BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2013

Project name

807 High Street Be Green

As designed

Date: Mon Aug 17 08:33:50 2020

Administrative information

Building Details

Address: Retail Units, 807 High Street, London, N17 8ER

Certification tool

Calculation engine: SBEM

Calculation engine version: v5.6.a.1

Interface to calculation engine: DesignBuilder SBEM

Interface to calculation engine version: v6.1.0

BRUKL compliance check version: v5.6.a.1

Owner Details

Name: c/o P3R Consulting Engineers

Telephone number:

Address: , ,

Certifier details

Name: Neil Ingham

Telephone number:

Address: Holborn Tower, 137-144 High Holborn London, WC1V 6PL

Criterion 1: The calculated CO_2 emission rate for the building must not exceed the target

CO_2 emission rate from the notional building, $kgCO_2/m^2.annum$	18.2
Target CO_2 emission rate (TER), $kgCO_2/m^2.annum$	18.2
Building CO_2 emission rate (BER), $kgCO_2/m^2.annum$	13.4
Are emissions from the building less than or equal to the target?	BER =< TER
Are as built details the same as used in the BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency

Values which do not achieve the standards in the Non-Domestic Building Services Compliance Guide and Part L are displayed in red.

Building fabric

Element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	Surface where the maximum value occurs*
Wall**	0.35	0.16	0.16	Block 1 - Circulation_W_16
Floor	0.25	0.14	0.14	Block 1 - Circulation_S_3
Roof	0.25	0.12	0.12	Block 1 - Circulation_R_4
Windows***, roof windows, and rooflights	2.2	1.4	1.4	Block 1 - Circulation_G_17
Personnel doors	2.2	1.4	1.4	Block 1 - Holding_D_8
Vehicle access & similar large doors	1.5	-	-	"No external vehicle access doors"
High usage entrance doors	3.5	-	-	"No external high usage entrance doors"

$U_{a\text{-}Limit}$ = Limiting area-weighted average U-values [$W/(m^2K)$]

$U_{a\text{-}Calc}$ = 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	3

Building services

The standard values listed below are minimum values for efficiencies and maximum values for SFPs. Refer to the Non-Domestic Building Services Compliance Guide for details.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	NO
Whole building electric power factor achieved by power factor correction	0.9 to 0.95

1- Panel Rads

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	1	-	-	-	-
Standard value	N/A	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO

2- VRF

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4.45	3.2	-	-	-
Standard value	2.5*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types <=12 kW output, refer to EN 14825 for limiting standards.					

1- PoU

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	1	-
Standard value	1	N/A

Local mechanical ventilation, exhaust, and terminal units

ID	System type in Non-domestic Building Services Compliance Guide
A	Local supply or extract ventilation units serving a single area
B	Zonal supply system where the fan is remote from the zone
C	Zonal extract system where the fan is remote from the zone
D	Zonal supply and extract ventilation units serving a single room or zone with heating and heat recovery
E	Local supply and extract ventilation system serving a single area with heating and heat recovery
F	Other local ventilation units
G	Fan-assisted terminal VAV unit
H	Fan coil units
I	Zonal extract system where the fan is remote from the zone with grease filter

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
Block 1 - Circulation	-	-	-	0.9	-	-	-	-	-	0.78	0.5
Block 1 - WC	-	-	-	0.9	-	-	-	-	-	0.78	0.5
Block 1 - Store	-	-	-	0.9	-	-	-	-	-	0.78	0.5
Block 2 - Circulation	-	-	-	0.9	-	-	-	-	-	0.78	0.5
Block 1 - Arrangment Room	-	-	-	0.9	-	-	-	-	-	0.78	0.5
Block 1 - Tea Prep	-	-	-	0.9	-	-	-	-	-	0.78	0.5
Block 1 - Viewing Room	-	-	-	0.9	-	-	-	-	-	0.78	0.5
Block 1 - Reception	-	-	-	0.9	-	-	-	-	-	0.78	0.5
Block 1 - Hall	-	-	-	0.9	-	-	-	-	-	0.78	0.5

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
Block 1 - Viewing Room	-	-	-	0.9	-	-	-	-	-	0.78	0.5
Block 1 - Holding	-	-	-	0.9	-	-	-	-	-	0.78	0.5
Block 2 - D1 Use	-	-	-	0.9	-	-	-	-	-	0.78	0.5

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	Luminaire	Lamp	Display lamp	General lighting [W]
Standard value	60	60	22	
Block 1 - Circulation	-	110	-	62
Block 1 - WC	-	110	-	31
Block 1 - Store	110	-	-	9
Block 2 - Circulation	-	110	-	41
Block 1 - Arrangment Room	110	-	-	105
Block 1 - Tea Prep	-	110	-	63
Block 1 - Viewing Room	-	110	80	107
Block 1 - Reception	-	110	-	63
Block 1 - Hall	-	110	-	26
Block 1 - Viewing Room	-	110	80	114
Block 1 - Holding	110	-	-	24
Block 2 - D1 Use	-	110	-	315

Criterion 3: The spaces in the building should have appropriate passive control measures to limit solar gains

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
Block 1 - Arrangment Room	YES (+65.8%)	NO
Block 1 - Tea Prep	N/A	N/A
Block 1 - Viewing Room	N/A	N/A
Block 1 - Reception	YES (+65.4%)	NO
Block 1 - Hall	N/A	N/A
Block 1 - Viewing Room	N/A	N/A
Block 1 - Holding	N/A	N/A
Block 2 - D1 Use	NO (-55.6%)	NO

Criterion 4: The performance of the building, as built, should be consistent with the calculated BER

Separate submission

Criterion 5: The necessary provisions for enabling energy-efficient operation of the building should be in place

Separate submission

EPBD (Recast): Consideration of alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	NO
Is evidence of such assessment available as a separate submission?	NO
Are any such measures included in the proposed design?	NO

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m²]	271	271
External area [m²]	412.3	412.3
Weather	LON	LON
Infiltration [m³/hm²@ 50Pa]	3	3
Average conductance [W/K]	113.29	160.25
Average U-value [W/m²K]	0.27	0.39
Alpha value* [%]	19.7	14.57

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

% Area	Building Type
73	**A1/A2 Retail/Financial and Professional services**
	A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
	B1 Offices and Workshop businesses
	B2 to B7 General Industrial and Special Industrial Groups
	B8 Storage or Distribution
	C1 Hotels
	C2 Residential Institutions: Hospitals and Care Homes
	C2 Residential Institutions: Residential schools
	C2 Residential Institutions: Universities and colleges
	C2A Secure Residential Institutions
	Residential spaces
27	**D1 Non-residential Institutions: Community/Day Centre**
	D1 Non-residential Institutions: Libraries, Museums, and Galleries
	D1 Non-residential Institutions: Education
	D1 Non-residential Institutions: Primary Health Care Building
	D1 Non-residential Institutions: Crown and County Courts
	D2 General Assembly and Leisure, Night Clubs, and Theatres
	Others: Passenger terminals
	Others: Emergency services
	Others: Miscellaneous 24hr activities
	Others: Car Parks 24 hrs
	Others: Stand alone utility block

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	3.21	8.33
Cooling	5.71	6.23
Auxiliary	4.41	3.91
Lighting	11.04	17.85
Hot water	1.69	1.95
Equipment*	11.22	11.22
TOTAL**	**26.06**	**38.27**

* Energy used by equipment does not count towards the total for consumption or calculating emissions.
** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m²]

	Actual	Notional
Photovoltaic systems	0	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m²]	144.05	149.75
Primary energy* [kWh/m²]	79.19	102.45
Total emissions [kg/m²]	13.4	18.2

* Primary energy is net of any electrical energy displaced by CHP generators, if applicable.

