Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.12 Printed on 14 December 2020 at 08:05:30

Project Information:

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

Dwelling Details:

**NEW DWELLING DESIGN STAGE** 

Total Floor Area: 48.05m<sup>2</sup>

Site Reference: **Plot Reference:** Green Flat 1 - Base

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: Mains gas

Fuel factor: 1.00 (mains gas)

23.62 kg/m<sup>2</sup> Target Carbon Dioxide Emission Rate (TER)

Dwelling Carbon Dioxide Emission Rate (DER) 38.60 kg/m<sup>2</sup> Fail

Excess emissions = 14.98 kg/m<sup>2</sup> (63.4 %)

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 66.0 kWh/m<sup>2</sup>

109.4 kWh/m<sup>2</sup> Dwelling Fabric Energy Efficiency (DFEE)

Excess energy =  $43.39 \text{ kg/m}^2 (65.7 \%)$ 

Fail

#### 2 Fabric U-values

Element	Average	Highest	
External wall	0.26 (max. 0.30)	0.28 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.22 (max. 0.25)	0.22 (max. 0.70)	OK
Roof	0.18 (max. 0.20)	0.18 (max. 0.35)	OK
Openings	1.60 (max. 2.00)	1.60 (max. 3.30)	OK

#### 2a Thermal bridging

Thermal bridging calculated using user-specified y-value of 0.15

#### 3 Air permeability

Air permeability at 50 pascals 15.00 **OK** 

4 Heating efficiency

Main Heating system: Boiler systems with radiators or underfloor heating - mains gas

Data from manufacturer

Efficiency 86.0 % SEDBUK2009

Minimum 88.0 % Fail

Secondary heating system: None

#### 5 Cylinder insulation

Hot water Storage:

	01/		
	Permitted by DBSCG:	1.89 kWh/day	OK
Primary pipework insulated:	Yes		OK
6 Controls			
Space heating controls	Programmer, room the	ermostat and TRVs	OK
Hot water controls:	Cylinderstat		OK
	Independent timer for I	DHW	ОК
Boiler interlock:	Yes		ОК
7 Low energy lights			
Percentage of fixed lights with lo	ow-energy fittings	75.0%	
Minimum	<i>57</i>	75.0%	OK
8 Mechanical ventilation			
Not applicable			
9 Summertime temperature			
Overheating risk (Thames valley	<b>/</b> ):	Slight	OK
Based on:			
Overshading:		Average or unknown	
Windows facing: South West		4.93m²	
Windows facing: North East		1.35m²	
Windows facing: North West		2.05m²	
Ventilation rate:		3.00	
10 Key features			
Party Walls U-value		0 W/m²K	

