	**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211) x	11.46	x 0.01 =	182.85	(240)
Space heating - main system 2	(213) x	0	x 0.01 =	0	(241)
Space heating - secondary	(215) x	0	x 0.01 =	0	(242)

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Water heating cost (other fuel)	(219)	11.46	x 0.01 =	229.39	(247)
Pumps, fans and electric keep-hot	(231)	11.46	x 0.01 =	0	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a					
Energy for lighting	(232)	11.46	x 0.01 =	51.2	(250)
Additional standing charges (Table 12)				0	(251)
Appendix Q items: repeat lines (253) and (254) as needed					
Total energy cost	(245)...(247) + (250)…(254) =			463.44	(255)

11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.47	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.43	(257)
SAP rating (Section 12)		80.08	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

		Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211)	x		0.517	=	824.9	(261)
Space heating (secondary)	(215)	x		0	=	0	(263)
Water heating	(219)	x		0.517	=	1034.86	(264)
Space and water heating	(261) + (262) + (263) + (264) =					1859.76	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x		0.517	=	0	(267)
Electricity for lighting	(232)	x		0.517	=	230.99	(268)
Total CO2, kg/year			sum of (265)…(271) =			2090.75	(272)
CO2 emissions per m²			(272) ÷ (4) =			19.44	(273)
EI rating (section 14)						82	(274)

13a. Primary Energy

		Energy kWh/year		**Primary** factor		**P. Energy** kWh/year	
Space heating (main system 1)	(211)	x		2.92	=	4659.03	(261)
Space heating (secondary)	(215)	x		0	=	0	(263)
Energy for water heating	(219)	x		2.92	=	5844.84	(264)
Space and water heating	(261) + (262) + (263) + (264) =					10503.87	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x		2.92	=	0	(267)
Electricity for lighting	(232)	x		0	=	1304.63	(268)
'Total Primary Energy			sum of (265)…(271) =			11808.5	(272)
Primary energy kWh/m²/year			(272) ÷ (4) =			109.8	(273)

Regulations Compliance Report

Approved Document L1A 2010 edition assessed by Stroma FSAP 2009 program, Version: 1.4.0.73
Printed on 02 May 2012 at 12:30:33

Project Information:

Assessed By: Mike Ovenden (STRO006697) **Building Type:** Mid-terrace House

Dwelling Details:

NEW DWELLING DESIGN STAGE

Site Reference : Plot 12 mid terrace **Plot Reference:** Plot 12

Address : Plot 12, Penistone Coal Drops, St. Mary's Street, Penistone, Sheffield, S36 6DT

Client Details:

Name: Stephen Sharp

Address : Yourspace Studio Limited , 180 main road, west winch, king's lynn, PE330LJ

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

1 TER and DER

Fuel for main heating system: Grid electricity

Target Carbon Dioxide Emission Rate (TER)	28.71 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	24.35 kg/m²	OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.23 (max. 0.30)	0.23 (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	0.14 (max. 0.20)	0.14 (max. 0.35)	OK
Openings	1.89 (max. 2.00)	3.00 (max. 3.30)	OK

3 Design air permeability

Design air permeability at 50 pascals	6.00	
Maximum	10.0	OK

4 Heating efficiency

Main Heating system:

Heat pumps with radiators or underfloor - electric
Mitsubishi ECODAN 5kW

Secondary heating system: None

5 Cylinder insulation

Hot water Storage:	Nominal cylinder loss: 2.37 kWh/day Permitted by DBSCG: 3.11 kWh/day	OK
Primary pipework insulated:	Yes	OK

6 Controls

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

7 Low energy lights

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

Regulations Compliance Report

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (North East England):	Not significant	**OK**
Based on:		
Overshading:	Average or unknown	
Windows facing: South	3.8m², Overhang twice as wide as window, ratio NaN	
Windows facing: South	7.14m², Overhang twice as wide as window, ratio NaN	
Ventilation rate:	8.00	
Blinds/curtains:	shutter closed 100% of daylight hours	

10 Key features

None

SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Mike Ovenden	**Stroma Number:**	STRO006697
Software Name:	Stroma FSAP 2009	**Software Version:**	Version: 1.4.0.73

Property Address: Plot 12 mid terrace

Address : Plot 12, Penistone Coal Drops, St. Mary's Street, Penistone, Sheffield, S36 6DT

1. Overall dwelling dimensions:

	Area(m²)		Ave Height(m)		Volume(m³)	
Ground floor	36.9 (1a)	x	2.6 (2a)	=	95.94	(3a)
First floor	36.9 (1b)	x	2.6 (2b)	=	95.94	(3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	73.8 (4)					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		191.88	(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	1	+	0	+	0	=	1	x 20 =	20	(6b)
Number of intermittent fans							4	x 10 =	40	(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) =	60	÷ (5) =	0.31	(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			6	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.61	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides on which sheltered			2	(19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.52	(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=	5.4	5.1	5.1	4.5	4.1	3.9	3.7	3.7	4.2	4.5	4.8	5.1

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Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.35	1.27	1.27	1.12	1.02	0.98	0.92	0.92	1.05	1.12	1.2	1.27

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

0.7	0.66	0.66	0.59	0.53	0.51	0.48	0.48	0.55	0.59	0.62	0.66

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

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

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0

(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=	0.75	0.72	0.72	0.67	0.64	0.63	0.62	0.62	0.65	0.67	0.7	0.72

(24d)

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

(25)m=	0.75	0.72	0.72	0.67	0.64	0.63	0.62	0.62	0.65	0.67	0.7	0.72

(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			1.9	x	3	=	5.7			(26)
Windows Type 1			3.8	x	1/[1/(1.7)+ 0.04]	=	6.05			(27)
Windows Type 2			7.14	x	1/[1/(1.7)+ 0.04]	=	11.37			(27)
Floor			36.9	x	0.2	=	7.380001			(28)
Walls	46.8	12.84	33.96	x	0.23	=	7.81			(29)
Roof	36.9	0	36.9	x	0.14	=	5.17			(30)
Total area of elements, m²			120.6							(31)
Party wall			85.28	x	0	=	0			(32)

** 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) = 43.47 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 10605.9 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (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 18.09 (36)

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

Total fabric heat loss (33) + (36) = 61.56 (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=	47.31	45.62	45.62	42.53	40.68	39.82	39.01	39.01	41.13	42.53	44.03	45.62	(38)

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

(39)m=	108.87	107.18	107.18	104.09	102.24	101.38	100.57	100.57	102.69	104.09	105.59	107.18	

Average = Sum(39)$_{1...12}$ /12= 104.3 (39)

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

(40)m=	1.48	1.45	1.45	1.41	1.39	1.37	1.36	1.36	1.39	1.41	1.43	1.45	

Average = Sum(40)$_{1...12}$ /12= 1.41 (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 89.65 (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=	98.62	95.03	91.44	87.86	84.27	80.69	80.69	84.27	87.86	91.44	95.03	98.62	

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

Total = Sum(44)$_{1...12}$ = 1075.8 (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=	146.59	128.21	132.3	115.34	110.68	95.5	88.5	101.55	102.77	119.77	130.73	141.97	

Total = Sum(45)$_{1...12}$ = 1413.92 (45)

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

(46)m=	21.99	19.23	19.85	17.3	16.6	14.33	13.27	15.23	15.42	17.96	19.61	21.3	(46)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (47)

Temperature factor from Table 2b 0 (48)

Energy lost from water storage, kWh/year (47) x (48) = 0 (49)

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

Cylinder volume (litres) including any solar storage within same 200 (50)

If community heating and no tank in dwelling, enter 110 litres in box (50)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in box (50)

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.01 (51)

Volume factor from Table 2a 0.84 (52)

Temperature factor from Table 2b 0.54 (53)

Energy lost from water storage, kWh/year ((50) x (51) x (52) x (53) = 1.05 (54)

Enter (49) or (54) in (55) 1.05 (55)

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

(56)m=	32.61	29.45	32.61	31.56	32.61	31.56	32.61	32.61	31.56	32.61	31.56	32.61	(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=	32.61	29.45	32.61	31.56	32.61	31.56	32.61	32.61	31.56	32.61	31.56	32.61	(57)

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Primary circuit loss (annual) from Table 3 | 280 | (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=	23.78	21.48	23.78	23.01	23.78	23.01	23.78	23.78	23.01	23.78	23.01	23.78	(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=	202.98	179.14	188.69	169.91	167.06	150.07	144.89	157.94	157.34	176.15	185.3	198.36	(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=	202.98	179.14	188.69	169.91	167.06	150.07	144.89	157.94	157.34	176.15	185.3	198.36	

Output from water heater (annual)$_{1...12}$ | 2077.85 | (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=	93.85	83.38	89.1	82.01	81.91	75.41	74.54	78.88	77.83	84.93	87.12	92.32	(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=	140.08	140.08	140.08	140.08	140.08	140.08	140.08	140.08	140.08	140.08	140.08	140.08	(66)

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

(67)m=	48.65	43.21	35.14	26.61	19.89	16.79	18.14	23.58	31.65	40.19	46.91	50.01	(67)

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

(68)m=	307.46	310.65	302.61	285.5	263.89	243.58	230.02	226.83	234.87	251.98	273.59	293.89	(68)

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

(69)m=	51.34	51.34	51.34	51.34	51.34	51.34	51.34	51.34	51.34	51.34	51.34	51.34	(69)

Pumps and fans gains (Table 5a)

(70)m=	10	10	10	10	10	10	10	10	10	10	10	10	(70)

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

(71)m=	-93.39	-93.39	-93.39	-93.39	-93.39	-93.39	-93.39	-93.39	-93.39	-93.39	-93.39	-93.39	(71)

Water heating gains (Table 5)

(72)m=	126.15	124.07	119.76	113.9	110.1	104.74	100.18	106.02	108.09	114.16	121.01	124.08	(72)

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

(73)m=	590.3	585.98	565.55	534.04	501.91	473.15	456.38	464.47	482.65	514.37	549.54	576.02	(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)	
South	0.9x 0.77	x	3.8	x	47.32	x	0.63	x	0.7	=	54.96	(78)
South	0.9x 0.77	x	7.14	x	47.32	x	0.63	x	0.7	=	103.26	(78)

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South	0.9x	0.77	x	3.8	x	77.18	x	0.63	x	0.7	=	89.64	(78)
South	0.9x	0.77	x	7.14	x	77.18	x	0.63	x	0.7	=	168.42	(78)
South	0.9x	0.77	x	3.8	x	94.25	x	0.63	x	0.7	=	109.45	(78)
South	0.9x	0.77	x	7.14	x	94.25	x	0.63	x	0.7	=	205.65	(78)
South	0.9x	0.77	x	3.8	x	105.11	x	0.63	x	0.7	=	122.07	(78)
South	0.9x	0.77	x	7.14	x	105.11	x	0.63	x	0.7	=	229.37	(78)
South	0.9x	0.77	x	3.8	x	108.55	x	0.63	x	0.7	=	126.06	(78)
South	0.9x	0.77	x	7.14	x	108.55	x	0.63	x	0.7	=	236.86	(78)
South	0.9x	0.77	x	3.8	x	108.9	x	0.63	x	0.7	=	126.47	(78)
South	0.9x	0.77	x	7.14	x	108.9	x	0.63	x	0.7	=	237.62	(78)
South	0.9x	0.77	x	3.8	x	107.14	x	0.63	x	0.7	=	124.42	(78)
South	0.9x	0.77	x	7.14	x	107.14	x	0.63	x	0.7	=	233.78	(78)
South	0.9x	0.77	x	3.8	x	103.88	x	0.63	x	0.7	=	120.64	(78)
South	0.9x	0.77	x	7.14	x	103.88	x	0.63	x	0.7	=	226.68	(78)
South	0.9x	0.77	x	3.8	x	99.99	x	0.63	x	0.7	=	116.12	(78)
South	0.9x	0.77	x	7.14	x	99.99	x	0.63	x	0.7	=	218.19	(78)
South	0.9x	0.77	x	3.8	x	85.29	x	0.63	x	0.7	=	99.05	(78)
South	0.9x	0.77	x	7.14	x	85.29	x	0.63	x	0.7	=	186.11	(78)
South	0.9x	0.77	x	3.8	x	56.07	x	0.63	x	0.7	=	65.11	(78)
South	0.9x	0.77	x	7.14	x	56.07	x	0.63	x	0.7	=	122.35	(78)
South	0.9x	0.77	x	3.8	x	40.89	x	0.63	x	0.7	=	47.49	(78)
South	0.9x	0.77	x	7.14	x	40.89	x	0.63	x	0.7	=	89.23	(78)