HVAC Systems Performance

System Type		Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Other local room heater - unfanned, [HS] Room heater, [HFT] Electricity, [CFT] Natural Gas										
	Actual	16.3	72.4	5.6	0	4.2	0.8	0	1	0
	Notional	48.4	81	16.4	0	4.2	0.82	0	----	----
[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	36.2	128.3	2.3	7.8	4.5	4.37	4.56	4.45	6.1
	Notional	46.7	110.5	5.3	8.5	3.8	2.43	3.6	----	----

Key to terms

Heat dem [MJ/m2] = Heating energy demand
Cool dem [MJ/m2] = Cooling energy demand
Heat con [kWh/m2] = Heating energy consumption
Cool con [kWh/m2] = Cooling energy consumption
Aux con [kWh/m2] = Auxiliary energy consumption
Heat SSEFF = Heating system seasonal efficiency (for notional building, value depends on activity glazing class)
Cool SSEER = Cooling system seasonal energy efficiency ratio
Heat gen SSEFF = Heating generator seasonal efficiency
Cool gen SSEER = Cooling generator seasonal energy efficiency ratio
ST = System type
HS = Heat source
HFT = Heating fuel type
CFT = Cooling fuel type

Key Features

The Building Control Body is advised to give particular attention to items whose specifications are better than typically expected.

Building fabric

Element	$U_{i\text{-}Typ}$	$U_{i\text{-}Min}$	Surface where the minimum value occurs*
Wall	0.23	0.16	Block 1 - Circulation_W_16
Floor	0.2	0.14	Block 1 - Circulation_S_3
Roof	0.15	0.12	Block 1 - Circulation_R_4
Windows, roof windows, and rooflights	1.5	1.4	Block 1 - Circulation_G_17
Personnel doors	1.5	1.4	Block 1 - Holding_D_8
Vehicle access & similar large doors	1.5	-	"No external vehicle access doors"
High usage entrance doors	1.5	-	"No external high usage entrance doors"

$U_{i\text{-}Typ}$ = Typical individual element U-values [W/(m²K)] $U_{i\text{-}Min}$ = Minimum individual element U-values [W/(m²K)]

* There might be more than one surface where the minimum U-value occurs.

Air Permeability	Typical value	This building
m³/(h.m²) at 50 Pa	5	3

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.4.23
Printed on 07 January 2020 at 16:11:44

Project Information:

Assessed By: Neil Ingham (STRO010943) **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 88.06m²

Site Reference : 807 High Street - Green **Plot Reference:** Sample 1

Address :

Client Details:

Name:

Address :

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

1a TER and DER

Fuel for main heating system: Electricity (c)
Fuel factor: 1.55 (electricity (c))

Target Carbon Dioxide Emission Rate (TER)	28.53 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	10.97 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	61.6 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	48.3 kWh/m²	
		OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.16 (max. 0.30)	0.16 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	0.14 (max. 0.25)	0.14 (max. 0.70)	**OK**
Roof	(no roof)		
Openings	1.10 (max. 2.00)	1.10 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

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

4 Heating efficiency

Main Heating system:	Community heating schemes - Heat pump	
Secondary heating system:	None	

5 Cylinder insulation

Hot water Storage:	Measured cylinder loss: 1.37 kWh/day	
	Permitted by DBSCG: 1.89 kWh/day	**OK**
Primary pipework insulated:	Yes	**OK**

6 Controls

Space heating controls	Charging system linked to use of community heating, programmer and at least two room thermostats	**OK**
Hot water controls:	Cylinderstat	**OK**

Regulations Compliance Report

7 Low energy lights

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

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.84	
Maximum	1.5	**OK**
MVHR efficiency:	81%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (Thames valley):	Slight	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: North	11.15m²
Windows facing: East	5.96m²
Ventilation rate:	6.00

10 Key features

Air permeablility	3.0 m³/m²h
Windows U-value	1.1 W/m²K
Doors U-value	1.1 W/m²K
Party Walls U-value	0 W/m²K
Community heating, heat from electric heat pump	
Photovoltaic array	

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Neil Ingham	**Stroma Number:**	STRO010943
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.23

Property Address: Sample 1

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	88.06	(1a) x	2.7	(2a) =	237.76	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	88.06	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		237.76	(5)

2. Ventilation rate:

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

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

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

DER WorkSheet: New dwelling design stage

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

0.19	0.19	0.18	0.16	0.16	0.14	0.14	0.14	0.15	0.16	0.17	0.18

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

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

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 68.85 (23c)

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

(24a)m=	0.35	0.34	0.34	0.32	0.32	0.3	0.3	0.29	0.31	0.32	0.32	0.33	(24a)

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

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

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

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

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

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

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

(25)m=	0.35	0.34	0.34	0.32	0.32	0.3	0.3	0.29	0.31	0.32	0.32	0.33	(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			1.95	x	1.1	=	2.145			(26)
Windows Type 1			11.15	x	1/[1/(1.1)+ 0.04]	=	11.75			(27)
Windows Type 2			5.96	x	1/[1/(1.1)+ 0.04]	=	6.28			(27)
Floor			88.06	x	0.14	=	12.3284	75	6604.5	(28)
Walls Type1	55.67	17.11	38.56	x	0.16	=	6.17	60	2313.6	(29)
Walls Type2	39.02	1.95	37.07	x	0.15	=	5.57	60	2224.2	(29)
Total area of elements, m²			182.75							(31)
Party wall			16.66	x	0	=	0	45	749.7	(32)
Party ceiling			88.06					30	2641.8	(32b)
Internal wall **			191.81					9	1726.29	(32c)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 44.25 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 16260.09 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 184.65 (35)

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

Thermal bridges : S (L x Y) calculated using Appendix K 14.39 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 58.64 (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

DER WorkSheet: New dwelling design stage

(38)m=	27.23	26.93	26.64	25.17	24.87	23.4	23.4	23.11	23.99	24.87	25.46	26.05	(38)

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

(39)m=	85.87	85.57	85.28	83.81	83.51	82.04	82.04	81.75	82.63	83.51	84.1	84.69	

Average = Sum(39)$_{1...12}$ /12= 83.73 (39)

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

(40)m=	0.98	0.97	0.97	0.95	0.95	0.93	0.93	0.93	0.94	0.95	0.96	0.96	

Average = Sum(40)$_{1...12}$ /12= 0.95 (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 2.6 (42)

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

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 95.91 (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=	105.5	101.66	97.83	93.99	90.15	86.32	86.32	90.15	93.99	97.83	101.66	105.5	

Total = Sum(44)$_{1...12}$ = 1150.89 (44)

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

(45)m=	156.45	136.83	141.2	123.1	118.12	101.93	94.45	108.38	109.68	127.82	139.52	151.51	

Total = Sum(45)$_{1...12}$ = 1509 (45)

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

(46)m=	23.47	20.53	21.18	18.47	17.72	15.29	14.17	16.26	16.45	19.17	20.93	22.73	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

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

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

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.37 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.82 (50)

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

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.82 (55)

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

(56)m=	25.48	23.02	25.48	24.66	25.48	24.66	25.48	25.48	24.66	25.48	24.66	25.48	(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=	25.48	23.02	25.48	24.66	25.48	24.66	25.48	25.48	24.66	25.48	24.66	25.48	(57)

DER WorkSheet: New dwelling design stage

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

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

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

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

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

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

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

(62)m=	205.2	180.86	189.94	170.27	166.86	149.1	143.2	157.13	156.85	176.56	186.7	200.26	(62)