		l lser I	Details:											
Assessor Name: Software Name:	Neil Ingham Stroma FSAP 2012		Strom Softwa	are Vei	rsion:			010943 on: 1.0.5.12						
Address :	· ·	Property	Address	Flat 1 -	Base									
	Overall dwelling dimensions:													
		Are	a(m²)		Av. He	ight(m)		Volume(m <sup>3</sup>	3)					
Ground floor			48.05	(1a) x	2	.95	(2a) =	141.75	(3a)					
Total floor area TFA = (1a	a)+(1b)+(1c)+(1d)+(1e)+(1	n) .	48.05	(4)										
Dwelling volume				(3a)+(3b	)+(3c)+(3c	d)+(3e)+	.(3n) =	141.75	(5)					
2. Ventilation rate:														
	main seconda heating heating	ry	other		total			m³ per hou	ır					
Number of chimneys	0 + 0	] + [	0	] = [	0	X 4	40 =	0	(6a)					
Number of open flues	0 + 0	<b>-</b> + [	0	] = [	0	x 2	20 =	0	(6b)					
Number of intermittent fa	ns			Ī	2	x ′	10 =	20	(7a)					
Number of passive vents				Ē	0	x ′	10 =	0	(7b)					
Number of flueless gas fi	res			F	0	X 4	40 =	0	(7c)					
				L										
							Air ch	anges per ho	our					
•	ys, flues and fans = $(6a)+(6b)+(6b)+(6a)+(6b)+(6a)+(6b)+(6a)+(6b)+(6a)+(6b)+(6b)+(6a)+(6b)+(6a)+(6b)+(6a)+(6b)+(6a)+(6b)+(6a)+(6b)+(6a)+(6a)+(6b)+(6a)+(6a)+(6a)+(6a)+(6a)+(6a)+(6a)+(6a$				20		÷ (5) =	0.14	(8)					
Number of storeys in the	een carried out or is intended, proced ne dwelling (ns)	ed to (17),	otherwise (	ontinue tr	om (9) to (	(16)		0	(9)					
Additional infiltration	ie aweimig (ne)					[(9)-	-1]x0.1 =	0	(10)					
Structural infiltration: 0.	25 for steel or timber frame o	r 0.35 fo	r masoni	y constr	uction			0	(11)					
if both types of wall are pri deducting areas of openir	resent, use the value corresponding t	o the grea	ter wall are	a (after										
,	loor, enter 0.2 (unsealed) or (	).1 (seal	ed), else	enter 0				0	(12)					
If no draught lobby, ent	ter 0.05, else enter 0							0	(13)					
Percentage of windows	s and doors draught stripped							0	(14)					
Window infiltration			0.25 - [0.2	. ,	-			0	(15)					
Infiltration rate			(8) + (10)					0	(16)					
•	q50, expressed in cubic metro ity value, then $(18) = [(17) \div 20] +$		•	•	etre of e	envelope	area	15	(17)					
•	s if a pressurisation test has been do				is being u	sed		0.89	(18)					
Number of sides sheltere			,	,	J			0	(19)					
Shelter factor			(20) = 1 -	0.075 x (1	19)] =			1	(20)					
Infiltration rate incorporat	•		(21) = (18	x (20) =				0.89	(21)					
Infiltration rate modified for	<del></del>	1	T .	_	T _	T		1						
L 1	Mar Apr May Jun	Jul	Aug	Sep	Oct	Nov	Dec							
Monthly average wind sp		1 00	1 0.7	4	1 40	1 45	4.7	1						
(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 = $(22a)$ m =	2)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 (allow	ing for sh	nelter an	d wind s	speed) =	(21a) x	(22a)m					