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

(83)m=	158.22	258.05	315.1	351.44	362.93	364.09	358.2	347.32	334.31	285.17	187.46	136.71	(83)

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

(84)m=	748.52	844.03	880.66	885.48	864.84	837.24	814.59	811.79	816.96	799.53	737	712.73	(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=	0.98	0.97	0.95	0.93	0.85	0.7	0.49	0.49	0.74	0.91	0.97	0.99	(86)

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

(87)m=	21	21	21	21	21	21	21	21	21	21	21	21	(87)

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

(88)m=	19.71	19.73	19.73	19.76	19.78	19.79	19.8	19.8	19.77	19.76	19.74	19.73	(88)

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

(89)m=	0.98	0.96	0.94	0.9	0.79	0.59	0.35	0.36	0.64	0.87	0.96	0.98	(89)

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

(90)m=	19.71	19.73	19.73	19.76	19.78	19.79	19.8	19.8	19.77	19.76	19.74	19.73	(90)

fLA = Living area ÷ (4) = 0.2 (91)

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

(92)m=	19.97	19.98	19.98	20.01	20.02	20.03	20.04	20.04	20.02	20.01	20	19.98	(92)

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

(93)m=	19.87	19.88	19.88	19.91	19.92	19.93	19.94	19.94	19.92	19.91	19.9	19.88	(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=	0.98	0.97	0.94	0.9	0.8	0.61	0.37	0.37	0.65	0.87	0.96	0.98	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	733.46	815.33	829.37	800.07	692.88	509.18	302.91	302.88	532.44	697.8	710.85	699.33	(95)
Monthly average external temperature from Table 8													
(96)m=	4.5	5	6.8	8.7	11.7	14.6	16.9	16.9	14.3	10.8	7	4.9	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1673.28	1595.18	1402.25	1166.67	840.81	540.46	305.48	305.48	577.11	948.09	1361.66	1605.89	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	699.22	524.05	426.23	263.96	110.06	0	0	0	0	186.22	468.58	674.48	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 3352.8 (98)

Space heating requirement in kWh/m²/year 45.43 (99)

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

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 317.82 (206)

Efficiency of secondary/supplementary heating system, % 0 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	699.22	524.05	426.23	263.96	110.06	0	0	0	0	186.22	468.58	674.48	
(211)m = {[(98)m x (204)] + (210)m } x 100 ÷ (206)													(211)
	220.01	164.89	134.11	83.05	34.63	0	0	0	0	58.59	147.44	212.22	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 1054.94 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] + (214) m } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10....12}$= 0 (215)

Water heating

Output from water heater (calculated above)

	202.98	179.14	188.69	169.91	167.06	150.07	144.89	157.94	157.34	176.15	185.3	198.36

Efficiency of water heater 112.5 (216)

(217)m=	112.5	112.5	112.5	112.5	112.5	112.5	112.5	112.5	112.5	112.5	112.5	112.5	(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	180.43	159.24	167.73	151.04	148.5	133.4	128.79	140.39	139.86	156.58	164.71	176.32	

Total = Sum(219a)$_{1...12}$ = 1846.98 (219)

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Annual totals		kWh/year	kWh/year	
Space heating fuel used, main system 1			1054.94	
Water heating fuel used			1846.98	
Electricity for pumps, fans and electric keep-hot				
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		0	(231)
Electricity for lighting			343.7	(232)

10a. Fuel costs - individual heating systems:

	Fuel kWh/year		Fuel Price (Table 12)		Fuel Cost £/year	
Space heating - main system 1	(211) x		11.46	x 0.01 =	120.9	(240)
Space heating - main system 2	(213) x		0	x 0.01 =	0	(241)
Space heating - secondary	(215) x		0	x 0.01 =	0	(242)
Water heating cost (other fuel)	(219)		11.46	x 0.01 =	211.66	(247)
Pumps, fans and electric keep-hot	(231)		11.46	x 0.01 =	0	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a						
Energy for lighting	(232)		11.46	x 0.01 =	39.39	(250)
Additional standing charges (Table 12)					0	(251)
Appendix Q items: repeat lines (253) and (254) as needed						
Total energy cost	(245)...(247) + (250)…(254) =				371.95	(255)

11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)	0.47	(256)
Energy cost factor (ECF) [(255) x (256)] ÷ [(4) + 45.0] =	1.47	(257)
SAP rating (Section 12)	79.47	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.517	=	545.4	(261)
Space heating (secondary)	(215) x		0	=	0	(263)
Water heating	(219) x		0.517	=	954.89	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1500.29	(265)
Electricity for pumps, fans and electric keep-hot	(231) x		0.517	=	0	(267)
Electricity for lighting	(232) x		0.517	=	177.69	(268)
Total CO2, kg/year	sum of (265)…(271) =				1677.99	(272)
CO2 emissions per m²	(272) ÷ (4) =				22.74	(273)
EI rating (section 14)					81	(274)

13a. Primary Energy

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	Energy kWh/year		**Primary** factor		**P. Energy** kWh/year	
Space heating (main system 1)	(211)	x	2.92	=	3080.43	(261)
Space heating (secondary)	(215)	x	0	=	0	(263)
Energy for water heating	(219)	x	2.92	=	5393.19	(264)
Space and water heating	(261) + (262) + (263) + (264) =				8473.61	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	2.92	=	0	(267)
Electricity for lighting	(232)	x	0	=	1003.61	(268)
'Total Primary Energy			sum of (265)…(271) =		9477.22	(272)
Primary energy kWh/m²/year			(272) ÷ (4) =		128.42	(273)

Regulations Compliance Report

Approved Document L1A 2010 edition assessed by Stroma FSAP 2009 program, Version: 1.4.0.73
Printed on 02 May 2012 at 12:30:26

Project Information:

Assessed By: Mike Ovenden (STRO006697) **Building Type:** Mid-terrace House

Dwelling Details:

NEW DWELLING DESIGN STAGE

Site Reference : Plot 13 mid terrace **Plot Reference:** Plot 13

Address : Plot 13, Penistone Coal Drops, St. Mary's Street, Penistone, Sheffield, S36 6DT

Client Details:

Name: Stephen Sharp

Address : Yourspace Studio Limited , 180 main road, west winch, king's lynn, PE330LJ

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

1 TER and DER

Fuel for main heating system: Grid electricity

Target Carbon Dioxide Emission Rate (TER)	28.71 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	24.35 kg/m²	OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.23 (max. 0.30)	0.23 (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	0.14 (max. 0.20)	0.14 (max. 0.35)	OK
Openings	1.89 (max. 2.00)	3.00 (max. 3.30)	OK

3 Design air permeability

Design air permeability at 50 pascals	6.00	
Maximum	10.0	OK

4 Heating efficiency

Main Heating system:

Heat pumps with radiators or underfloor - electric
Mitsubishi ECODAN 5kW

Secondary heating system: None

5 Cylinder insulation

Hot water Storage:	Nominal cylinder loss: 2.37 kWh/day Permitted by DBSCG: 3.11 kWh/day	OK
Primary pipework insulated:	Yes	OK

6 Controls

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

7 Low energy lights

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

Regulations Compliance Report

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (North East England):	Not significant	**OK**
Based on:		
Overshading:	Average or unknown	
Windows facing: South	3.8m², Overhang twice as wide as window, ratio NaN	
Windows facing: South	7.14m², Overhang twice as wide as window, ratio NaN	
Ventilation rate:	8.00	
Blinds/curtains:	shutter closed 100% of daylight hours	

10 Key features

None

SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Mike Ovenden	**Stroma Number:**	STRO006697
Software Name:	Stroma FSAP 2009	**Software Version:**	Version: 1.4.0.73

Property Address: Plot 13 mid terrace

Address : Plot 13, Penistone Coal Drops, St. Mary's Street, Penistone, Sheffield, S36 6DT

1. Overall dwelling dimensions:

	Area(m²)		Ave Height(m)		Volume(m³)	
Ground floor	36.9 (1a)	x	2.6 (2a)	=	95.94	(3a)
First floor	36.9 (1b)	x	2.6 (2b)	=	95.94	(3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	73.8 (4)					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		191.88	(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	1	+	0	+	0	=	1	x 20 =	20	(6b)
Number of intermittent fans							4	x 10 =	40	(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) =	60	÷ (5) =	0.31 (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				6 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.61 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides on which sheltered				2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =			0.85 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =			0.52 (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=	5.4	5.1	5.1	4.5	4.1	3.9	3.7	3.7	4.2	4.5	4.8	5.1

SAP WorkSheet: New dwelling design stage

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.35	1.27	1.27	1.12	1.02	0.98	0.92	0.92	1.05	1.12	1.2	1.27

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

0.7	0.66	0.66	0.59	0.53	0.51	0.48	0.48	0.55	0.59	0.62	0.66

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

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

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0

(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=	0.75	0.72	0.72	0.67	0.64	0.63	0.62	0.62	0.65	0.67	0.7	0.72

(24d)

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

(25)m=	0.75	0.72	0.72	0.67	0.64	0.63	0.62	0.62	0.65	0.67	0.7	0.72

(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			1.9	x	3	=	5.7			(26)
Windows Type 1			3.8	x	1/[1/(1.7)+ 0.04]	=	6.05			(27)
Windows Type 2			7.14	x	1/[1/(1.7)+ 0.04]	=	11.37			(27)
Floor			36.9	x	0.2	=	7.380001			(28)
Walls	46.8	12.84	33.96	x	0.23	=	7.81			(29)
Roof	36.9	0	36.9	x	0.14	=	5.17			(30)
Total area of elements, m²			120.6							(31)
Party wall			85.28	x	0	=	0			(32)

** 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) = 43.47 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 10605.9 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (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 18.09 (36)

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

Total fabric heat loss (33) + (36) = 61.56 (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=	47.31	45.62	45.62	42.53	40.68	39.82	39.01	39.01	41.13	42.53	44.03	45.62	(38)

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

(39)m=	108.87	107.18	107.18	104.09	102.24	101.38	100.57	100.57	102.69	104.09	105.59	107.18	

Average = Sum(39)$_{1...12}$ /12= 104.3 (39)

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

(40)m=	1.48	1.45	1.45	1.41	1.39	1.37	1.36	1.36	1.39	1.41	1.43	1.45	

Average = Sum(40)$_{1...12}$ /12= 1.41 (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 89.65 (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=	98.62	95.03	91.44	87.86	84.27	80.69	80.69	84.27	87.86	91.44	95.03	98.62	

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

Total = Sum(44)$_{1...12}$ = 1075.8 (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=	146.59	128.21	132.3	115.34	110.68	95.5	88.5	101.55	102.77	119.77	130.73	141.97	

Total = Sum(45)$_{1...12}$ = 1413.92 (45)

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

(46)m=	21.99	19.23	19.85	17.3	16.6	14.33	13.27	15.23	15.42	17.96	19.61	21.3	(46)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (47)

Temperature factor from Table 2b 0 (48)

Energy lost from water storage, kWh/year (47) x (48) = 0 (49)

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

Cylinder volume (litres) including any solar storage within same 200 (50)

If community heating and no tank in dwelling, enter 110 litres in box (50)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in box (50)

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.01 (51)

Volume factor from Table 2a 0.84 (52)

Temperature factor from Table 2b 0.54 (53)

Energy lost from water storage, kWh/year ((50) x (51) x (52) x (53) = 1.05 (54)

Enter (49) or (54) in (55) 1.05 (55)

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

(56)m=	32.61	29.45	32.61	31.56	32.61	31.56	32.61	32.61	31.56	32.61	31.56	32.61	(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=	32.61	29.45	32.61	31.56	32.61	31.56	32.61	32.61	31.56	32.61	31.56	32.61	(57)