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

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

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	205.2	180.86	189.94	170.27	166.86	149.1	143.2	157.13	156.85	176.56	186.7	200.26	

Output from water heater (annual)$_{1...12}$ | 2082.93 | (64)

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

(65)m=	91.02	80.72	85.94	78.67	78.27	71.63	70.4	75.03	74.21	81.5	84.13	89.37	(65)

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

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	129.91	129.91	129.91	129.91	129.91	129.91	129.91	129.91	129.91	129.91	129.91	129.91	(66)

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

(67)m=	21.21	18.84	15.32	11.6	8.67	7.32	7.91	10.28	13.8	17.52	20.45	21.8	(67)

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

(68)m=	235.46	237.91	231.75	218.64	202.09	186.54	176.15	173.71	179.87	192.98	209.52	225.07	(68)

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

(69)m=	35.99	35.99	35.99	35.99	35.99	35.99	35.99	35.99	35.99	35.99	35.99	35.99	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

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

(71)m=	-103.93	-103.93	-103.93	-103.93	-103.93	-103.93	-103.93	-103.93	-103.93	-103.93	-103.93	-103.93	(71)

Water heating gains (Table 5)

(72)m=	122.33	120.12	115.52	109.26	105.2	99.48	94.62	100.85	103.06	109.54	116.85	120.13	(72)

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

(73)m=	440.98	438.83	424.56	401.47	377.94	355.32	340.66	346.82	358.7	382.01	408.79	428.97	(73)

6. Solar gains:

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

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x 0.77	x	11.15	x	10.63	x	0.63	x	0.7	=	36.23	(74)
North	0.9x 0.77	x	11.15	x	20.32	x	0.63	x	0.7	=	69.25	(74)

DER WorkSheet: New dwelling design stage

North	0.9x	0.77	x	11.15	x	34.53	x	0.63	x	0.7	=	117.66		(74)
North	0.9x	0.77	x	11.15	x	55.46	x	0.63	x	0.7	=	189		(74)
North	0.9x	0.77	x	11.15	x	74.72	x	0.63	x	0.7	=	254.6		(74)
North	0.9x	0.77	x	11.15	x	79.99	x	0.63	x	0.7	=	272.56		(74)
North	0.9x	0.77	x	11.15	x	74.68	x	0.63	x	0.7	=	254.47		(74)
North	0.9x	0.77	x	11.15	x	59.25	x	0.63	x	0.7	=	201.89		(74)
North	0.9x	0.77	x	11.15	x	41.52	x	0.63	x	0.7	=	141.47		(74)
North	0.9x	0.77	x	11.15	x	24.19	x	0.63	x	0.7	=	82.43		(74)
North	0.9x	0.77	x	11.15	x	13.12	x	0.63	x	0.7	=	44.7		(74)
North	0.9x	0.77	x	11.15	x	8.86	x	0.63	x	0.7	=	30.21		(74)
East	0.9x	0.77	x	5.96	x	19.64	x	0.63	x	0.7	=	35.77		(76)
East	0.9x	0.77	x	5.96	x	38.42	x	0.63	x	0.7	=	69.98		(76)
East	0.9x	0.77	x	5.96	x	63.27	x	0.63	x	0.7	=	115.25		(76)
East	0.9x	0.77	x	5.96	x	92.28	x	0.63	x	0.7	=	168.08		(76)
East	0.9x	0.77	x	5.96	x	113.09	x	0.63	x	0.7	=	205.99		(76)
East	0.9x	0.77	x	5.96	x	115.77	x	0.63	x	0.7	=	210.87		(76)
East	0.9x	0.77	x	5.96	x	110.22	x	0.63	x	0.7	=	200.76		(76)
East	0.9x	0.77	x	5.96	x	94.68	x	0.63	x	0.7	=	172.45		(76)
East	0.9x	0.77	x	5.96	x	73.59	x	0.63	x	0.7	=	134.04		(76)
East	0.9x	0.77	x	5.96	x	45.59	x	0.63	x	0.7	=	83.04		(76)
East	0.9x	0.77	x	5.96	x	24.49	x	0.63	x	0.7	=	44.61		(76)
East	0.9x	0.77	x	5.96	x	16.15	x	0.63	x	0.7	=	29.42		(76)

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

(83)m=	72.01	139.23	232.91	357.08	460.59	483.43	455.22	374.33	275.51	165.47	89.31	59.63	(83)

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

(84)m=	512.99	578.06	657.47	758.56	838.53	838.75	795.88	721.15	634.21	547.47	498.1	488.6	(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	0.92	0.79	0.6	0.45	0.51	0.78	0.95	0.99	0.99	(86)

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

(87)m=	19.71	19.87	20.16	20.55	20.84	20.97	20.99	20.99	20.89	20.51	20.05	19.68	(87)

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

(88)m=	20.1	20.11	20.11	20.12	20.13	20.14	20.14	20.14	20.14	20.13	20.12	20.12	(88)

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

(89)m=	0.99	0.99	0.97	0.9	0.74	0.53	0.36	0.42	0.71	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=	18.36	18.61	19.03	19.59	19.96	20.12	20.14	20.14	20.04	19.54	18.88	18.34	(90)

fLA = Living area ÷ (4) = 0.32 (91)

DER WorkSheet: New dwelling design stage

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

(92)m=	18.8	19.02	19.4	19.9	20.24	20.39	20.41	20.41	20.31	19.86	19.26	18.78

(92)

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

(93)m=	18.8	19.02	19.4	19.9	20.24	20.39	20.41	20.41	20.31	19.86	19.26	18.78

(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	0.89	0.75	0.55	0.39	0.45	0.73	0.93	0.98	0.99

(94)

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

(95)m=	507.4	567.09	630.19	675.9	628.62	460.03	310.52	323.51	460.83	509.35	488.44	484.24

(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2

(96)

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

(97)m=	1245.01	1207.87	1099.81	921.86	713.58	475.12	312.97	328.03	513.48	773.03	1022.28	1234.46

(97)

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

(98)m=	548.78	430.61	349.4	177.09	63.21	0	0	0	0	196.17	384.36	558.16

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2707.78 (98)

Space heating requirement in kWh/m²/year 30.75 (99)

9b. Energy requirements – Community heating scheme

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

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none 0 (301)

Fraction of space heat from community system 1 – (301) = 1 (302)

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

Fraction of heat from Community heat pump 1 (303a)

Fraction of total space heat from Community heat pump (302) x (303a) = 1 (304a)

Factor for control and charging method (Table 4c(3)) for community heating system 1 (305)

Distribution loss factor (Table 12c) for community heating system 1.05 (306)

Space heating **kWh/year**

Annual space heating requirement 2707.78

Space heat from Community heat pump (98) x (304a) x (305) x (306) = 2843.17 (307a)

Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) 0 (308

Space heating requirement from secondary/supplementary system (98) x (301) x 100 ÷ (308) = 0 (309)

Water heating

Annual water heating requirement 2082.93

If DHW from community scheme:

Water heat from Community heat pump (64) x (303a) x (305) x (306) = 2187.08 (310a)

Electricity used for heat distribution 0.01 × [(307a)…(307e) + (310a)…(310e)] = 50.3 (313)

Cooling System Energy Efficiency Ratio 0 (314)

Space cooling (if there is a fixed cooling system, if not enter 0) = (107) ÷ (314) = 0 (315)