1.14 1.1	1.09	0.98	0.96	0.85	0.85	0.82	0.89	0.96	1	1.05	]	
Calculate effective a	•	rate for t	he appli	cable ca	se		!			!		
If mechanical ver		andiv N. (2	2h) _ (22a	a) Emy (	aguation (I	NEN otho	ruino (22h	s) - (22a)			0	(23a)
								)) = (23a)			0	(23b)
If balanced with heat	-	-	_					OL ) (	(001)	4 (00.)	0	(23c)
a) If balanced me	1	1		i	<del>,                                    </del>	<del>-                                    </del>	<del>í `</del>	<del>,                                    </del>	<del>`                                    </del>	<del>- ` ` `</del>	) ÷ 100] 1	(240)
(24a)m= 0 0	0	0	0	0	0	0	0	0	0	0		(24a)
b) If balanced me					<del>, , `</del>	<del>- ´ `                                  </del>	<del>´ `</del>	<del>, ´ `</del>	<del>-                                    </del>	Ι.,	1	(24b)
(24b)m= 0 0	0	0	0	0	0	0	0	0	0	0		(24b)
c) If whole house if (22b)m < 0.				•				5 v (23k	2)			
(24c)m = 0 0	0	0	0	0	0	0	0	0	)   0	0	1	(24c)
d) If natural ventil				<u> </u>			ļ					(= 15)
if (22b)m = 1,			•	•				0.5]				
(24d)m= 1.14 1.1	1.09	0.98	0.96	0.86	0.86	0.84	0.9	0.96	1	1.05	]	(24d)
Effective air chan	ge rate - er	nter (24a	) or (24k	o) or (24	c) or (24	d) in bo	x (25)		!		•	
(25)m= 1.14 1.1	1.09	0.98	0.96	0.86	0.86	0.84	0.9	0.96	1	1.05	1	(25)
2 Heat leases and	haat laas	poromoto	251									
3. Heat losses and	ross	Openin		Net Ar	200	U-val		ΑXU		k-value	2	AXk
	ea (m²)	operiiri m		A,r		W/m2		(W/		kJ/m².		kJ/K
Doors				1.89	x	1.6	=	3.024				(26)
Windows Type 1				4.93	x1	/[1/( 1.6 )+	0.04] =	7.41				(27)
Windows Type 2				1.35	x1	/[1/( 1.6 )+	0.04] =	2.03				(27)
Windows Type 3				2.05	x1	/[1/( 1.6 )+	0.04] =	3.08				(27)
Floor				48.05	x	0.22		10.571	=			(28)
Walls Type1	32.49	8.33		24.16	=	0.28	<del>-</del>	6.76			<b>-</b>	(29)
\\\\alla T: ::= =0	29.43	1.89	_	27.54	=	0.25		6.88	<b>=</b>			(29)
_, . · ·  =	5.41	0	_	15.41	=	0.18		2.77			<b>-</b>   -	(30)
Total area of eleme					=	0.10		2.11				
	113, 111			125.3	=							(31)
Party wall				45.18	=	0	=	0	[		┥	(32)
Party ceiling	:	- <b>6</b> 6 - 46		32.64		. f	1/5/4/11					(32b)
* for windows and roof w ** include the areas on b					atea using	j tormula 1	/[(1/U-vail	ue)+0.04] a	as given in	ı paragrapı	1 3.2	
Fabric heat loss, W	K = S (A x	U)				(26)(30	) + (32) =				42.54	(33)
Heat capacity Cm =							((28).	(30) + (3	2) + (32a)	(32e) =	12667.	99 (34)
Thermal mass para	meter (TMI	P = Cm ÷	- TFA) ir	n kJ/m²K			Indica	ative Value	: Medium		250	(35)
For design assessments can be used instead of a			construct	ion are no	t known pi	recisely the	e indicative	e values of	TMP in T	able 1f		
Thermal bridges : S			using Ap	pendix I	K						18.81	(36)
if details of thermal bridg				-								`` ′
Total fabric heat los	s						(33) +	- (36) =			61.35	(37)