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Primary circuit loss (annual) from Table 3 | 280 | (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=	23.78	21.48	23.78	23.01	23.78	23.01	23.78	23.78	23.01	23.78	23.01	23.78	(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=	202.98	179.14	188.69	169.91	167.06	150.07	144.89	157.94	157.34	176.15	185.3	198.36	(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=	202.98	179.14	188.69	169.91	167.06	150.07	144.89	157.94	157.34	176.15	185.3	198.36	

Output from water heater (annual)$_{1...12}$ | 2077.85 | (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=	93.85	83.38	89.1	82.01	81.91	75.41	74.54	78.88	77.83	84.93	87.12	92.32	(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=	140.08	140.08	140.08	140.08	140.08	140.08	140.08	140.08	140.08	140.08	140.08	140.08	(66)

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

(67)m=	48.65	43.21	35.14	26.61	19.89	16.79	18.14	23.58	31.65	40.19	46.91	50.01	(67)

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

(68)m=	307.46	310.65	302.61	285.5	263.89	243.58	230.02	226.83	234.87	251.98	273.59	293.89	(68)

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

(69)m=	51.34	51.34	51.34	51.34	51.34	51.34	51.34	51.34	51.34	51.34	51.34	51.34	(69)

Pumps and fans gains (Table 5a)

(70)m=	10	10	10	10	10	10	10	10	10	10	10	10	(70)

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

(71)m=	-93.39	-93.39	-93.39	-93.39	-93.39	-93.39	-93.39	-93.39	-93.39	-93.39	-93.39	-93.39	(71)

Water heating gains (Table 5)

(72)m=	126.15	124.07	119.76	113.9	110.1	104.74	100.18	106.02	108.09	114.16	121.01	124.08	(72)

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

(73)m=	590.3	585.98	565.55	534.04	501.91	473.15	456.38	464.47	482.65	514.37	549.54	576.02	(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)	
South	0.9x 0.77	x	3.8	x	47.32	x	0.63	x	0.7	=	54.96	(78)
South	0.9x 0.77	x	7.14	x	47.32	x	0.63	x	0.7	=	103.26	(78)

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South	0.9x	0.77	x	3.8	x	77.18	x	0.63	x	0.7	=	89.64	(78)
South	0.9x	0.77	x	7.14	x	77.18	x	0.63	x	0.7	=	168.42	(78)
South	0.9x	0.77	x	3.8	x	94.25	x	0.63	x	0.7	=	109.45	(78)
South	0.9x	0.77	x	7.14	x	94.25	x	0.63	x	0.7	=	205.65	(78)
South	0.9x	0.77	x	3.8	x	105.11	x	0.63	x	0.7	=	122.07	(78)
South	0.9x	0.77	x	7.14	x	105.11	x	0.63	x	0.7	=	229.37	(78)
South	0.9x	0.77	x	3.8	x	108.55	x	0.63	x	0.7	=	126.06	(78)
South	0.9x	0.77	x	7.14	x	108.55	x	0.63	x	0.7	=	236.86	(78)
South	0.9x	0.77	x	3.8	x	108.9	x	0.63	x	0.7	=	126.47	(78)
South	0.9x	0.77	x	7.14	x	108.9	x	0.63	x	0.7	=	237.62	(78)
South	0.9x	0.77	x	3.8	x	107.14	x	0.63	x	0.7	=	124.42	(78)
South	0.9x	0.77	x	7.14	x	107.14	x	0.63	x	0.7	=	233.78	(78)
South	0.9x	0.77	x	3.8	x	103.88	x	0.63	x	0.7	=	120.64	(78)
South	0.9x	0.77	x	7.14	x	103.88	x	0.63	x	0.7	=	226.68	(78)
South	0.9x	0.77	x	3.8	x	99.99	x	0.63	x	0.7	=	116.12	(78)
South	0.9x	0.77	x	7.14	x	99.99	x	0.63	x	0.7	=	218.19	(78)
South	0.9x	0.77	x	3.8	x	85.29	x	0.63	x	0.7	=	99.05	(78)
South	0.9x	0.77	x	7.14	x	85.29	x	0.63	x	0.7	=	186.11	(78)
South	0.9x	0.77	x	3.8	x	56.07	x	0.63	x	0.7	=	65.11	(78)
South	0.9x	0.77	x	7.14	x	56.07	x	0.63	x	0.7	=	122.35	(78)
South	0.9x	0.77	x	3.8	x	40.89	x	0.63	x	0.7	=	47.49	(78)
South	0.9x	0.77	x	7.14	x	40.89	x	0.63	x	0.7	=	89.23	(78)

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

(83)m=	158.22	258.05	315.1	351.44	362.93	364.09	358.2	347.32	334.31	285.17	187.46	136.71	(83)

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

(84)m=	748.52	844.03	880.66	885.48	864.84	837.24	814.59	811.79	816.96	799.53	737	712.73	(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=	0.98	0.97	0.95	0.93	0.85	0.7	0.49	0.49	0.74	0.91	0.97	0.99	(86)

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

(87)m=	21	21	21	21	21	21	21	21	21	21	21	21	(87)

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

(88)m=	19.71	19.73	19.73	19.76	19.78	19.79	19.8	19.8	19.77	19.76	19.74	19.73	(88)

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

(89)m=	0.98	0.96	0.94	0.9	0.79	0.59	0.35	0.36	0.64	0.87	0.96	0.98	(89)

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

(90)m=	19.71	19.73	19.73	19.76	19.78	19.79	19.8	19.8	19.77	19.76	19.74	19.73	(90)

fLA = Living area ÷ (4) = 0.2 (91)

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

(92)m=	19.97	19.98	19.98	20.01	20.02	20.03	20.04	20.04	20.02	20.01	20	19.98	(92)

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

(93)m=	19.87	19.88	19.88	19.91	19.92	19.93	19.94	19.94	19.92	19.91	19.9	19.88	(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=	0.98	0.97	0.94	0.9	0.8	0.61	0.37	0.37	0.65	0.87	0.96	0.98	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	733.46	815.33	829.37	800.07	692.88	509.18	302.91	302.88	532.44	697.8	710.85	699.33	(95)
Monthly average external temperature from Table 8													
(96)m=	4.5	5	6.8	8.7	11.7	14.6	16.9	16.9	14.3	10.8	7	4.9	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1673.28	1595.18	1402.25	1166.67	840.81	540.46	305.48	305.48	577.11	948.09	1361.66	1605.89	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	699.22	524.05	426.23	263.96	110.06	0	0	0	0	186.22	468.58	674.48	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 3352.8 (98)

Space heating requirement in kWh/m²/year 45.43 (99)

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

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 317.82 (206)

Efficiency of secondary/supplementary heating system, % 0 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	699.22	524.05	426.23	263.96	110.06	0	0	0	0	186.22	468.58	674.48	
(211)m = {[(98)m x (204)] + (210)m } x 100 ÷ (206)													(211)
	220.01	164.89	134.11	83.05	34.63	0	0	0	0	58.59	147.44	212.22	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 1054.94 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] + (214) m } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10....12}$= 0 (215)

Water heating

Output from water heater (calculated above)

	202.98	179.14	188.69	169.91	167.06	150.07	144.89	157.94	157.34	176.15	185.3	198.36

Efficiency of water heater 112.5 (216)

(217)m=	112.5	112.5	112.5	112.5	112.5	112.5	112.5	112.5	112.5	112.5	112.5	112.5	(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	180.43	159.24	167.73	151.04	148.5	133.4	128.79	140.39	139.86	156.58	164.71	176.32	

Total = Sum(219a)$_{1...12}$ = 1846.98 (219)

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Annual totals		kWh/year	kWh/year	
Space heating fuel used, main system 1			1054.94	
Water heating fuel used			1846.98	
Electricity for pumps, fans and electric keep-hot				
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		0	(231)
Electricity for lighting			343.7	(232)

10a. Fuel costs - individual heating systems:

	Fuel kWh/year		Fuel Price (Table 12)		Fuel Cost £/year	
Space heating - main system 1	(211) x		11.46	x 0.01 =	120.9	(240)
Space heating - main system 2	(213) x		0	x 0.01 =	0	(241)
Space heating - secondary	(215) x		0	x 0.01 =	0	(242)
Water heating cost (other fuel)	(219)		11.46	x 0.01 =	211.66	(247)
Pumps, fans and electric keep-hot	(231)		11.46	x 0.01 =	0	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a						
Energy for lighting	(232)		11.46	x 0.01 =	39.39	(250)
Additional standing charges (Table 12)					0	(251)
Appendix Q items: repeat lines (253) and (254) as needed						
Total energy cost	(245)...(247) + (250)…(254) =				371.95	(255)

11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)	0.47	(256)
Energy cost factor (ECF) [(255) x (256)] ÷ [(4) + 45.0] =	1.47	(257)
SAP rating (Section 12)	79.47	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.517	=	545.4	(261)
Space heating (secondary)	(215) x		0	=	0	(263)
Water heating	(219) x		0.517	=	954.89	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1500.29	(265)
Electricity for pumps, fans and electric keep-hot	(231) x		0.517	=	0	(267)
Electricity for lighting	(232) x		0.517	=	177.69	(268)
Total CO2, kg/year	sum of (265)…(271) =				1677.99	(272)
CO2 emissions per m²	(272) ÷ (4) =				22.74	(273)
EI rating (section 14)					81	(274)

13a. Primary Energy

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	Energy kWh/year		**Primary** factor		**P. Energy** kWh/year	
Space heating (main system 1)	(211)	x	2.92	=	3080.43	(261)
Space heating (secondary)	(215)	x	0	=	0	(263)
Energy for water heating	(219)	x	2.92	=	5393.19	(264)
Space and water heating	(261) + (262) + (263) + (264) =				8473.61	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	2.92	=	0	(267)
Electricity for lighting	(232)	x	0	=	1003.61	(268)
'Total Primary Energy			sum of (265)…(271) =		9477.22	(272)
Primary energy kWh/m²/year			(272) ÷ (4) =		128.42	(273)

Regulations Compliance Report

Approved Document L1A 2010 edition assessed by Stroma FSAP 2009 program, Version: 1.4.0.73
Printed on 02 May 2012 at 12:30:19

Project Information:

Assessed By: Mike Ovenden (STRO006697) **Building Type:** Mid-terrace House

Dwelling Details:

NEW DWELLING DESIGN STAGE

Site Reference : Plot 14 mid terrace **Plot Reference:** Plot 14

Address : Plot 14, Penistone Coal Drops, St. Mary's Street, Penistone, Sheffield, S36 6DT

Client Details:

Name: Stephen Sharp

Address : Yourspace Studio Limited , 180 main road, west winch, king's lynn, PE330LJ

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

1 TER and DER

Fuel for main heating system: Grid electricity

Target Carbon Dioxide Emission Rate (TER)	24.48 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	20.58 kg/m²	OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.23 (max. 0.30)	0.23 (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	0.11 (max. 0.20)	0.11 (max. 0.35)	OK
Openings	1.95 (max. 2.00)	3.00 (max. 3.30)	OK

3 Design air permeability

Design air permeability at 50 pascals	6.00	
Maximum	10.0	OK

4 Heating efficiency

Main Heating system: Heat pumps with radiators or underfloor - electric
Mitsubishi ECODAN 5kW

Secondary heating system: None

5 Cylinder insulation

Hot water Storage:	Nominal cylinder loss: 2.37 kWh/day Permitted by DBSCG: 3.11 kWh/day	OK
Primary pipework insulated:	Yes	OK

6 Controls

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

7 Low energy lights

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

Regulations Compliance Report

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (North East England):	Not significant	**OK**
Based on:		
Overshading:	Average or unknown	
Windows facing: South	4.2m², Overhang twice as wide as window, ratio NaN	
Windows facing: North	12.88m², Overhang twice as wide as window, ratio NaN	
Roof windows facing: South	1.4m²	
Roof windows facing: North	2.8m²	
Ventilation rate:	8.00	
Blinds/curtains:	shutter closed 100% of daylight hours	