DER WorkSheet: New dwelling design stage

Electricity for pumps and fans within dwelling (Table 4f):			
mechanical ventilation - balanced, extract or positive input from outside		304.57	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	304.57	(331)
Energy for lighting (calculated in Appendix L)		374.56	(332)
Electricity generated by PVs (Appendix M) (negative quantity)		-664.99	(333)
Electricity generated by wind turbine (Appendix M) (negative quantity)		0	(334)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP)						
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				280	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.52	=	932.39	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	26.11	(372)
Total CO2 associated with community systems	(363)...(366) + (368)...(372)			=	958.5	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.52	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				958.5	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	158.07	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	194.39	(379)
Energy saving/generation technologies (333) to (334) as applicable						
Item 1			0.52	x 0.01 =	-345.13	(380)
Total CO2, kg/year	sum of (376)...(382) =				965.84	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				10.97	(384)
EI rating (section 14)					90.27	(385)

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.4.23
Printed on 07 January 2020 at 16:11:32

Project Information:

Assessed By: Neil Ingham (STRO010943) **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 79.71m²

Site Reference : 807 High Street - Green **Plot Reference:** Sample 2

Address :

Client Details:

Name:

Address :

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

1a TER and DER

Fuel for main heating system: Electricity (c)
Fuel factor: 1.55 (electricity (c))

Target Carbon Dioxide Emission Rate (TER)	28.23 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	10.22 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	58.4 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	44.2 kWh/m²	
		OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.16 (max. 0.30)	0.16 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	0.07 (max. 0.25)	0.07 (max. 0.70)	**OK**
Roof	0.12 (max. 0.20)	0.12 (max. 0.35)	**OK**
Openings	1.10 (max. 2.00)	1.10 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

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

4 Heating efficiency

Main Heating system: Community heating schemes - Heat pump

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: No cylinder

6 Controls

Space heating controls	Charging system linked to use of community heating, programmer and at least two room thermostats	**OK**
Hot water controls:	No cylinder thermostat	
	No cylinder	

Regulations Compliance Report

7 Low energy lights

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

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.84	
Maximum	1.5	**OK**
MVHR efficiency:	81%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (Thames valley):	Not significant	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: North West	9.29m²
Windows facing: South East	7.52m²
Ventilation rate:	8.00

10 Key features

Air permeablility	3.0 m³/m²h
Windows U-value	1.1 W/m²K
Doors U-value	1.1 W/m²K
Roofs U-value	0.12 W/m²K
Party Walls U-value	0 W/m²K
Floors U-value	0.07 W/m²K
Community heating, heat from electric heat pump	
Photovoltaic array	

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Neil Ingham	**Stroma Number:**	STRO010943
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.23

Property Address: Sample 2

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	44.41 (1a)	x	2.7 (2a)	=	119.91	(3a)
First floor	35.3 (1b)	x	3.23 (2b)	=	114.02	(3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	79.71	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	=	233.93	(5)

2. Ventilation rate:

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

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

Infiltration rate modified for monthly wind speed

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

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

DER WorkSheet: New dwelling design stage

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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

0.19	0.19	0.18	0.16	0.16	0.14	0.14	0.14	0.15	0.16	0.17	0.18

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

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

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 68.85 (23c)

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

(24a)m=	0.35	0.34	0.34	0.32	0.32	0.3	0.3	0.29	0.31	0.32	0.32	0.33

(24a)

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

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0

(24b)

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

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0

(24c)

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

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0

(24d)

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

(25)m=	0.35	0.34	0.34	0.32	0.32	0.3	0.3	0.29	0.31	0.32	0.32	0.33

(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			1.95	x	1.1	=	2.145			(26)
Windows Type 1			9.29	x	1/[1/(1.1)+ 0.04]	=	9.79			(27)
Windows Type 2			7.52	x	1/[1/(1.1)+ 0.04]	=	7.92			(27)
Floor			44.41	x	0.07	=	3.1087	75	3330.75	(28)
Walls	58.83	18.76	40.07	x	0.16	=	6.41	60	2404.2	(29)
Roof Type1	3.92	0	3.92	x	0.12	=	0.47	9	35.28	(30)
Roof Type2	35.67	0	35.67	x	0.12	=	4.28	9	321.03	(30)
Total area of elements, m²			142.83							(31)
Party wall			101.47	x	0	=	0	45	4566.15	(32)
Internal wall **			123.2					9	1108.8	(32c)
Internal floor			35.3					18	635.4	(32d)
Internal ceiling			35.3					9	317.7	(32e)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 34.13 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 12719.31 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 159.57 (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 — 14.64 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 48.76 (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	
(38)m=	26.79	26.5	26.21	24.76	24.47	23.02	23.02	22.73	23.6	24.47	25.05	25.63	(38)

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

(39)m=	75.55	75.26	74.97	73.52	73.23	71.79	71.79	71.5	72.36	73.23	73.81	74.39	

Average = Sum(39)$_{1...12}$ /12= 73.45 (39)

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

(40)m=	0.95	0.94	0.94	0.92	0.92	0.9	0.9	0.9	0.91	0.92	0.93	0.93	

Average = Sum(40)$_{1...12}$ /12= 0.92 (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 — 2.46 (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 — 92.56 (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=	101.82	98.12	94.41	90.71	87.01	83.31	83.31	87.01	90.71	94.41	98.12	101.82	

Total = Sum(44)$_{1...12}$ = 1110.74 (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=	150.99	132.06	136.27	118.81	114	98.37	91.16	104.6	105.85	123.36	134.66	146.23	

Total = Sum(45)$_{1...12}$ = 1456.36 (45)

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

(46)m=	22.65	19.81	20.44	17.82	17.1	14.76	13.67	15.69	15.88	18.5	20.2	21.93	(46)

Water storage loss:

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

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

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

Water storage loss:

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

Temperature factor from Table 2b — 0 (49)

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

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

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

If community heating see section 4.3

Volume factor from Table 2a — 1.03 (52)

Temperature factor from Table 2b — 0.6 (53)

DER WorkSheet: New dwelling design stage

Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	1.03	(54)
Enter (50) or (54) in (55)		1.03	(55)

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

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

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

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

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

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

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

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

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

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

(62)m=	206.27	181.99	191.55	172.3	169.27	151.87	146.43	159.88	159.35	178.64	188.15	201.51	(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=	206.27	181.99	191.55	172.3	169.27	151.87	146.43	159.88	159.35	178.64	188.15	201.51	

Output from water heater (annual)$_{1...12}$ 2107.2 (64)

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

(65)m=	94.43	83.85	89.53	82.3	82.13	75.5	74.53	79	77.99	85.24	87.57	92.84	(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=	122.87	122.87	122.87	122.87	122.87	122.87	122.87	122.87	122.87	122.87	122.87	122.87	(66)

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

(67)m=	19.51	17.33	14.09	10.67	7.97	6.73	7.27	9.46	12.69	16.12	18.81	20.05	(67)

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

(68)m=	218.83	221.1	215.38	203.2	187.82	173.37	163.71	161.44	167.16	179.35	194.72	209.18	(68)

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

(69)m=	35.29	35.29	35.29	35.29	35.29	35.29	35.29	35.29	35.29	35.29	35.29	35.29	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

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

(71)m=	-98.29	-98.29	-98.29	-98.29	-98.29	-98.29	-98.29	-98.29	-98.29	-98.29	-98.29	-98.29	(71)

Water heating gains (Table 5)

(72)m=	126.92	124.78	120.34	114.3	110.38	104.87	100.18	106.19	108.32	114.57	121.62	124.79	(72)

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

(73)m=	425.12	423.07	409.67	388.03	366.04	344.83	331.02	336.94	348.04	369.89	395.02	413.88	(73)