Ventila	ation hea	at loss ca	alculated	d monthly	y				(38)m	= 0.33 × (	25)m x (5)	1		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	53.15	52.1	51.06	45.86	44.85	40.15	40.15	39.28	41.96	44.85	46.89	48.98		(38)
Heat to	ansfer c	coefficier	nt, W/K	•		•	•	•	(39)m	= (37) + (3	38)m	•		
(39)m=	114.49	113.45	112.41	107.21	106.2	101.5	101.5	100.63	103.31	106.2	108.24	110.33		
Heat lo	oss para	meter (H	HLP), W	/m²K				-		Average = = (39)m ÷	Sum(39) <sub>1</sub> .	12 /12=	107.12	(39)
(40)m=	2.38	2.36	2.34	2.23	2.21	2.11	2.11	2.09	2.15	2.21	2.25	2.3		
Numbe	er of day	s in moi	nth (Tab	le 1a)						Average =	Sum(40) <sub>1</sub>	12 /12=	2.23	(40)
	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. Wa	ater heat	ing ene	rgy requi	irement:								kWh/ye	ear:	
	ned occu											63		(42)
	A > 13.9 A £ 13.9		+ 1.76 x	[1 - exp	(-0.0003	849 x (TF	FA -13.9	)2)] + 0.0	0013 x (	ΓFA -13.	.9)			
Annua	l averag	e hot wa	ater usaç	,	•	•	_	,				2.98		(43)
		-	hot water person per			-	-	to achieve	a water us	se target o	f			
not mon								T .						
Hot wat	Jan er usage in	Feb	Mar day for ea	Apr	May $Vd m = fa$	Jun	Jul Table 1c x	Aug (43)	Sep	Oct	Nov	Dec		
	80.28	77.36	74.44	71.52	68.6	65.68	1	· <i>'</i>	71.52	74.44	77.36	80.28		
(44)m=	60.26	11.30	74.44	71.52	00.0	00.00	65.68	68.6		<u> </u>	m(44) <sub>112</sub> =	l	875.77	(44)
Energy	content of	hot water	used - cal	culated mo	onthly $= 4$ .	190 x Vd,r	n x nm x E	OTm / 3600					675.77	(44)
(45)m=	119.05	104.12	107.45	93.67	89.88	77.56	71.87	82.47	83.46	97.26	106.17	115.29		
If instan	taneous w	ater heatii	ng at point	of use (no	hot water	r storage),	enter 0 in	boxes (46		Total = Su	m(45) <sub>112</sub> =	=	1148.27	(45)
(46)m=	17.86	15.62	16.12	14.05	13.48	11.63	10.78	12.37	12.52	14.59	15.93	17.29		(46)
	storage			•										
•		` ,	includir	•			•		ame ves	sel		150		(47)
Otherv	vise if no	stored	ind no ta hot wate		_			. ,	ers) ente	er '0' in (	47)			
	storage nanufact		eclared I	oss facto	or is kno	wn (kWh	n/dav):					0		(48)
,			m Table		), 10 mil	(	"uay).					0		(49)
•			storage		ear			(48) x (49	) =			50		(50)
			eclared o	-		or is not		(10) // (10	,		1	30		(30)
		_	factor fr		e 2 (kW	h/litre/da	ıy)				0.	.01		(51)
	-	_	ee secti	on 4.3										
Volume factor from Table 2a Temperature factor from Table 2b												93		(52)
								(47) x (51) x (52) x (53) =			0.54			(53)
٠.	(50) or (		storage 55)	;, KVVII/Y6	zai			(41) X (51	, x (32) X (	JJ) =		67 67		(54) (55)
	• •	, ,	culated t	for each	month			((56)m = (	55) × (41)	m	L			(30)
(56)m=	20.88	18.86	20.88	20.2	20.88	20.2	20.88	20.88	20.2	20.88	20.2	20.88		(56)
• ,		<u> </u>	I	I		L	L	<u> </u>	L	<u> </u>	I	l .		, ,