10 Key features

Roofs U-value	0.11 W/m²K

SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Mike Ovenden	**Stroma Number:**	STRO006697
Software Name:	Stroma FSAP 2009	**Software Version:**	Version: 1.4.0.73

Property Address: Plot 14 mid terrace

Address : Plot 14, Penistone Coal Drops, St. Mary's Street, Penistone, Sheffield, S36 6DT

1. Overall dwelling dimensions:

	Area(m²)		Ave Height(m)		Volume(m³)	
Ground floor	51.75 (1a)	x	2.6 (2a)	=	134.55	(3a)
First floor	39.6 (1b)	x	2.6 (2b)	=	102.96	(3b)
Second floor	28.35 (1c)	x	1.9 (2c)	=	53.87	(3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	119.7	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	=	291.37	(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	1	+	0	+	0	=	1	x 20 =	20	(6b)
Number of intermittent fans							5	x 10 =	50	(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) =	70	÷ (5) =	0.24	(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			6	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.54	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides on which sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.46	(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=	5.4	5.1	5.1	4.5	4.1	3.9	3.7	3.7	4.2	4.5	4.8	5.1

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Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.35	1.27	1.27	1.12	1.02	0.98	0.92	0.92	1.05	1.12	1.2	1.27

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

0.62	0.59	0.59	0.52	0.47	0.45	0.42	0.42	0.48	0.52	0.55	0.59

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

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

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0

(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=	0.69	0.67	0.67	0.63	0.61	0.6	0.59	0.59	0.62	0.63	0.65	0.67

(24d)

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

(25)m=	0.69	0.67	0.67	0.63	0.61	0.6	0.59	0.59	0.62	0.63	0.65	0.67

(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 Type 1			1.9	x	3	=	5.7			(26)
Doors Type 2			1.9	x	3	=	5.7			(26)
Windows Type 1			4.2	x	1/[1/(1.7)+ 0.04]	=	6.69			(27)
Windows Type 2			12.88	x	1/[1/(1.7)+ 0.04]	=	20.5			(27)
Rooflights Type 1			1.4	x	1/[1/(2) + 0.04]	=	2.8			(27b)
Rooflights Type 2			2.8	x	1/[1/(2) + 0.04]	=	5.6			(27b)
Floor			39.6	x	0.2	=	7.92			(28)
Walls	70.9	20.88	50.02	x	0.23	=	11.5			(29)
Roof Type1	55.44	4.2	51.24	x	0.11	=	5.64			(30)
Roof Type2	12.15	0	12.15	x	0.11	=	1.34			(30)
Total area of elements, m²			178.09							(31)
Party wall			115.46	x	0	=	0			(32)

** 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) = 72.76 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 13623.61 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f

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can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K — 26.71 (36)

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

Total fabric heat loss (33) + (36) = 99.48 (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=	66.55	64.56	64.56	60.91	58.73	57.71	56.75	56.75	59.25	60.91	62.68	64.56	(38)

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

(39)m=	166.03	164.03	164.03	160.38	158.2	157.19	156.23	156.23	158.73	160.38	162.15	164.03	

Average = Sum(39)$_{1...12}$ /12= 160.64 (39)

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

(40)m=	1.39	1.37	1.37	1.34	1.32	1.31	1.31	1.31	1.33	1.34	1.35	1.37	

Average = Sum(40)$_{1...12}$ /12= 1.34 (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 — 2.86 (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 — 102.18 (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=	112.39	108.31	104.22	100.13	96.05	91.96	91.96	96.05	100.13	104.22	108.31	112.39	

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

Total = Sum(44)$_{1...12}$ = 1226.11 (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=	167.08	146.13	150.79	131.46	126.14	108.85	100.86	115.74	117.13	136.5	149	161.8	

Total = Sum(45)$_{1...12}$ = 1611.47 (45)

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

(46)m=	25.06	21.92	22.62	19.72	18.92	16.33	15.13	17.36	17.57	20.47	22.35	24.27	(46)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (47)

Temperature factor from Table 2b 0 (48)

Energy lost from water storage, kWh/year (47) x (48) = 0 (49)

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

Cylinder volume (litres) including any solar storage within same 200 (50)

If community heating and no tank in dwelling, enter 110 litres in box (50)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in box (50)

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.01 (51)

Volume factor from Table 2a 0.84 (52)

Temperature factor from Table 2b 0.54 (53)

Energy lost from water storage, kWh/year ((50) x (51) x (52) x (53) = 1.05 (54)

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Enter (49) or (54) in (55) | 1.05 | (55)

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

(56)m=	32.61	29.45	32.61	31.56	32.61	31.56	32.61	32.61	31.56	32.61	31.56	32.61	(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=	32.61	29.45	32.61	31.56	32.61	31.56	32.61	32.61	31.56	32.61	31.56	32.61	(57)

Primary circuit loss (annual) from Table 3 | 280 | (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=	23.78	21.48	23.78	23.01	23.78	23.01	23.78	23.78	23.01	23.78	23.01	23.78	(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=	223.46	197.06	207.18	186.03	182.53	163.42	157.25	172.13	171.7	192.89	203.57	218.19	(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=	223.46	197.06	207.18	186.03	182.53	163.42	157.25	172.13	171.7	192.89	203.57	218.19	

Output from water heater (annual)$_{1...12}$ | 2275.41 | (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=	100.66	89.33	95.25	87.37	87.05	79.85	78.65	83.6	82.6	90.5	93.2	98.91	(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=	171.73	171.73	171.73	171.73	171.73	171.73	171.73	171.73	171.73	171.73	171.73	171.73	(66)

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

(67)m=	64.57	57.35	46.64	35.31	26.39	22.28	24.08	31.3	42	53.33	62.25	66.36	(67)

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

(68)m=	425.11	429.52	418.4	394.74	364.86	336.79	318.03	313.62	324.74	348.4	378.27	406.35	(68)

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

(69)m=	55.04	55.04	55.04	55.04	55.04	55.04	55.04	55.04	55.04	55.04	55.04	55.04	(69)

Pumps and fans gains (Table 5a)

(70)m=	10	10	10	10	10	10	10	10	10	10	10	10	(70)

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

(71)m=	-114.49	-114.49	-114.49	-114.49	-114.49	-114.49	-114.49	-114.49	-114.49	-114.49	-114.49	-114.49	(71)

Water heating gains (Table 5)

(72)m=	135.3	132.93	128.02	121.34	117.01	110.9	105.71	112.36	114.72	121.64	129.44	132.94	(72)

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

(73)m=	747.25	742.08	715.34	673.67	630.54	592.25	570.1	579.55	603.74	645.65	692.24	727.93	(73)

6. Solar gains:

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

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Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North 0.9x	0.77	x	12.88	x	10.73	x	0.63	x	0.7	=	42.22	(74)
North 0.9x	0.77	x	12.88	x	20.36	x	0.63	x	0.7	=	80.14	(74)
North 0.9x	0.77	x	12.88	x	33.31	x	0.63	x	0.7	=	131.11	(74)
North 0.9x	0.77	x	12.88	x	54.64	x	0.63	x	0.7	=	215.08	(74)
North 0.9x	0.77	x	12.88	x	75.22	x	0.63	x	0.7	=	296.07	(74)
North 0.9x	0.77	x	12.88	x	84.09	x	0.63	x	0.7	=	331	(74)
North 0.9x	0.77	x	12.88	x	79.12	x	0.63	x	0.7	=	311.44	(74)
North 0.9x	0.77	x	12.88	x	61.56	x	0.63	x	0.7	=	242.34	(74)
North 0.9x	0.77	x	12.88	x	41.09	x	0.63	x	0.7	=	161.72	(74)
North 0.9x	0.77	x	12.88	x	24.81	x	0.63	x	0.7	=	97.68	(74)
North 0.9x	0.77	x	12.88	x	13.22	x	0.63	x	0.7	=	52.03	(74)
North 0.9x	0.77	x	12.88	x	8.94	x	0.63	x	0.7	=	35.21	(74)
South 0.9x	0.77	x	4.2	x	47.32	x	0.63	x	0.7	=	60.74	(78)
South 0.9x	0.77	x	4.2	x	77.18	x	0.63	x	0.7	=	99.07	(78)
South 0.9x	0.77	x	4.2	x	94.25	x	0.63	x	0.7	=	120.97	(78)
South 0.9x	0.77	x	4.2	x	105.11	x	0.63	x	0.7	=	134.92	(78)
South 0.9x	0.77	x	4.2	x	108.55	x	0.63	x	0.7	=	139.33	(78)
South 0.9x	0.77	x	4.2	x	108.9	x	0.63	x	0.7	=	139.78	(78)
South 0.9x	0.77	x	4.2	x	107.14	x	0.63	x	0.7	=	137.52	(78)
South 0.9x	0.77	x	4.2	x	103.88	x	0.63	x	0.7	=	133.34	(78)
South 0.9x	0.77	x	4.2	x	99.99	x	0.63	x	0.7	=	128.35	(78)
South 0.9x	0.77	x	4.2	x	85.29	x	0.63	x	0.7	=	109.48	(78)
South 0.9x	0.77	x	4.2	x	56.07	x	0.63	x	0.7	=	71.97	(78)
South 0.9x	0.77	x	4.2	x	40.89	x	0.63	x	0.7	=	52.49	(78)
Rooflights 0.9x	1	x	1.4	x	26	x	0.63	x	0.7	=	14.45	(82)
Rooflights 0.9x	1	x	2.8	x	10.73	x	0.63	x	0.7	=	11.92	(82)
Rooflights 0.9x	1	x	1.4	x	54	x	0.63	x	0.7	=	30.01	(82)
Rooflights 0.9x	1	x	2.8	x	20.36	x	0.63	x	0.7	=	22.63	(82)
Rooflights 0.9x	1	x	1.4	x	94	x	0.63	x	0.7	=	52.23	(82)
Rooflights 0.9x	1	x	2.8	x	33.31	x	0.63	x	0.7	=	37.02	(82)
Rooflights 0.9x	1	x	1.4	x	150	x	0.63	x	0.7	=	83.35	(82)
Rooflights 0.9x	1	x	2.8	x	54.64	x	0.63	x	0.7	=	60.72	(82)
Rooflights 0.9x	1	x	1.4	x	190	x	0.63	x	0.7	=	105.58	(82)
Rooflights 0.9x	1	x	2.8	x	75.22	x	0.63	x	0.7	=	83.59	(82)
Rooflights 0.9x	1	x	1.4	x	201	x	0.63	x	0.7	=	111.69	(82)
Rooflights 0.9x	1	x	2.8	x	84.09	x	0.63	x	0.7	=	93.45	(82)
Rooflights 0.9x	1	x	1.4	x	194	x	0.63	x	0.7	=	107.8	(82)
Rooflights 0.9x	1	x	2.8	x	79.12	x	0.63	x	0.7	=	87.93	(82)
Rooflights 0.9x	1	x	1.4	x	164	x	0.63	x	0.7	=	91.13	(82)

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Rooflights 0.9x	1	x	2.8	x	61.56	x	0.63	x	0.7	=	68.42	(82)
Rooflights 0.9x	1	x	1.4	x	116	x	0.63	x	0.7	=	64.46	(82)
Rooflights 0.9x	1	x	2.8	x	41.09	x	0.63	x	0.7	=	45.66	(82)
Rooflights 0.9x	1	x	1.4	x	68	x	0.63	x	0.7	=	37.78	(82)
Rooflights 0.9x	1	x	2.8	x	24.81	x	0.63	x	0.7	=	27.58	(82)
Rooflights 0.9x	1	x	1.4	x	33	x	0.63	x	0.7	=	18.34	(82)
Rooflights 0.9x	1	x	2.8	x	13.22	x	0.63	x	0.7	=	14.69	(82)
Rooflights 0.9x	1	x	1.4	x	21	x	0.63	x	0.7	=	11.67	(82)
Rooflights 0.9x	1	x	2.8	x	8.94	x	0.63	x	0.7	=	9.94	(82)

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

(83)m=	129.33	231.84	341.33	494.07	624.57	675.92	644.68	535.23	400.18	272.52	157.03	109.3	(83)