6. Solar gains:

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

DER WorkSheet: New dwelling design stage

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Southeast 0.9x	0.77	x	7.52	x	36.79	x	0.63	x	0.7	=	84.56	(77)
Southeast 0.9x	0.77	x	7.52	x	62.67	x	0.63	x	0.7	=	144.04	(77)
Southeast 0.9x	0.77	x	7.52	x	85.75	x	0.63	x	0.7	=	197.08	(77)
Southeast 0.9x	0.77	x	7.52	x	106.25	x	0.63	x	0.7	=	244.19	(77)
Southeast 0.9x	0.77	x	7.52	x	119.01	x	0.63	x	0.7	=	273.51	(77)
Southeast 0.9x	0.77	x	7.52	x	118.15	x	0.63	x	0.7	=	271.53	(77)
Southeast 0.9x	0.77	x	7.52	x	113.91	x	0.63	x	0.7	=	261.79	(77)
Southeast 0.9x	0.77	x	7.52	x	104.39	x	0.63	x	0.7	=	239.91	(77)
Southeast 0.9x	0.77	x	7.52	x	92.85	x	0.63	x	0.7	=	213.39	(77)
Southeast 0.9x	0.77	x	7.52	x	69.27	x	0.63	x	0.7	=	159.19	(77)
Southeast 0.9x	0.77	x	7.52	x	44.07	x	0.63	x	0.7	=	101.28	(77)
Southeast 0.9x	0.77	x	7.52	x	31.49	x	0.63	x	0.7	=	72.37	(77)
Northwest 0.9x	0.77	x	9.29	x	11.28	x	0.63	x	0.7	=	32.03	(81)
Northwest 0.9x	0.77	x	9.29	x	22.97	x	0.63	x	0.7	=	65.21	(81)
Northwest 0.9x	0.77	x	9.29	x	41.38	x	0.63	x	0.7	=	117.48	(81)
Northwest 0.9x	0.77	x	9.29	x	67.96	x	0.63	x	0.7	=	192.94	(81)
Northwest 0.9x	0.77	x	9.29	x	91.35	x	0.63	x	0.7	=	259.34	(81)
Northwest 0.9x	0.77	x	9.29	x	97.38	x	0.63	x	0.7	=	276.49	(81)
Northwest 0.9x	0.77	x	9.29	x	91.1	x	0.63	x	0.7	=	258.65	(81)
Northwest 0.9x	0.77	x	9.29	x	72.63	x	0.63	x	0.7	=	206.2	(81)
Northwest 0.9x	0.77	x	9.29	x	50.42	x	0.63	x	0.7	=	143.15	(81)
Northwest 0.9x	0.77	x	9.29	x	28.07	x	0.63	x	0.7	=	79.69	(81)
Northwest 0.9x	0.77	x	9.29	x	14.2	x	0.63	x	0.7	=	40.31	(81)
Northwest 0.9x	0.77	x	9.29	x	9.21	x	0.63	x	0.7	=	26.16	(81)

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

(83)m=	116.59	209.24	314.56	437.12	532.86	548.02	520.44	446.11	356.54	238.88	141.59	98.53	(83)

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

(84)m=	541.71	632.31	724.23	825.16	898.9	892.85	851.46	783.05	704.58	608.77	536.61	512.4	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.98	0.97	0.93	0.84	0.68	0.5	0.37	0.41	0.65	0.89	0.97	0.99	(86)

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

(87)m=	19.73	19.95	20.28	20.65	20.88	20.98	20.99	20.99	20.93	20.61	20.11	19.7	(87)

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

(88)m=	20.13	20.13	20.13	20.15	20.15	20.17	20.17	20.17	20.16	20.15	20.15	20.14	(88)

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

(89)m=	0.98	0.96	0.92	0.81	0.64	0.44	0.3	0.34	0.59	0.86	0.96	0.98	(89)

DER WorkSheet: New dwelling design stage

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

(90)m=	18.43	18.75	19.22	19.74	20.03	20.15	20.16	20.17	20.1	19.7	19	18.39	(90)

fLA = Living area ÷ (4) = 0.43 (91)

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

(92)m=	18.99	19.27	19.67	20.13	20.4	20.5	20.52	20.52	20.46	20.09	19.48	18.95	(92)

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

(93)m=	18.99	19.27	19.67	20.13	20.4	20.5	20.52	20.52	20.46	20.09	19.48	18.95	(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=	0.97	0.95	0.91	0.81	0.65	0.46	0.33	0.37	0.61	0.86	0.95	0.98	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	526.86	601.73	657.15	666.79	584.84	414.44	279.78	291.77	430.79	522.18	511.19	500.74	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1109.69	1081.38	987.5	825.67	636.88	423.79	281.44	294.55	459.88	695.02	913.49	1097.54	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	433.62	322.32	245.78	114.39	38.72	0	0	0	0	128.59	289.66	444.02	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2017.11 (98)

Space heating requirement in kWh/m²/year 25.31 (99)

9b. Energy requirements – Community heating scheme

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

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none 0 (301)

Fraction of space heat from community system 1 – (301) = 1 (302)

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

Fraction of heat from Community heat pump 1 (303a)

Fraction of total space heat from Community heat pump (302) x (303a) = 1 (304a)

Factor for control and charging method (Table 4c(3)) for community heating system 1 (305)

Distribution loss factor (Table 12c) for community heating system 1.05 (306)

Space heating		**kWh/year**	
Annual space heating requirement		2017.11	
Space heat from Community heat pump	(98) x (304a) x (305) x (306) =	2117.96	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)

Water heating

Annual water heating requirement 2107.2

If DHW from community scheme:

DER WorkSheet: New dwelling design stage

Water heat from Community heat pump	(64) x (303a) x (305) x (306) =	2212.56	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	43.31	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		299.66	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	299.66	(331)
Energy for lighting (calculated in Appendix L)		344.54	(332)
Electricity generated by PVs (Appendix M) (negative quantity)		-664.99	(333)
Electricity generated by wind turbine (Appendix M) (negative quantity)		0	(334)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP)						
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				280	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.52	=	802.69	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	22.48	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	825.17	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.52	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				825.17	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	155.52	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	178.82	(379)
Energy saving/generation technologies (333) to (334) as applicable						
Item 1			0.52	x 0.01 =	-345.13	(380)
Total CO2, kg/year	sum of (376)…(382) =				814.38	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				10.22	(384)
EI rating (section 14)					91.25	(385)

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.4.23
Printed on 07 January 2020 at 16:11:20

Project Information:

Assessed By: Neil Ingham (STRO010943) **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 50.84m²

Site Reference : 807 High Street - Green **Plot Reference:** Sample 3

Address :

Client Details:

Name:

Address :

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

1a TER and DER

Fuel for main heating system: Electricity (c)
Fuel factor: 1.55 (electricity (c))

Target Carbon Dioxide Emission Rate (TER)	30.39 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	9.05 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	54.3 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	42.4 kWh/m²	
		OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.16 (max. 0.30)	0.16 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	0.14 (max. 0.25)	0.14 (max. 0.70)	**OK**
Roof	0.12 (max. 0.20)	0.12 (max. 0.35)	**OK**
Openings	1.10 (max. 2.00)	1.10 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

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

4 Heating efficiency

Main Heating system: Community heating schemes - Heat pump

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: No cylinder

6 Controls

Space heating controls	Charging system linked to use of community heating, programmer and at least two room thermostats	**OK**
Hot water controls:	No cylinder thermostat	
	No cylinder	

Regulations Compliance Report

7 Low energy lights

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

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.78	
Maximum	1.5	**OK**
MVHR efficiency:	81%	
Minimum	70%	**OK**

9 Summertime temperature

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

Based on:

Overshading:	Average or unknown
Windows facing: East	9.58m²
Ventilation rate:	4.00