If cylinde	er contains	dedicate	d solar sto	rage, (57)ı	m = (56)m	x [(50) – (	H11)] ÷ (5	0), else (5	7)m = (56)	m where (	H11) is fro	m Append	ix H	
(57)m=	20.88	18.86	20.88	20.2	20.88	20.2	20.88	20.88	20.2	20.88	20.2	20.88		(57)
Primar	v circuit	loss (ar	nual) fro	m Table	3	ļ.	l	ļ.	ļ.	ļ.		0		(58)
	•	•	culated t			59)m = (	(58) ÷ 36	65 × (41)	m					
(mo	dified by	factor f	rom Tab	le H5 if t	here is s	solar wat	er heati	ng and a	cylinde	r thermo	stat)			
(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 cal	culated	for each	month (	(61)m =	(60) ÷ 36	65 × (41)	)m						
(61)m=	0	0	0	0	0	0	0	0	0	0	0	0		(61)
Total h	neat requ	ired for	water he	eating ca	alculated	for eac	h month	(62)m =	0.85 ×	(45)m +	(46)m +	(57)m +	(59)m + (61)m	
(62)m=	163.19	143.99	151.59	136.39	134.02	120.28	116.01	126.62	126.18	141.4	148.89	159.44		(62)
Solar DI	HW input o	alculated	using App	endix G oı	· Appendix	H (negati	ve quantity	/) (enter '0	if no sola	r contribut	ion to wate	er heating)		
(add a	dditional	lines if	FGHRS	and/or \	WWHRS	applies	, see Ap	pendix (	3)					
(63)m=	0	0	0	0	0	0	0	0	0	0	0	0		(63)
Output	t from wa	ater hea	ter											
(64)m=	163.19	143.99	151.59	136.39	134.02	120.28	116.01	126.62	126.18	141.4	148.89	159.44		_
								Outp	out from w	ater heate	r (annual) <sub>1</sub>	12	1667.99	(64)
Heat g	ains fror	n water	heating,	kWh/m	onth 0.2	5 ´ [0.85	× (45)m	+ (61)m	n] + 0.8 x	د [(46)m	+ (57)m	+ (59)m	]	
(65)m=	74.9	66.52	71.04	65.32	65.2	59.96	59.21	62.74	61.92	67.65	69.48	73.65		(65)
inclu	ıde (57)r	n in cal	culation o	of (65)m	only if c	ylinder i	s in the o	dwelling	or hot w	ater is fr	om com	munity h	eating	
5. In	ternal ga	ins (see	Table 5	and 5a	):									
Metab	olic gain	s (Table	5), Wat	ts										
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m=	81.64	81.64	81.64	81.64	81.64	81.64	81.64	81.64	81.64	81.64	81.64	81.64		(66)
Lightin	g gains	(calcula	ted in Ap	pendix	L, equat	ion L9 o	r L9a), a	lso see	Table 5					
(67)m=	16.86	14.98	12.18	9.22	6.89	5.82	6.29	8.17	10.97	13.93	16.26	17.33		(67)
Applia	nces gai	ns (calc	ulated in	Append	dix L, eq	uation L	13 or L1	3a), also	see Ta	ble 5				
(68)m=	142.17	143.65	139.93	132.01	122.02	112.63	106.36	104.89	108.6	116.52	126.51	135.9		(68)
Cookir	ng gains	(calcula	ted in A	ppendix	L, equat	tion L15	or L15a)	), also se	ee Table	5				
(69)m=	31.16	31.16	31.16	31.16	31.16	31.16	31.16	31.16	31.16	31.16	31.16	31.16		(69)
Pumps	s and far	ns gains	(Table 5	āa)										
(70)m=	3	3	3	3	3	3	3	3	3	3	3	3		(70)
Losses	s e.g. ev	aporatio	n (nega	tive valu	es) (Tab	le 5)								
(71)m=	-65.31	-65.31	-65.31	-65.31	-65.31	-65.31	-65.31	-65.31	-65.31	-65.31	-65.31	-65.31		(71)
Water	heating	gains (T	able 5)											
(72)m=	100.67	98.98	95.48	90.72	87.63	83.28	79.58	84.32	86.01	90.93	96.49	98.99		(72)
Total i	internal	gains =	ŀ			(66)	m + (67)m	n + (68)m -	+ (69)m +	(70)m + (7	1)m + (72)	m		
(73)m=	310.2	308.1	298.08	282.45	267.04	252.23	242.73	247.87	256.07	271.87	289.75	302.71		(73)
6. So	lar gains	i.												
Solar (	gains are c	alculated	using sola	r flux from	Table 6a	and assoc	iated equa	itions to co	onvert to th	e applicab	ole orientat	ion.		
	ation: A			Area		Flu					FF			