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

(84)m=	876.58	973.92	1056.67	1167.74	1255.11	1268.16	1214.78	1114.78	1003.93	918.17	849.27	837.24	(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=	1	0.99	0.98	0.96	0.88	0.71	0.51	0.55	0.84	0.97	0.99	1	(86)

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

(87)m=	21	21	21	21	21	21	21	21	21	21	21	21	(87)

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

(88)m=	19.78	19.79	19.79	19.81	19.83	19.83	19.84	19.84	19.82	19.81	19.8	19.79	(88)

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

(89)m=	0.99	0.99	0.98	0.94	0.83	0.61	0.38	0.41	0.76	0.95	0.99	0.99	(89)

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

(90)m=	19.78	19.79	19.79	19.81	19.83	19.83	19.84	19.84	19.82	19.81	19.8	19.79	(90)

fLA = Living area ÷ (4) = 0.2 (91)

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

(92)m=	20.02	20.03	20.03	20.04	20.06	20.06	20.07	20.07	20.05	20.04	20.04	20.03	(92)

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

(93)m=	19.92	19.93	19.93	19.94	19.96	19.96	19.97	19.97	19.95	19.94	19.94	19.93	(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=	0.99	0.99	0.98	0.94	0.83	0.63	0.39	0.42	0.77	0.95	0.99	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	871.04	963.48	1032.3	1102.26	1047.01	793.09	474.82	473.14	772.27	871.97	839.89	832.33	(95)
Monthly average external temperature from Table 8													
(96)m=	4.5	5	6.8	8.7	11.7	14.6	16.9	16.9	14.3	10.8	7	4.9	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	2559.45	2448.35	2153.09	1803.49	1306.16	842.77	479.07	479.07	897.37	1466.68	2097.54	2464.76	(97)

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Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	1256.18	997.83	833.87	504.88	192.81	0	0	0	0	442.47	905.51	1214.52

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 6348.06 (98)

Space heating requirement in kWh/m²/year 53.03 (99)

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

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 324.35 (206)

Efficiency of secondary/supplementary heating system, % 0 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	1256.18	997.83	833.87	504.88	192.81	0	0	0	0	442.47	905.51	1214.52	
(211)m = {[(98)m x (204)] + (210)m } x 100 ÷ (206) (211)	387.28	307.64	257.09	155.66	59.44	0	0	0	0	136.41	279.17	374.44	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 1957.13 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] + (214) m } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

	223.46	197.06	207.18	186.03	182.53	163.42	157.25	172.13	171.7	192.89	203.57	218.19

Efficiency of water heater 112.5 (216)

(217)m=	112.5	112.5	112.5	112.5	112.5	112.5	112.5	112.5	112.5	112.5	112.5	112.5

(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	198.63	175.16	184.16	165.36	162.25	145.26	139.78	153.01	152.62	171.46	180.95	193.95

Total = Sum(219a)$_{1...12}$ = 2022.59 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		1957.13
Water heating fuel used		2022.59
Electricity for pumps, fans and electric keep-hot		
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	0 (231)
Electricity for lighting		456.1 (232)

10a. Fuel costs - individual heating systems:

	Fuel kWh/year	**Fuel Price** (Table 12)	**Fuel Cost** £/year
Space heating - main system 1	(211) x	11.46 x 0.01 =	224.29 (240)

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Space heating - main system 2	(213)	x	0	x 0.01 =	0	(241)
Space heating - secondary	(215)	x	0	x 0.01 =	0	(242)
Water heating cost (other fuel)	(219)		11.46	x 0.01 =	231.79	(247)
Pumps, fans and electric keep-hot	(231)		11.46	x 0.01 =	0	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a						
Energy for lighting	(232)		11.46	x 0.01 =	52.27	(250)
Additional standing charges (Table 12)					0	(251)
Appendix Q items: repeat lines (253) and (254) as needed						
Total energy cost	(245)...(247) + (250)…(254) =				508.34	(255)

11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)	0.47	(256)
Energy cost factor (ECF) [(255) x (256)] ÷ [(4) + 45.0] =	1.45	(257)
SAP rating (Section 12)	79.76	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

		Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211)	x		0.517	=	1011.84	(261)
Space heating (secondary)	(215)	x		0	=	0	(263)
Water heating	(219)	x		0.517	=	1045.68	(264)
Space and water heating	(261) + (262) + (263) + (264) =					2057.52	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x		0.517	=	0	(267)
Electricity for lighting	(232)	x		0.517	=	235.8	(268)
Total CO2, kg/year	sum of (265)…(271) =					2293.32	(272)
CO2 emissions per m²	(272) ÷ (4) =					19.16	(273)
EI rating (section 14)						81	(274)

13a. Primary Energy

		Energy kWh/year		**Primary** factor		**P. Energy** kWh/year	
Space heating (main system 1)	(211)	x		2.92	=	5714.83	(261)
Space heating (secondary)	(215)	x		0	=	0	(263)
Energy for water heating	(219)	x		2.92	=	5905.95	(264)
Space and water heating	(261) + (262) + (263) + (264) =					11620.79	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x		2.92	=	0	(267)
Electricity for lighting	(232)	x		0	=	1331.8	(268)
'Total Primary Energy	sum of (265)…(271) =					12952.59	(272)
Primary energy kWh/m²/year	(272) ÷ (4) =					108.21	(273)

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Regulations Compliance Report

Approved Document L1A 2010 edition assessed by Stroma FSAP 2009 program, Version: 1.4.0.73
Printed on 02 May 2012 at 12:30:12

Project Information:

Assessed By: Mike Ovenden (STRO006697) **Building Type:** End-terrace House

Dwelling Details:

NEW DWELLING DESIGN STAGE

Site Reference : Plot 15 end terrace **Plot Reference:** Plot 15

Address : Plot 15, Penistone Coal Drops, St. Mary's Street, Penistone, Sheffield, S36 6DT

Client Details:

Name: Stephen Sharp

Address : Yourspace Studio Limited , 180 main road, west winch, king's lynn, PE330LJ

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

1 TER and DER

Fuel for main heating system: Grid electricity

Target Carbon Dioxide Emission Rate (TER)	29.08 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	23.21 kg/m²	OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.23 (max. 0.30)	0.23 (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	0.11 (max. 0.20)	0.11 (max. 0.35)	OK
Openings	1.92 (max. 2.00)	3.00 (max. 3.30)	OK

3 Design air permeability

Design air permeability at 50 pascals	6.00	
Maximum	10.0	OK

4 Heating efficiency

Main Heating system: Heat pumps with radiators or underfloor - electric
Mitsubishi ECODAN 5kW

Secondary heating system: None

5 Cylinder insulation

Hot water Storage:	Nominal cylinder loss: 2.37 kWh/day Permitted by DBSCG: 3.11 kWh/day	OK
Primary pipework insulated:	Yes	OK

6 Controls

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

7 Low energy lights

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

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8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (North East England):	Not significant	**OK**
Based on:		
Overshading:	Average or unknown	
Windows facing: South	5.8m², Overhang twice as wide as window, ratio NaN	
Windows facing: North	10.92m², Overhang twice as wide as window, ratio NaN	
Windows facing: East	4m², Overhang twice as wide as window, ratio NaN	
Roof windows facing: South	1.4m²	
Roof windows facing: North	2.8m²	
Ventilation rate:	8.00	
Blinds/curtains:	shutter closed 100% of daylight hours	

10 Key features

Roofs U-value	0.11 W/m²K

SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Mike Ovenden	**Stroma Number:**	STRO006697
Software Name:	Stroma FSAP 2009	**Software Version:**	Version: 1.4.0.73

Property Address: Plot 15 end terrace

Address : Plot 15, Penistone Coal Drops, St. Mary's Street, Penistone, Sheffield, S36 6DT

1. Overall dwelling dimensions:

	Area(m²)		Ave Height(m)		Volume(m³)	
Ground floor	56.92 (1a)	x	2.6 (2a)	=	147.99	(3a)
First floor	39.6 (1b)	x	2.6 (2b)	=	102.96	(3b)
Second floor	28.35 (1c)	x	1.9 (2c)	=	53.87	(3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	124.87	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	=	304.82	(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	1	+	0	+	0	=	1	x 20 =	20	(6b)
Number of intermittent fans							5	x 10 =	50	(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) =	70	÷ (5) =	0.23	(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			6	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.53	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides on which sheltered			1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.92	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.49	(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=	5.4	5.1	5.1	4.5	4.1	3.9	3.7	3.7	4.2	4.5	4.8	5.1

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Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.35	1.27	1.27	1.12	1.02	0.98	0.92	0.92	1.05	1.12	1.2	1.27

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

0.66	0.62	0.62	0.55	0.5	0.48	0.45	0.45	0.51	0.55	0.59	0.62

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

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

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0

(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=	0.72	0.7	0.7	0.65	0.63	0.61	0.6	0.6	0.63	0.65	0.67	0.7

(24d)

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

(25)m=	0.72	0.7	0.7	0.65	0.63	0.61	0.6	0.6	0.63	0.65	0.67	0.7

(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 Type 1			1.9	x	3	=	5.7			(26)
Doors Type 2			1.9	x	3	=	5.7			(26)
Windows Type 1			5.8	x	1/[1/(1.7)+ 0.04]	=	9.23			(27)
Windows Type 2			10.92	x	1/[1/(1.7)+ 0.04]	=	17.38			(27)
Windows Type 3			4	x	1/[1/(1.7)+ 0.04]	=	6.37			(27)
Rooflights Type 1			1.4	x	1/[1/(2) + 0.04]	=	2.8			(27b)
Rooflights Type 2			2.8	x	1/[1/(2) + 0.04]	=	5.6			(27b)
Floor			56.92	x	0.2	=	11.384			(28)
Walls	141.13	24.52	116.61	x	0.23	=	26.82			(29)
Roof Type1	79.68	4.2	75.48	x	0.11	=	8.3			(30)
Roof Type2	12.15	0	12.15	x	0.11	=	1.34			(30)
Total area of elements, m²			289.88							(31)
Party wall			57.73	x	0	=	0			(32)

** 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) = 100 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 17810.42 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f

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can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K — 43.48 (36)

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

Total fabric heat loss (33) + (36) = 143.48 (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=	72.3	69.92	69.92	65.57	62.98	61.77	60.62	60.62	63.6	65.57	67.68	69.92	(38)

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

(39)m=	215.78	213.4	213.4	209.06	206.46	205.26	204.11	204.11	207.09	209.06	211.16	213.4	

Average = Sum(39)$_{1...12}$ /12= 209.36 (39)

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

(40)m=	1.73	1.71	1.71	1.67	1.65	1.64	1.63	1.63	1.66	1.67	1.69	1.71	

Average = Sum(40)$_{1...12}$ /12= 1.68 (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 — 2.88 (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 — 102.61 (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=	112.87	108.76	104.66	100.56	96.45	92.35	92.35	96.45	100.56	104.66	108.76	112.87	

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

Total = Sum(44)$_{1...12}$ = 1231.29 (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=	167.78	146.74	151.43	132.02	126.67	109.31	101.29	116.23	117.62	137.08	149.63	162.49	

Total = Sum(45)$_{1...12}$ = 1618.28 (45)

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

(46)m=	25.17	22.01	22.71	19.8	19	16.4	15.19	17.43	17.64	20.56	22.44	24.37	(46)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (47)

Temperature factor from Table 2b 0 (48)

Energy lost from water storage, kWh/year (47) x (48) = 0 (49)

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

Cylinder volume (litres) including any solar storage within same 200 (50)

If community heating and no tank in dwelling, enter 110 litres in box (50)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in box (50)

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.01 (51)

Volume factor from Table 2a 0.84 (52)

Temperature factor from Table 2b 0.54 (53)

Energy lost from water storage, kWh/year ((50) x (51) x (52) x (53) = 1.05 (54)

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Enter (49) or (54) in (55) | 1.05 | (55)

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

(56)m=	32.61	29.45	32.61	31.56	32.61	31.56	32.61	32.61	31.56	32.61	31.56	32.61	(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=	32.61	29.45	32.61	31.56	32.61	31.56	32.61	32.61	31.56	32.61	31.56	32.61	(57)