10 Key features

Air permeablility	3.0 m³/m²h
Windows U-value	1.1 W/m²K
Doors U-value	1.1 W/m²K
Roofs U-value	0.12 W/m²K
Party Walls U-value	0 W/m²K
Community heating, heat from electric heat pump	
Photovoltaic array	

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Neil Ingham	**Stroma Number:**	STRO010943
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.23

Property Address: Sample 3

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	50.84	(1a) x	2.7	(2a) =	137.27	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.84	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		137.27	(5)

2. Ventilation rate:

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

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

Infiltration rate modified for monthly wind speed

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

DER WorkSheet: New dwelling design stage

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

0.19	0.19	0.18	0.16	0.16	0.14	0.14	0.14	0.15	0.16	0.17	0.18

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

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

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 68.85 (23c)

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

(24a)m=	0.35	0.34	0.34	0.32	0.32	0.3	0.3	0.29	0.31	0.32	0.32	0.33	(24a)

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

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

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

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

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

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

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

(25)m=	0.35	0.34	0.34	0.32	0.32	0.3	0.3	0.29	0.31	0.32	0.32	0.33	(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			1.95	x	1.1	=	2.145			(26)
Windows			9.58	x	1/[1/(1.1)+ 0.04]	=	10.09			(27)
Floor			9.71	x	0.14	=	1.3594	20	194.2	(28)
Walls Type1	25.8	9.58	16.22	x	0.16	=	2.6	60	973.2	(29)
Walls Type2	11.85	1.95	9.9	x	0.15	=	1.49	60	594	(29)
Roof	14.09	0	14.09	x	0.12	=	1.69	9	126.81	(30)
Total area of elements, m²			61.45							(31)
Party wall			48.84	x	0	=	0	45	2197.8	(32)
Party floor			41.13					40	1645.2	(32a)
Party ceiling			36.75					30	1102.5	(32b)
Internal wall **			77.44					9	696.96	(32c)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 19.37 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 7530.67 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 148.12 (35)

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

Thermal bridges : S (L x Y) calculated using Appendix K 12.37 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 31.75 (37)

DER WorkSheet: New dwelling design stage

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	15.72	15.55	15.38	14.53	14.36	13.51	13.51	13.34	13.85	14.36	14.7	15.04	(38)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(39)m=	47.46	47.29	47.13	46.28	46.11	45.26	45.26	45.09	45.6	46.11	46.45	46.79	

Average = Sum(39)$_{1...12}$ /12= 46.23 (39)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	0.93	0.93	0.93	0.91	0.91	0.89	0.89	0.89	0.9	0.91	0.91	0.92	

Average = Sum(40)$_{1...12}$ /12= 0.91 (40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.71 (42)

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

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 74.93 (43)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	82.42	79.42	76.43	73.43	70.43	67.43	67.43	70.43	73.43	76.43	79.42	82.42	

Total = Sum(44)$_{1...12}$ = 899.13 (44)

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

(45)m=	122.23	106.9	110.31	96.17	92.28	79.63	73.79	84.67	85.69	99.86	109	118.37	

Total = Sum(45)$_{1...12}$ = 1178.91 (45)

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

(46)m=	18.33	16.04	16.55	14.43	13.84	11.94	11.07	12.7	12.85	14.98	16.35	17.76	(46)

Water storage loss:

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

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

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

Water storage loss:

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

Temperature factor from Table 2b 0 (49)

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

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

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

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

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

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

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

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

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

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

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

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

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

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

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

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

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

(62)m=	177.5	156.83	165.59	149.67	147.56	133.12	129.07	139.95	139.18	155.14	162.5	173.65	(62)

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

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

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	177.5	156.83	165.59	149.67	147.56	133.12	129.07	139.95	139.18	155.14	162.5	173.65	

Output from water heater (annual)$_{1...12}$ — 1829.75 — (64)

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

(65)m=	84.86	75.49	80.9	74.77	74.9	69.27	68.76	72.38	71.29	77.42	79.04	83.58	(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=	85.74	85.74	85.74	85.74	85.74	85.74	85.74	85.74	85.74	85.74	85.74	85.74	(66)

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

(67)m=	13.51	12	9.76	7.39	5.52	4.66	5.04	6.55	8.79	11.16	13.03	13.89	(67)

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

(68)m=	149.42	150.97	147.06	138.74	128.24	118.37	111.78	110.23	114.14	122.45	132.95	142.82	(68)

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

(69)m=	31.57	31.57	31.57	31.57	31.57	31.57	31.57	31.57	31.57	31.57	31.57	31.57	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

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

(71)m=	-68.59	-68.59	-68.59	-68.59	-68.59	-68.59	-68.59	-68.59	-68.59	-68.59	-68.59	-68.59	(71)

Water heating gains (Table 5)

(72)m=	114.06	112.33	108.74	103.85	100.68	96.21	92.41	97.28	99.01	104.07	109.78	112.34	(72)

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

(73)m=	325.71	324.02	314.28	298.7	283.17	267.97	257.96	262.78	270.66	286.4	304.48	317.77	(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)

DER WorkSheet: New dwelling design stage

East	0.9x	0.77	x	9.58	x	19.64	x	0.63	x	0.7	=	57.5	(76)
East	0.9x	0.77	x	9.58	x	38.42	x	0.63	x	0.7	=	112.49	(76)
East	0.9x	0.77	x	9.58	x	63.27	x	0.63	x	0.7	=	185.25	(76)
East	0.9x	0.77	x	9.58	x	92.28	x	0.63	x	0.7	=	270.18	(76)
East	0.9x	0.77	x	9.58	x	113.09	x	0.63	x	0.7	=	331.11	(76)
East	0.9x	0.77	x	9.58	x	115.77	x	0.63	x	0.7	=	338.95	(76)
East	0.9x	0.77	x	9.58	x	110.22	x	0.63	x	0.7	=	322.69	(76)
East	0.9x	0.77	x	9.58	x	94.68	x	0.63	x	0.7	=	277.19	(76)
East	0.9x	0.77	x	9.58	x	73.59	x	0.63	x	0.7	=	215.45	(76)
East	0.9x	0.77	x	9.58	x	45.59	x	0.63	x	0.7	=	133.47	(76)
East	0.9x	0.77	x	9.58	x	24.49	x	0.63	x	0.7	=	71.7	(76)
East	0.9x	0.77	x	9.58	x	16.15	x	0.63	x	0.7	=	47.29	(76)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(83)m=	57.5	112.49	185.25	270.18	331.11	338.95	322.69	277.19	215.45	133.47	71.7	47.29	(83)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(84)m=	383.21	436.51	499.53	568.88	614.28	606.92	580.65	539.97	486.11	419.88	376.18	365.06	(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=	0.97	0.95	0.9	0.79	0.64	0.46	0.34	0.38	0.6	0.85	0.95	0.97	(86)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(87)m=	19.78	19.99	20.32	20.68	20.89	20.98	21	20.99	20.94	20.64	20.16	19.75	(87)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(88)m=	20.14	20.14	20.14	20.16	20.16	20.18	20.18	20.18	20.17	20.16	20.16	20.15	(88)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(89)m=	0.96	0.94	0.89	0.76	0.59	0.41	0.28	0.31	0.54	0.82	0.94	0.97	(89)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(90)m=	18.52	18.83	19.29	19.79	20.05	20.16	20.17	20.17	20.12	19.75	19.08	18.48	(90)

fLA = Living area ÷ (4) = 0.45 (91)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(92)m=	19.09	19.36	19.76	20.2	20.43	20.53	20.55	20.54	20.49	20.15	19.57	19.06	(92)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(93)m=	19.09	19.36	19.76	20.2	20.43	20.53	20.55	20.54	20.49	20.15	19.57	19.06	(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:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(94)m=	0.96	0.93	0.88	0.77	0.61	0.43	0.31	0.34	0.57	0.82	0.93	0.96	(94)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(95)m=	366.32	406.4	437.93	435.36	373.87	262.9	177.54	185.28	275.46	344.18	349.66	351.14	(95)