Primary circuit loss (annual) from Table 3 | 280 | (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=	23.78	21.48	23.78	23.01	23.78	23.01	23.78	23.78	23.01	23.78	23.01	23.78	(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=	224.17	197.67	207.81	186.59	183.06	163.88	157.68	172.62	172.19	193.46	204.2	218.88	(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=	224.17	197.67	207.81	186.59	183.06	163.88	157.68	172.62	172.19	193.46	204.2	218.88	

Output from water heater (annual)$_{1...12}$ | 2282.22 | (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=	100.9	89.54	95.46	87.55	87.23	80	78.79	83.76	82.76	90.69	93.41	99.14	(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=	172.82	172.82	172.82	172.82	172.82	172.82	172.82	172.82	172.82	172.82	172.82	172.82	(66)

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

(67)m=	65.21	57.92	47.11	35.66	26.66	22.51	24.32	31.61	42.43	53.87	62.88	67.03	(67)

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

(68)m=	434.96	439.48	428.1	403.89	373.32	344.59	325.4	320.89	332.26	356.48	387.04	415.77	(68)

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

(69)m=	55.16	55.16	55.16	55.16	55.16	55.16	55.16	55.16	55.16	55.16	55.16	55.16	(69)

Pumps and fans gains (Table 5a)

(70)m=	10	10	10	10	10	10	10	10	10	10	10	10	(70)

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

(71)m=	-115.21	-115.21	-115.21	-115.21	-115.21	-115.21	-115.21	-115.21	-115.21	-115.21	-115.21	-115.21	(71)

Water heating gains (Table 5)

(72)m=	135.62	133.24	128.31	121.6	117.24	111.11	105.9	112.58	114.95	121.89	129.73	133.25	(72)

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

(73)m=	758.56	753.41	726.28	683.92	639.99	600.98	578.39	587.85	612.41	655.01	702.42	738.82	(73)

6. Solar gains:

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

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Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x 0.77	x	10.92	x	10.73	x	0.63	x	0.7	=	35.8	(74)
North	0.9x 0.77	x	10.92	x	20.36	x	0.63	x	0.7	=	67.94	(74)
North	0.9x 0.77	x	10.92	x	33.31	x	0.63	x	0.7	=	111.16	(74)
North	0.9x 0.77	x	10.92	x	54.64	x	0.63	x	0.7	=	182.35	(74)
North	0.9x 0.77	x	10.92	x	75.22	x	0.63	x	0.7	=	251.02	(74)
North	0.9x 0.77	x	10.92	x	84.09	x	0.63	x	0.7	=	280.63	(74)
North	0.9x 0.77	x	10.92	x	79.12	x	0.63	x	0.7	=	264.04	(74)
North	0.9x 0.77	x	10.92	x	61.56	x	0.63	x	0.7	=	205.46	(74)
North	0.9x 0.77	x	10.92	x	41.09	x	0.63	x	0.7	=	137.11	(74)
North	0.9x 0.77	x	10.92	x	24.81	x	0.63	x	0.7	=	82.81	(74)
North	0.9x 0.77	x	10.92	x	13.22	x	0.63	x	0.7	=	44.11	(74)
North	0.9x 0.77	x	10.92	x	8.94	x	0.63	x	0.7	=	29.85	(74)
East	0.9x 1	x	4	x	19.87	x	0.63	x	0.7	=	24.29	(76)
East	0.9x 1	x	4	x	38.52	x	0.63	x	0.7	=	47.09	(76)
East	0.9x 1	x	4	x	61.57	x	0.63	x	0.7	=	75.26	(76)
East	0.9x 1	x	4	x	91.41	x	0.63	x	0.7	=	111.74	(76)
East	0.9x 1	x	4	x	111.22	x	0.63	x	0.7	=	135.96	(76)
East	0.9x 1	x	4	x	116.05	x	0.63	x	0.7	=	141.87	(76)
East	0.9x 1	x	4	x	112.64	x	0.63	x	0.7	=	137.7	(76)
East	0.9x 1	x	4	x	98.03	x	0.63	x	0.7	=	119.84	(76)
East	0.9x 1	x	4	x	73.6	x	0.63	x	0.7	=	89.98	(76)
East	0.9x 1	x	4	x	46.91	x	0.63	x	0.7	=	57.34	(76)
East	0.9x 1	x	4	x	24.71	x	0.63	x	0.7	=	30.2	(76)
East	0.9x 1	x	4	x	16.39	x	0.63	x	0.7	=	20.04	(76)
South	0.9x 0.77	x	5.8	x	47.32	x	0.63	x	0.7	=	83.88	(78)
South	0.9x 0.77	x	5.8	x	77.18	x	0.63	x	0.7	=	136.81	(78)
South	0.9x 0.77	x	5.8	x	94.25	x	0.63	x	0.7	=	167.06	(78)
South	0.9x 0.77	x	5.8	x	105.11	x	0.63	x	0.7	=	186.32	(78)
South	0.9x 0.77	x	5.8	x	108.55	x	0.63	x	0.7	=	192.41	(78)
South	0.9x 0.77	x	5.8	x	108.9	x	0.63	x	0.7	=	193.03	(78)
South	0.9x 0.77	x	5.8	x	107.14	x	0.63	x	0.7	=	189.91	(78)
South	0.9x 0.77	x	5.8	x	103.88	x	0.63	x	0.7	=	184.14	(78)
South	0.9x 0.77	x	5.8	x	99.99	x	0.63	x	0.7	=	177.24	(78)
South	0.9x 0.77	x	5.8	x	85.29	x	0.63	x	0.7	=	151.18	(78)
South	0.9x 0.77	x	5.8	x	56.07	x	0.63	x	0.7	=	99.39	(78)
South	0.9x 0.77	x	5.8	x	40.89	x	0.63	x	0.7	=	72.48	(78)
Rooflights	0.9x 1	x	1.4	x	26	x	0.63	x	0.7	=	14.45	(82)
Rooflights	0.9x 1	x	2.8	x	10.73	x	0.63	x	0.7	=	11.92	(82)
Rooflights	0.9x 1	x	1.4	x	54	x	0.63	x	0.7	=	30.01	(82)

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Rooflights 0.9x	1	x	2.8	x	20.36	x	0.63	x	0.7	=	22.63	(82)
Rooflights 0.9x	1	x	1.4	x	94	x	0.63	x	0.7	=	52.23	(82)
Rooflights 0.9x	1	x	2.8	x	33.31	x	0.63	x	0.7	=	37.02	(82)
Rooflights 0.9x	1	x	1.4	x	150	x	0.63	x	0.7	=	83.35	(82)
Rooflights 0.9x	1	x	2.8	x	54.64	x	0.63	x	0.7	=	60.72	(82)
Rooflights 0.9x	1	x	1.4	x	190	x	0.63	x	0.7	=	105.58	(82)
Rooflights 0.9x	1	x	2.8	x	75.22	x	0.63	x	0.7	=	83.59	(82)
Rooflights 0.9x	1	x	1.4	x	201	x	0.63	x	0.7	=	111.69	(82)
Rooflights 0.9x	1	x	2.8	x	84.09	x	0.63	x	0.7	=	93.45	(82)
Rooflights 0.9x	1	x	1.4	x	194	x	0.63	x	0.7	=	107.8	(82)
Rooflights 0.9x	1	x	2.8	x	79.12	x	0.63	x	0.7	=	87.93	(82)
Rooflights 0.9x	1	x	1.4	x	164	x	0.63	x	0.7	=	91.13	(82)
Rooflights 0.9x	1	x	2.8	x	61.56	x	0.63	x	0.7	=	68.42	(82)
Rooflights 0.9x	1	x	1.4	x	116	x	0.63	x	0.7	=	64.46	(82)
Rooflights 0.9x	1	x	2.8	x	41.09	x	0.63	x	0.7	=	45.66	(82)
Rooflights 0.9x	1	x	1.4	x	68	x	0.63	x	0.7	=	37.78	(82)
Rooflights 0.9x	1	x	2.8	x	24.81	x	0.63	x	0.7	=	27.58	(82)
Rooflights 0.9x	1	x	1.4	x	33	x	0.63	x	0.7	=	18.34	(82)
Rooflights 0.9x	1	x	2.8	x	13.22	x	0.63	x	0.7	=	14.69	(82)
Rooflights 0.9x	1	x	1.4	x	21	x	0.63	x	0.7	=	11.67	(82)
Rooflights 0.9x	1	x	2.8	x	8.94	x	0.63	x	0.7	=	9.94	(82)

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

(83)m=	170.34	304.47	442.73	624.48	768.55	820.66	787.38	668.99	514.45	356.7	206.73	143.98	(83)

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

(84)m=	928.9	1057.88	1169.01	1308.4	1408.55	1421.65	1365.77	1256.83	1126.86	1011.71	909.15	882.8	(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=	0.99	0.99	0.98	0.96	0.89	0.76	0.57	0.61	0.86	0.97	0.99	1	(86)

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

(87)m=	21	21	21	21	21	21	21	21	21	21	21	21	(87)

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

(88)m=	19.53	19.54	19.54	19.56	19.58	19.59	19.59	19.59	19.58	19.56	19.55	19.54	(88)

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

(89)m=	0.99	0.99	0.97	0.94	0.84	0.65	0.39	0.43	0.78	0.95	0.99	0.99	(89)

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

(90)m=	19.53	19.54	19.54	19.56	19.58	19.59	19.59	19.59	19.58	19.56	19.55	19.54	(90)

fLA = Living area ÷ (4) = 0.17 (91)

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

(92)m=	19.77	19.78	19.78	19.8	19.81	19.82	19.83	19.83	19.81	19.8	19.79	19.78	(92)

SAP WorkSheet: New dwelling design stage

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

(93)m=	19.67	19.68	19.68	19.7	19.71	19.72	19.73	19.73	19.71	19.7	19.69	19.68	(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=	0.99	0.99	0.98	0.94	0.85	0.66	0.41	0.45	0.79	0.95	0.99	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	922.42	1045.31	1140.32	1236.05	1197.52	938.13	564.34	560.63	889.22	962.49	898.52	877.13	(95)
Monthly average external temperature from Table 8													
(96)m=	4.5	5	6.8	8.7	11.7	14.6	16.9	16.9	14.3	10.8	7	4.9	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	3273.43	3133.07	2748.94	2300.07	1654.7	1050.97	576.78	576.78	1120.66	1861.05	2680.09	3154.41	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	1749.15	1402.97	1196.82	766.1	340.14	0	0	0	0	668.53	1282.73	1694.29	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 9100.73 (98)

Space heating requirement in kWh/m²/year 72.88 (99)

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

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 327.24 (206)

Efficiency of secondary/supplementary heating system, % 0 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	1749.15	1402.97	1196.82	766.1	340.14	0	0	0	0	668.53	1282.73	1694.29	
(211)m = {[(98)m x (204)] + (210)m } x 100 ÷ (206)													(211)
	534.51	428.73	365.73	234.11	103.94	0	0	0	0	204.29	391.98	517.75	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 2781.03 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] + (214) m } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10....12}$= 0 (215)

Water heating

Output from water heater (calculated above)

	224.17	197.67	207.81	186.59	183.06	163.88	157.68	172.62	172.19	193.46	204.2	218.88	

Efficiency of water heater 112.5 (216)

(217)m=	112.5	112.5	112.5	112.5	112.5	112.5	112.5	112.5	112.5	112.5	112.5	112.5	(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	199.26	175.71	184.72	165.85	162.72	145.67	140.16	153.44	153.06	171.97	181.51	194.56	

Total = Sum(219a)$_{1...12}$ = 2028.64 (219)

SAP WorkSheet: New dwelling design stage

Annual totals		kWh/year	kWh/year	
Space heating fuel used, main system 1			2781.03	
Water heating fuel used			2028.64	
Electricity for pumps, fans and electric keep-hot				
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		0	(231)
Electricity for lighting			460.69	(232)

10a. Fuel costs - individual heating systems:

	Fuel kWh/year		Fuel Price (Table 12)		Fuel Cost £/year	
Space heating - main system 1	(211) x		11.46	x 0.01 =	318.71	(240)
Space heating - main system 2	(213) x		0	x 0.01 =	0	(241)
Space heating - secondary	(215) x		0	x 0.01 =	0	(242)
Water heating cost (other fuel)	(219)		11.46	x 0.01 =	232.48	(247)
Pumps, fans and electric keep-hot	(231)		11.46	x 0.01 =	0	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a						
Energy for lighting	(232)		11.46	x 0.01 =	52.79	(250)
Additional standing charges (Table 12)					0	(251)
Appendix Q items: repeat lines (253) and (254) as needed						
Total energy cost	(245)...(247) + (250)…(254) =				603.98	(255)

11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)	0.47	(256)
Energy cost factor (ECF) [(255) x (256)] ÷ [(4) + 45.0] =	1.67	(257)
SAP rating (Section 12)	76.69	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.517	=	1437.8	(261)
Space heating (secondary)	(215) x		0	=	0	(263)
Water heating	(219) x		0.517	=	1048.81	(264)
Space and water heating	(261) + (262) + (263) + (264) =				2486.6	(265)
Electricity for pumps, fans and electric keep-hot	(231) x		0.517	=	0	(267)
Electricity for lighting	(232) x		0.517	=	238.17	(268)
Total CO2, kg/year	sum of (265)…(271) =				2724.78	(272)
CO2 emissions per m²	(272) ÷ (4) =				21.82	(273)
EI rating (section 14)					79	(274)

13a. Primary Energy

SAP WorkSheet: New dwelling design stage

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211)	x	2.92	=	8120.62	(261)
Space heating (secondary)	(215)	x	0	=	0	(263)
Energy for water heating	(219)	x	2.92	=	5923.62	(264)
Space and water heating	(261) + (262) + (263) + (264) =				14044.25	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	2.92	=	0	(267)
Electricity for lighting	(232)	x	0	=	1345.2	(268)
'Total Primary Energy			sum of (265)…(271) =		15389.45	(272)
Primary energy kWh/m²/year			(272) ÷ (4) =		123.24	(273)

BRUKL Output Document

HM Government

Compliance with England and Wales Building Regulations Part L 2010

Project name **Shell and Core**

unit 1- 5 Coal Drop Pennistones

As designed

Date: Wed May 02 11:35:46 2012

Administrative information

Building Details

Address: Unit 1, Coal Drop, St. Mary's Street, Penistone, Sheffield, S36 6DT

Certification tool

Calculation engine: SBEM

Calculation engine version: v4.1.d.0

Interface to calculation engine: DesignBuilder SBEM

Interface to calculation engine version: v3.0.0

BRUKL compliance check version: v4.1.d.0

Owner Details

Name: Reliant Building Contractors Ltd

Telephone number:

Address: 101 Elm Tree Court, London, NW8 9JT

Certifier details

Name: Mike Ovenden

Telephone number: 01908 850109

Address: 4 Dudley Hill Shenley Church End, Milton Keynes, MK5 6LL

Criterion 1: The calculated CO_2 emission rate for the building should not exceed the target

1.1	CO_2 emission rate from the notional building, $kgCO_2/m^2.annum$	44.2
1.2	Target CO_2 emission rate (TER), $kgCO_2/m^2.annum$	44.2
1.3	Building CO_2 emission rate (BER), $kgCO_2/m^2.annum$	36.6
1.4	Are emissions from the building less than or equal to the target?	BER =< TER
1.5	Are as built details the same as used in the BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and the building services should achieve reasonable overall standards of energy efficiency

The building does not follow guidance in England and Wales Building Regulations Part L 2010

2.a Building fabric

Element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	Surface where the maximum value occurs*
Wall**	0.35	1.31	1.31	Block 1 - Zone 1_W_5
Floor	0.25	0.16	0.16	Block 1 - Zone 1_S_2
Roof	0.25	0.16	0.16	Block 1 - Zone 1_R_3
Windows***, roof windows, and rooflights	2.2	-	-	"No heat loss windows/rooflights"
Personnel doors	2.2	-	-	"No heat loss personnel doors"
Vehicle access & similar large doors	1.5	-	-	"No heat loss vehicle access doors"
High usage entrance doors	3.5	-	-	"No heat loss high usage entrance doors"

$U_{a\text{-}Limit}$ = Limiting area-weighted average U-values [$W/(m^2K)$]
$U_{a\text{-}Calc}$ = Calculated area-weighted average U-values [$W/(m^2K)$] $U_{i\text{-}Calc}$ = Calculated maximum individual element U-values [$W/(m^2K)$]

* 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	0

2.b Building services

The building services parameters listed below are expected to be checked by the BCO against guidance. No automatic checking is performed by the tool.

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 to 0.95

1- project hesting

Heating seasonal efficiency	**Cooling nominal efficiency**	**SFP [W/(l/s)]**	**HR seasonal efficiency**
4.35	2.6	-	-
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system			NO

1- Project DHW

Heating seasonal efficiency	**Hot water storage loss factor [kWh/litre per day]**
1	-

"No zones in project where local mechanical ventilation or exhaust is applicable"

Shell and core configuration

Zone	**Assumed shell?**
Block 1 - Zone 1	YES

General lighting and display lighting

Zone	**General lighting [W]**	**Display lamps efficacy [lm/W]**
Block 1 - Zone 1	250	50

Criterion 3: The spaces in the building should have propriate passive control measures to limit solar gains

Zone	**Solar gain limit exceeded? (%)**	**Internal blinds used?**
Block 1 - Zone 1	YES (+39.6%)	NO

Criterion 4: The performance of the building, as built, should be consistent with the BER

Separate submission

Criterion 5: The necessary provisions for enabling energy-efficient operation of the building should be in place

Separate submission

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m^2]	27.7	27.7
External area [m^2]	94	94
Weather	LON	LON
Infiltration [m^3/hm^2@ 50Pa]	0	5
Average conductance [W/K]	62.53	27
Average U-value [W/m^2K]	0.67	0.29
Alpha value* [%]	15.95	23.91

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

% Area	Building Type
100	**A1/A2 Retail/Financial and Professional services**
	A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
	B1 Offices and Workshop businesses
	B2 to B7 General Industrial and Special Industrial Groups
	B8 Storage or Distribution
	C1 Hotels
	C2 Residential Inst.: Hospitals and Care Homes
	C2 Residential Inst.: Residential schools
	C2 Residential Inst.: Universities and colleges
	C2A Secure Residential Inst.
	Residential spaces
	D1 Non-residential Inst.: Community/Day Centre
	D1 Non-residential Inst.: Libraries, Museums, and Galleries
	D1 Non-residential Inst.: Education
	D1 Non-residential Inst.: Primary Health Care Building
	D1 Non-residential Inst.: Crown and County Courts
	D2 General Assembly and Leisure, Night Clubs and Theatres
	Others: Passenger terminals
	Others: Emergency services
	Others: Telephone exchanges
	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	24.44	9.18
Cooling	11.33	9.96
Auxiliary	0	0
Lighting	33.36	65.16
Hot water	1.68	2.03
Equipment*	20.05	19.75
TOTAL	**70.81**	**86.33**

* Energy used by equipment does not count towards the total for calculating emissions.

Energy Production by Technology [kWh/m^2]

	Actual	Notional
Photovoltaic systems	0	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0

Energy & CO_2 Emissions Summary

	Actual	Indicative Target
Heating + cooling demand [MJ/m^2]	424.55	214.79
Total consumption [kWh/m^2]	70.81	86.33
Total emissions [kg/m^2]	36.6	44.2

HVAC Systems Performance

System Type		Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	360.2	64.3	24.4	11.3	0	4.05	1.56	4.35	2.2
	Notional	82.4	132.4	9.2	10	0	2.43	3.6	----	----

Key to terms

Heat dem [MJ/m2] = Heating energy demand
Cool dem [MJ/m2] = Cooling energy demand
Heat con [kWh/m2] = Heating energy consumption
Cool con [kWh/m2] = Cooling energy consumption
Aux con [kWh/m2] = Auxiliary energy consumption
Heat SSEFF = Heating system seasonal efficiency (for notional building, value depends on activity glazing class)
Cool SSEER = Cooling system seasonal energy efficiency ratio
Heat gen SSEFF = Heating generator seasonal efficiency
Cool gen SSEER = Cooling generator seasonal energy efficiency ratio
ST = System type
HS = Heat source
HFT = Heating fuel type
CFT = Cooling fuel type

Key Features

The BCO can give particular attention to items with specifications that are better than typically expected.

Building fabric

Element	$U_{i\text{-}Typ}$	$U_{i\text{-}Min}$	Surface where the minimum value occurs*
Wall	0.23	1.31	Block 1 - Zone 1_W_5
Floor	0.2	0.16	Block 1 - Zone 1_S_2
Roof	0.15	0.16	Block 1 - Zone 1_R_3
Windows, roof windows, and rooflights	1.5	-	"No heat loss windows/rooflights"
Personnel doors	1.5	-	"No heat loss personnel doors"
Vehicle access & similar large doors	1.5	-	"No heat loss vehicle access doors"
High usage entrance doors	1.5	-	"No heat loss high usage entrance doors"

$U_{i\text{-}Typ}$ = Typical individual element U-values [W/(m²K)] $U_{i\text{-}Min}$ = Minimum individual element U-values [W/(m²K)]

* There might be more than one surface where the minimum U-value occurs.

Air Permeability	Typical value	This building
m³/(h.m²) at 50 Pa	5	0

BRUKL Output Document

HM Government

Compliance with England and Wales Building Regulations Part L 2010

Project name **Shell and Core**

unit A1 Coal Drop Pennistones

As designed

Date: Wed May 02 11:48:22 2012

Administrative information

Building Details

Address: Unit A1, Coal Drop, St. Mary's Street, Penistone, Sheffield, S36 6DT

Certification tool

Calculation engine: SBEM

Calculation engine version: v4.1.d.0

Interface to calculation engine: DesignBuilder SBEM

Interface to calculation engine version: v3.0.0

BRUKL compliance check version: v4.1.d.0

Owner Details

Name: Reliant Building Contractors Ltd

Telephone number:

Address: 101 Elm Tree Court, London, NW8 9JT

Certifier details

Name: Mike Ovenden

Telephone number: 01908 850109

Address: 4 Dudley Hill Shenley Church End, Milton Keynes, MK5 6LL

Criterion 1: The calculated CO_2 emission rate for the building should not exceed the target

1.1	CO_2 emission rate from the notional building, $kgCO_2/m^2.annum$	39.2
1.2	Target CO_2 emission rate (TER), $kgCO_2/m^2.annum$	39.2
1.3	Building CO_2 emission rate (BER), $kgCO_2/m^2.annum$	33.2
1.4	Are emissions from the building less than or equal to the target?	BER =< TER
1.5	Are as built details the same as used in the BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and the building services should achieve reasonable overall standards of energy efficiency

2.a Building fabric

Element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	Surface where the maximum value occurs*
Wall**	0.35	0.27	0.27	Block 2 - Zone 1_W_4
Floor	0.25	0.16	0.16	Block 2 - Zone 1_S_2
Roof	0.25	-	-	"No heat loss roofs"
Windows***, roof windows, and rooflights	2.2	-	-	"No heat loss windows/rooflights"
Personnel doors	2.2	-	-	"No heat loss personnel doors"
Vehicle access & similar large doors	1.5	-	-	"No heat loss vehicle access doors"
High usage entrance doors	3.5	-	-	"No heat loss high usage entrance doors"

$U_{a\text{-}Limit}$ = Limiting area-weighted average U-values [W/(m²K)]
$U_{a\text{-}Calc}$ = Calculated area-weighted average U-values [W/(m²K)]
$U_{i\text{-}Calc}$ = Calculated maximum individual element U-values [W/(m²K)]

* There might be more than one surface where the maximum U-value occurs.
** Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.
*** Display windows and similar glazing are excluded from the U-value check.
N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air Permeability	Worst acceptable standard	This building
$m^3/(h.m^2)$ at 50 Pa	10	0

2.b Building services

The building services parameters listed below are expected to be checked by the BCO against guidance. No automatic checking is performed by the tool.