DER WorkSheet: New dwelling design stage

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

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

(97)m=	702.04	683.65	624.84	522.7	402.67	268.34	178.55	186.87	291.25	440.49	579.01	695.03	(97)

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

(98)m=	249.77	186.31	139.06	62.88	21.42	0	0	0	0	71.66	165.13	255.86	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1152.1	(98)
Space heating requirement in kWh/m²/year	22.66	(99)

9b. Energy requirements – Community heating scheme

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

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

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

Fraction of heat from Community heat pump		1	(303a)
Fraction of total space heat from Community heat pump	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)

Space heating		**kWh/year**	
Annual space heating requirement		1152.1	
Space heat from Community heat pump	(98) x (304a) x (305) x (306) =	1209.7	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)

Water heating			
Annual water heating requirement		1829.75	
If DHW from community scheme:			
Water heat from Community heat pump	(64) x (303a) x (305) x (306) =	1921.23	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	31.31	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f):			
mechanical ventilation - balanced, extract or positive input from outside		163.28	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	163.28	(331)
Energy for lighting (calculated in Appendix L)		238.63	(332)
Electricity generated by PVs (Appendix M) (negative quantity)		-664.99	(333)
Electricity generated by wind turbine (Appendix M) (negative quantity)		0	(334)

DER WorkSheet: New dwelling design stage

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP)						
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				280	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.52	=	580.34	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	16.25	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	596.59	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.52	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				596.59	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	84.74	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	123.85	(379)
Energy saving/generation technologies (333) to (334) as applicable						
Item 1		0.52	x 0.01 =		-345.13	(380)
Total CO2, kg/year	sum of (376)…(382) =				460.05	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				9.05	(384)
EI rating (section 14)					93.57	(385)

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.4.23
Printed on 07 January 2020 at 16:11:07

Project Information:

Assessed By: Neil Ingham (STRO010943) **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 57.67m²

Site Reference : 807 High Street - Green **Plot Reference:** Sample 4

Address :

Client Details:

Name:

Address :

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

1a TER and DER

Fuel for main heating system: Electricity (c)
Fuel factor: 1.55 (electricity (c))

Target Carbon Dioxide Emission Rate (TER)	34.28 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	11.62 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	70.8 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	54.2 kWh/m²	
		OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.16 (max. 0.30)	0.16 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	0.12 (max. 0.20)	0.12 (max. 0.35)	**OK**
Openings	1.10 (max. 2.00)	1.10 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

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

4 Heating efficiency

Main Heating system: Community heating schemes - Heat pump

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: No cylinder

6 Controls

Space heating controls	Charging system linked to use of community heating, programmer and at least two room thermostats	**OK**
Hot water controls:	No cylinder thermostat	
	No cylinder	

Regulations Compliance Report

7 Low energy lights

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

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.78	
Maximum	1.5	**OK**
MVHR efficiency:	81%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (Thames valley):	Slight	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: East	7.27m²
Windows facing: North	7.6m²
Ventilation rate:	6.00

10 Key features

Air permeablility	3.0 m³/m²h
Windows U-value	1.1 W/m²K
Doors U-value	1.1 W/m²K
Roofs U-value	0.12 W/m²K
Party Walls U-value	0 W/m²K
Community heating, heat from electric heat pump	
Photovoltaic array	

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Neil Ingham	**Stroma Number:**	STRO010943
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.23

Property Address: Sample 4

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	57.67	(1a) x	3.05	(2a) =	175.89	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	57.67	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		175.89	(5)

2. Ventilation rate:

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

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

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

DER WorkSheet: New dwelling design stage

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

0.19	0.19	0.18	0.16	0.16	0.14	0.14	0.14	0.15	0.16	0.17	0.18

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

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

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 68.85 (23c)

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

(24a)m=

0.35	0.34	0.34	0.32	0.32	0.3	0.3	0.29	0.31	0.32	0.32	0.33

(24a)

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

(24b)m=

0	0	0	0	0	0	0	0	0	0	0	0

(24b)

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

(24c)m=

0	0	0	0	0	0	0	0	0	0	0	0

(24c)

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

(24d)m=

0	0	0	0	0	0	0	0	0	0	0	0

(24d)

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

(25)m=

0.35	0.34	0.34	0.32	0.32	0.3	0.3	0.29	0.31	0.32	0.32	0.33

(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			1.95	x	1.1	=	2.145			(26)
Windows Type 1			7.27	x	1/[1/(1.1)+ 0.04]	=	7.66			(27)
Windows Type 2			7.6	x	1/[1/(1.1)+ 0.04]	=	8.01			(27)
Walls Type1	62.23	14.87	47.36	x	0.16	=	7.58	60	2841.6	(29)
Walls Type2	24.13	1.95	22.18	x	0.15	=	3.34	60	1330.8	(29)
Roof	62.75	0	62.75	x	0.12	=	7.53	9	564.75	(30)
Total area of elements, m²			149.11							(31)
Party wall			18.83	x	0	=	0	45	847.35	(32)
Party floor			57.67					40	2306.8	(32a)
Internal wall **			112.3					9	1010.7	(32c)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 36.26 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 8902 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 154.36 (35)

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

Thermal bridges : S (L x Y) calculated using Appendix K 9.63 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 45.89 (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

DER WorkSheet: New dwelling design stage

(38)m=	20.14	19.92	19.71	18.62	18.4	17.31	17.31	17.09	17.75	18.4	18.84	19.27	(38)

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

(39)m=	66.03	65.81	65.59	64.5	64.29	63.2	63.2	62.98	63.63	64.29	64.72	65.16	

Average = Sum(39)$_{1...12}$ /12= 64.45 (39)

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

(40)m=	1.14	1.14	1.14	1.12	1.11	1.1	1.1	1.09	1.1	1.11	1.12	1.13	

Average = Sum(40)$_{1...12}$ /12= 1.12 (40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.92 (42)

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

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 79.68 (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=	87.65	84.46	81.28	78.09	74.9	71.71	71.71	74.9	78.09	81.28	84.46	87.65	

Total = Sum(44)$_{1...12}$ = 956.19 (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=	129.98	113.68	117.31	102.28	98.14	84.68	78.47	90.05	91.12	106.2	115.92	125.88	

Total = Sum(45)$_{1...12}$ = 1253.71 (45)

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

(46)m=	19.5	17.05	17.6	15.34	14.72	12.7	11.77	13.51	13.67	15.93	17.39	18.88	(46)

Water storage loss:

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

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

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

Water storage loss:

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

Temperature factor from Table 2b 0 (49)

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

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

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

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

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

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

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

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

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

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

DER WorkSheet: New dwelling design stage

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

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

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

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

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

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

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

(62)m=	185.26	163.61	172.59	155.77	153.41	138.18	133.75	145.32	144.62	161.47	169.41	181.16	(62)

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

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

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	185.26	163.61	172.59	155.77	153.41	138.18	133.75	145.32	144.62	161.47	169.41	181.16	

Output from water heater (annual)$_{1...12}$ | 1904.55 | (64)

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

(65)m=	87.44	77.74	83.23	76.8	76.85	70.95	70.31	74.16	73.09	79.53	81.34	86.08	(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=	95.75	95.75	95.75	95.75	95.75	95.75	95.75	95.75	95.75	95.75	95.75	95.75	(66)

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

(67)m=	14.89	13.23	10.76	8.14	6.09	5.14	5.55	7.22	9.69	12.3	14.36	15.31	(67)

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

(68)m=	167.03	168.77	164.4	155.1	143.36	132.33	124.96	123.23	127.6	136.89	148.63	159.66	(68)

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

(69)m=	32.58	32.58	32.58	32.58	32.58	32.58	32.58	32.58	32.58	32.58	32.58	32.58	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

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

(71)m=	-76.6	-76.6	-76.6	-76.6	-76.6	-76.6	-76.6	-76.6	-76.6	-76.6	-76.6	-76.6	(71)

Water heating gains (Table 5)

(72)m=	117.53	115.69	111.87	106.67	103.3	98.54	94.51	99.68	101.52	106.9	112.97	115.7	(72)

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

(73)m=	351.18	349.41	338.75	321.64	304.47	287.74	276.75	281.85	290.53	307.82	327.69	342.39	(73)

6. Solar gains:

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

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x 0.77	x	7.6	x	10.63	x	0.63	x	0.7	=	24.7	(74)
North	0.9x 0.77	x	7.6	x	20.32	x	0.63	x	0.7	=	47.2	(74)

DER WorkSheet: New dwelling design stage

North	0.9x	0.77	x	7.6	x	34.53	x	0.63	x	0.7	=	80.2		(74)
North	0.9x	0.77	x	7.6	x	55.46	x	0.63	x	0.7	=	128.82		(74)
North	0.9x	0.77	x	7.6	x	74.72	x	0.63	x	0.7	=	173.54		(74)
North	0.9x	0.77	x	7.6	x	79.99	x	0.63	x	0.7	=	185.78		(74)
North	0.9x	0.77	x	7.6	x	74.68	x	0.63	x	0.7	=	173.45		(74)
North	0.9x	0.77	x	7.6	x	59.25	x	0.63	x	0.7	=	137.61		(74)
North	0.9x	0.77	x	7.6	x	41.52	x	0.63	x	0.7	=	96.43		(74)
North	0.9x	0.77	x	7.6	x	24.19	x	0.63	x	0.7	=	56.18		(74)
North	0.9x	0.77	x	7.6	x	13.12	x	0.63	x	0.7	=	30.47		(74)
North	0.9x	0.77	x	7.6	x	8.86	x	0.63	x	0.7	=	20.59		(74)
East	0.9x	0.77	x	7.27	x	19.64	x	0.63	x	0.7	=	43.64		(76)
East	0.9x	0.77	x	7.27	x	38.42	x	0.63	x	0.7	=	85.36		(76)
East	0.9x	0.77	x	7.27	x	63.27	x	0.63	x	0.7	=	140.58		(76)
East	0.9x	0.77	x	7.27	x	92.28	x	0.63	x	0.7	=	205.03		(76)
East	0.9x	0.77	x	7.27	x	113.09	x	0.63	x	0.7	=	251.27		(76)
East	0.9x	0.77	x	7.27	x	115.77	x	0.63	x	0.7	=	257.22		(76)
East	0.9x	0.77	x	7.27	x	110.22	x	0.63	x	0.7	=	244.88		(76)
East	0.9x	0.77	x	7.27	x	94.68	x	0.63	x	0.7	=	210.35		(76)
East	0.9x	0.77	x	7.27	x	73.59	x	0.63	x	0.7	=	163.5		(76)
East	0.9x	0.77	x	7.27	x	45.59	x	0.63	x	0.7	=	101.29		(76)
East	0.9x	0.77	x	7.27	x	24.49	x	0.63	x	0.7	=	54.41		(76)
East	0.9x	0.77	x	7.27	x	16.15	x	0.63	x	0.7	=	35.88		(76)

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

(83)m=	68.33	132.56	220.78	333.85	424.81	443	418.33	347.96	259.93	157.47	84.88	56.47	(83)

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

(84)m=	419.51	481.97	559.53	655.49	729.28	730.74	695.08	629.81	550.46	465.29	412.56	398.86	(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	0.96	0.93	0.84	0.7	0.52	0.39	0.44	0.69	0.9	0.96	0.98	(86)

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

(87)m=	19.38	19.61	19.99	20.46	20.79	20.95	20.99	20.98	20.86	20.41	19.82	19.35	(87)

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

(88)m=	19.96	19.97	19.97	19.99	19.99	20	20	20.01	20	19.99	19.98	19.98	(88)

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

(89)m=	0.97	0.96	0.92	0.81	0.65	0.45	0.31	0.35	0.62	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=	17.82	18.15	18.7	19.36	19.78	19.96	20	19.99	19.87	19.3	18.47	17.78	(90)

fLA = Living area ÷ (4) = 0.43 (91)

DER WorkSheet: New dwelling design stage

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

(92)m=	18.49	18.78	19.25	19.83	20.21	20.39	20.42	20.42	20.3	19.78	19.05	18.46	(92)

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

(93)m=	18.49	18.78	19.25	19.83	20.21	20.39	20.42	20.42	20.3	19.78	19.05	18.46	(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=	0.97	0.95	0.9	0.81	0.66	0.48	0.34	0.39	0.64	0.86	0.95	0.97	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	405.19	456.3	505.66	529.72	480.04	349.98	238.05	247.34	351.18	401.54	390.59	387.1	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	937.17	913.3	836.54	705.27	547.25	365.64	241.55	253.02	394.22	590.02	773.51	929.01	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	395.8	307.1	246.18	126.4	50	0	0	0	0	140.23	275.7	403.18	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1944.59 (98)

Space heating requirement in kWh/m²/year 33.72 (99)

9b. Energy requirements – Community heating scheme

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

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none 0 (301)

Fraction of space heat from community system 1 – (301) = 1 (302)

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

Fraction of heat from Community heat pump 1 (303a)

Fraction of total space heat from Community heat pump (302) x (303a) = 1 (304a)

Factor for control and charging method (Table 4c(3)) for community heating system 1 (305)

Distribution loss factor (Table 12c) for community heating system 1.05 (306)

Space heating **kWh/year**

Annual space heating requirement 1944.59

Space heat from Community heat pump (98) x (304a) x (305) x (306) = 2041.82 (307a)

Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) 0 (308

Space heating requirement from secondary/supplementary system (98) x (301) x 100 ÷ (308) = 0 (309)

Water heating

Annual water heating requirement 1904.55

If DHW from community scheme:

Water heat from Community heat pump (64) x (303a) x (305) x (306) = 1999.78 (310a)

Electricity used for heat distribution 0.01 × [(307a)…(307e) + (310a)…(310e)] = 40.42 (313)

Cooling System Energy Efficiency Ratio 0 (314)

Space cooling (if there is a fixed cooling system, if not enter 0) = (107) ÷ (314) = 0 (315)

DER WorkSheet: New dwelling design stage

Electricity for pumps and fans within dwelling (Table 4f):			
mechanical ventilation - balanced, extract or positive input from outside		209.23	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	209.23	(331)
Energy for lighting (calculated in Appendix L)		262.98	(332)
Electricity generated by PVs (Appendix M) (negative quantity)		-664.99	(333)
Electricity generated by wind turbine (Appendix M) (negative quantity)		0	(334)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP)						
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				280	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.52	=	749.14	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	20.98	(372)
Total CO2 associated with community systems	(363)...(366) + (368)...(372)			=	770.12	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.52	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				770.12	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	108.59	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	136.49	(379)
Energy saving/generation technologies (333) to (334) as applicable						
Item 1			0.52	x 0.01 =	-345.13	(380)
Total CO2, kg/year	sum of (376)...(382) =				670.06	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				11.62	(384)
EI rating (section 14)					91.25	(385)