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 to 0.95

1- project hesting

Heating seasonal efficiency	**Cooling nominal efficiency**	**SFP [W/(l/s)]**	**HR seasonal efficiency**
4.35	2.6	-	-
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system			NO

1- Project DHW

Heating seasonal efficiency	**Hot water storage loss factor [kWh/litre per day]**
1	-

"No zones in project where local mechanical ventilation or exhaust is applicable"

Shell and core configuration

Zone	**Assumed shell?**
Block 2 - Zone 1	YES

General lighting and display lighting

Zone	**General lighting [W]**	**Display lamps efficacy [lm/W]**
Block 2 - Zone 1	1240	50

Criterion 3: The spaces in the building should have propriate passive control measures to limit solar gains

Zone	**Solar gain limit exceeded? (%)**	**Internal blinds used?**
Block 2 - Zone 1	N/A	N/A

Criterion 4: The performance of the building, as built, should be consistent with the BER

Separate submission

Criterion 5: The necessary provisions for enabling energy-efficient operation of the building should be in place

Separate submission

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m^2]	123.6	123.6
External area [m^2]	266.8	266.8
Weather	LON	LON
Infiltration [m^3/hm^2@ 50Pa]	0	0
Average conductance [W/K]	58.05	64.42
Average U-value [W/m^2K]	0.22	0.24
Alpha value* [%]	24.44	14.68

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

% Area	Building Type
100	**A1/A2 Retail/Financial and Professional services**
	A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
	B1 Offices and Workshop businesses
	B2 to B7 General Industrial and Special Industrial Groups
	B8 Storage or Distribution
	C1 Hotels
	C2 Residential Inst.: Hospitals and Care Homes
	C2 Residential Inst.: Residential schools
	C2 Residential Inst.: Universities and colleges
	C2A Secure Residential Inst.
	Residential spaces
	D1 Non-residential Inst.: Community/Day Centre
	D1 Non-residential Inst.: Libraries, Museums, and Galleries
	D1 Non-residential Inst.: Education
	D1 Non-residential Inst.: Primary Health Care Building
	D1 Non-residential Inst.: Crown and County Courts
	D2 General Assembly and Leisure, Night Clubs and Theatres
	Others: Passenger terminals
	Others: Emergency services
	Others: Telephone exchanges
	Others: Miscellaneous 24hr activities
	Others: Car Parks 24 hrs
	Others - Stand alone utility block

Energy Consumption by End Use [kWh/m^2]

	Actual	Notional
Heating	2.95	3.5
Cooling	15.42	10.06
Auxiliary	0	0
Lighting	44.23	61.13
Hot water	1.68	2.03
Equipment*	20.05	19.75
TOTAL	**64.27**	**76.72**

* Energy used by equipment does not count towards the total for calculating emissions.

Energy Production by Technology [kWh/m^2]

	Actual	Notional
Photovoltaic systems	0	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0

Energy & CO_2 Emissions Summary

	Actual	Indicative Target
Heating + cooling demand [MJ/m^2]	131.03	165.17
Total consumption [kWh/m^2]	64.27	76.72
Total emissions [kg/m^2]	33.2	39.2

HVAC Systems Performance

System Type		Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	43.5	87.6	2.9	15.4	0	4.05	1.56	4.35	2.2
	Notional	31.4	133.8	3.5	10.1	0	2.43	3.6	----	----

Key to terms

Heat dem [MJ/m2] = Heating energy demand
Cool dem [MJ/m2] = Cooling energy demand
Heat con [kWh/m2] = Heating energy consumption
Cool con [kWh/m2] = Cooling energy consumption
Aux con [kWh/m2] = Auxiliary energy consumption
Heat SSEFF = Heating system seasonal efficiency (for notional building, value depends on activity glazing class)
Cool SSEER = Cooling system seasonal energy efficiency ratio
Heat gen SSEFF = Heating generator seasonal efficiency
Cool gen SSEER = Cooling generator seasonal energy efficiency ratio
ST = System type
HS = Heat source
HFT = Heating fuel type
CFT = Cooling fuel type

Key Features

The BCO can give particular attention to items with specifications that are better than typically expected.

Building fabric

Element	$U_{i\text{-}Typ}$	$U_{i\text{-}Min}$	Surface where the minimum value occurs*
Wall	0.23	0.27	Block 2 - Zone 1_W_4
Floor	0.2	0.16	Block 2 - Zone 1_S_2
Roof	0.15	-	"No heat loss roofs"
Windows, roof windows, and rooflights	1.5	-	"No heat loss windows/rooflights"
Personnel doors	1.5	-	"No heat loss personnel doors"
Vehicle access & similar large doors	1.5	-	"No heat loss vehicle access doors"
High usage entrance doors	1.5	-	"No heat loss high usage entrance doors"

$U_{i\text{-}Typ}$ = Typical individual element U-values [W/(m²K)] $U_{i\text{-}Min}$ = Minimum individual element U-values [W/(m²K)]

* There might be more than one surface where the minimum U-value occurs.

Air Permeability	Typical value	This building
m³/(h.m²) at 50 Pa	5	0

BRUKL Output Document

HM Government

Compliance with England and Wales Building Regulations Part L 2010

Project name **Shell and Core**

unit A2 Coal Drop Pennistone

As designed

Date: Wed May 02 11:50:50 2012

Administrative information

Building Details

Address: Unit A2, Coal Drop, St. Mary's Street, Penistone, Sheffield, S36 6DT

Certification tool

Calculation engine: SBEM

Calculation engine version: v4.1.d.0

Interface to calculation engine: DesignBuilder SBEM

Interface to calculation engine version: v3.0.0

BRUKL compliance check version: v4.1.d.0

Owner Details

Name: Reliant Building Contractors Ltd

Telephone number:

Address: 101 Elm Tree Court, London, NW8 9JT

Certifier details

Name: Mike Ovenden

Telephone number: 01908 850109

Address: 4 Dudley Hill Shenley Church End, Milton Keynes, MK5 6LL

Criterion 1: The calculated CO_2 emission rate for the building should not exceed the target

1.1	CO_2 emission rate from the notional building, $kgCO_2/m^2.annum$	28.6
1.2	Target CO_2 emission rate (TER), $kgCO_2/m^2.annum$	28.6
1.3	Building CO_2 emission rate (BER), $kgCO_2/m^2.annum$	24.7
1.4	Are emissions from the building less than or equal to the target?	BER =< TER
1.5	Are as built details the same as used in the BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and the building services should achieve reasonable overall standards of energy efficiency

2.a Building fabric

Element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	Surface where the maximum value occurs*
Wall**	0.35	0.32	0.32	Block 1 - Zone 2_W_4
Floor	0.25	0.18	0.22	Block 2 - Zone 1_F_3
Roof	0.25	-	-	"No heat loss roofs"
Windows***, roof windows, and rooflights	2.2	-	-	"No heat loss windows/rooflights"
Personnel doors	2.2	-	-	"No heat loss personnel doors"
Vehicle access & similar large doors	1.5	-	-	"No heat loss vehicle access doors"
High usage entrance doors	3.5	2.04	2.04	Block 1 - Zone 2_D_8

$U_{a\text{-}Limit}$ = Limiting area-weighted average U-values [$W/(m^2K)$]
$U_{a\text{-}Calc}$ = Calculated area-weighted average U-values [$W/(m^2K)$]
$U_{i\text{-}Calc}$ = Calculated maximum individual element U-values [$W/(m^2K)$]

* 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	0

2.b Building services

The building services parameters listed below are expected to be checked by the BCO against guidance. No automatic checking is performed by the tool.

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 to 0.95

1- project hesting

Heating seasonal efficiency	**Cooling nominal efficiency**	**SFP [W/(l/s)]**	**HR seasonal efficiency**
4.35	2.6	-	-
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system			NO

1- Project DHW

Heating seasonal efficiency	**Hot water storage loss factor [kWh/litre per day]**
1	-

"No zones in project where local mechanical ventilation or exhaust is applicable"

Shell and core configuration

Zone	**Assumed shell?**
Block 1 - Zone 2	YES
Block 1 - Zone 1	YES
Block 2 - Zone 2	YES
Block 2 - Zone 1	YES

General lighting and display lighting

Zone	**General lighting [W]**	**Display lamps efficacy [lm/W]**
Block 1 - Zone 2	100	-
Block 1 - Zone 1	10	-
Block 2 - Zone 2	100	-
Block 2 - Zone 1	20	-

Criterion 3: The spaces in the building should have propriate passive control measures to limit solar gains

Zone	**Solar gain limit exceeded? (%)**	**Internal blinds used?**
Block 1 - Zone 2	NO (-63.2%)	NO
Block 2 - Zone 2	NO (-58.9%)	NO

Criterion 4: The performance of the building, as built, should be consistent with the BER

Separate submission

Criterion 5: The necessary provisions for enabling energy-efficient operation of the building should be in place

Separate submission

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m^2]	53	53
External area [m^2]	173.4	173.4
Weather	LON	LON
Infiltration [m^3/hm^2@ 50Pa]	0	5
Average conductance [W/K]	79.82	136.28
Average U-value [W/m^2K]	0.46	0.79
Alpha value* [%]	22.21	17.28

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

% Area	Building Type
	A1/A2 Retail/Financial and Professional services
	A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
100	**B1 Offices and Workshop businesses**
	B2 to B7 General Industrial and Special Industrial Groups
	B8 Storage or Distribution
	C1 Hotels
	C2 Residential Inst.: Hospitals and Care Homes
	C2 Residential Inst.: Residential schools
	C2 Residential Inst.: Universities and colleges
	C2A Secure Residential Inst.
	Residential spaces
	D1 Non-residential Inst.: Community/Day Centre
	D1 Non-residential Inst.: Libraries, Museums, and Galleries
	D1 Non-residential Inst.: Education
	D1 Non-residential Inst.: Primary Health Care Building
	D1 Non-residential Inst.: Crown and County Courts
	D2 General Assembly and Leisure, Night Clubs and Theatres
	Others: Passenger terminals
	Others: Emergency services
	Others: Telephone exchanges
	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	13.62	30.3
Cooling	19.98	14.37
Auxiliary	0	0
Lighting	11.87	9.09
Hot water	2.32	2.81
Equipment*	34.66	34.14
TOTAL	**47.8**	**56.56**

* Energy used by equipment does not count towards the total for calculating emissions.

Energy Production by Technology [kWh/m^2]

	Actual	Notional
Photovoltaic systems	0	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0

Energy & CO_2 Emissions Summary

	Actual	Indicative Target
Heating + cooling demand [MJ/m^2]	314.28	462.88
Total consumption [kWh/m^2]	47.8	56.56
Total emissions [kg/m^2]	24.7	28.6

HVAC Systems Performance

System Type		Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	200.8	113.5	13.6	20	0	4.05	1.56	4.35	2.2
	Notional	271.8	191.1	30.3	14.4	0	2.43	3.6	----	----

Key to terms

Heat dem [MJ/m2] = Heating energy demand
Cool dem [MJ/m2] = Cooling energy demand
Heat con [kWh/m2] = Heating energy consumption
Cool con [kWh/m2] = Cooling energy consumption
Aux con [kWh/m2] = Auxiliary energy consumption
Heat SSEFF = Heating system seasonal efficiency (for notional building, value depends on activity glazing class)
Cool SSEER = Cooling system seasonal energy efficiency ratio
Heat gen SSEFF = Heating generator seasonal efficiency
Cool gen SSEER = Cooling generator seasonal energy efficiency ratio
ST = System type
HS = Heat source
HFT = Heating fuel type
CFT = Cooling fuel type

Key Features

The BCO can give particular attention to items with specifications that are better than typically expected.

Building fabric

Element	$U_{i\text{-}Typ}$	$U_{i\text{-}Min}$	Surface where the minimum value occurs*
Wall	0.23	0.32	Block 1 - Zone 2_W_4
Floor	0.2	0.17	Block 1 - Zone 2_S_2
Roof	0.15	-	"No heat loss roofs"
Windows, roof windows, and rooflights	1.5	-	"No heat loss windows/rooflights"
Personnel doors	1.5	-	"No heat loss personnel doors"
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High usage entrance doors	1.5	2.04	Block 1 - Zone 2_D_8

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Air Permeability	Typical value	This building
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