Table 6a

Table 6b

Table 6c

m²

Table 6d

(W)

		, ,		ı		,						_
Northeast <sub>0.9x</sub>	0.3	X	1.35	X	11.28	X	0.63	×	0.7	=	1.81	(75)
Northeast <sub>0.9x</sub>	0.3	X	1.35	X	22.97	X	0.63	X	0.7	=	3.69	(75)
Northeast <sub>0.9x</sub>	0.3	X	1.35	X	41.38	X	0.63	X	0.7	=	6.65	(75)
Northeast <sub>0.9x</sub>	0.3	X	1.35	X	67.96	X	0.63	X	0.7	=	10.92	(75)
Northeast <sub>0.9x</sub>	0.3	X	1.35	X	91.35	X	0.63	X	0.7	=	14.68	(75)
Northeast <sub>0.9x</sub>	0.3	X	1.35	X	97.38	X	0.63	x	0.7	=	15.65	(75)
Northeast 0.9x	0.3	x	1.35	X	91.1	X	0.63	X	0.7	=	14.64	(75)
Northeast <sub>0.9x</sub>	0.3	×	1.35	x	72.63	X	0.63	x	0.7	= [	11.67	(75)
Northeast <sub>0.9x</sub>	0.3	x	1.35	x	50.42	x	0.63	x	0.7	=	8.1	(75)
Northeast 0.9x	0.3	x	1.35	x	28.07	x	0.63	x	0.7	=	4.51	(75)
Northeast <sub>0.9x</sub>	0.3	x	1.35	x	14.2	X	0.63	x	0.7	=	2.28	(75)
Northeast <sub>0.9x</sub>	0.3	X	1.35	х	9.21	х	0.63	X	0.7	=	1.48	(75)
Southwest <sub>0.9x</sub>	0.77	x	4.93	x	36.79	]	0.63	x	0.7	=	55.44	(79)
Southwest <sub>0.9x</sub>	0.77	X	4.93	x	62.67	]	0.63	x	0.7	=	94.43	(79)
Southwest <sub>0.9x</sub>	0.77	x	4.93	x	85.75	ĺ	0.63	×	0.7	<b>=</b>	129.2	(79)
Southwest <sub>0.9x</sub>	0.77	x	4.93	x	106.25	Ī	0.63	x	0.7	_ = [	160.09	(79)
Southwest <sub>0.9x</sub>	0.77	X	4.93	x	119.01	ĺ	0.63	x	0.7	<u> </u>	179.31	(79)
Southwest <sub>0.9x</sub>	0.77	x	4.93	x	118.15	ĺ	0.63	×	0.7	<b>=</b>	178.01	(79)
Southwest <sub>0.9x</sub>	0.77	X	4.93	x	113.91	ĺ	0.63	_ x [	0.7	<del>=</del>	171.62	(79)
Southwest <sub>0.9x</sub>	0.77	X	4.93	x	104.39	ĺ	0.63	x	0.7	=	157.28	(79)
Southwest <sub>0.9x</sub>	0.77	x	4.93	x	92.85	ĺ	0.63	×	0.7	<b>=</b>	139.9	(79)
Southwest <sub>0.9x</sub>	0.77	X	4.93	x	69.27	Ī	0.63	x	0.7	<u> </u>	104.36	(79)
Southwest <sub>0.9x</sub>	0.77	X	4.93	х	44.07	]	0.63	x	0.7	=	66.4	(79)
Southwest <sub>0.9x</sub>	0.77	X	4.93	x	31.49	]	0.63	x	0.7	=	47.44	(79)
Northwest <sub>0.9x</sub>	0.3	X	2.05	x	11.28	x	0.63	x [	0.7	=	2.75	(81)
Northwest 0.9x	0.3	X	2.05	x	22.97	X	0.63	x	0.7	=	5.61	(81)
Northwest <sub>0.9x</sub>	0.3	X	2.05	X	41.38	X	0.63	X	0.7	=	10.1	(81)
Northwest <sub>0.9x</sub>	0.3	X	2.05	X	67.96	X	0.63	×	0.7	=	16.59	(81)
Northwest <sub>0.9x</sub>	0.3	X	2.05	x	91.35	X	0.63	X	0.7	=	22.3	(81)
Northwest 0.9x	0.3	X	2.05	x	97.38	X	0.63	x [	0.7	=	23.77	(81)
Northwest 0.9x	0.3	X	2.05	x	91.1	X	0.63	x	0.7	=	22.24	(81)
Northwest <sub>0.9x</sub>	0.3	X	2.05	X	72.63	X	0.63	x	0.7	=	17.73	(81)
Northwest 0.9x	0.3	X	2.05	X	50.42	X	0.63	x [	0.7	= [	12.31	(81)
Northwest <sub>0.9x</sub>	0.3	X	2.05	x	28.07	x	0.63	x [	0.7	= [	6.85	(81)
Northwest <sub>0.9x</sub>	0.3	X	2.05	X	14.2	X	0.63	x	0.7	= [	3.47	(81)
Northwest <sub>0.9x</sub>	0.3	X	2.05	X	9.21	X	0.63	X	0.7	=	2.25	(81)
Solar gains in w					47.44 000.54		= Sum(74)m.		T 70.45	54.47		(02)
(83)m= 60 Total gains – int		5.95 solar	187.6 216.29		17.44 208.51	186	.68   160.31	115.73	72.15	51.17		(83)
		4.04	470.05 483.3	<u> </u>	69.67 451.23	434	.56 416.38	387.6	361.9	353.88		(84)
` '			I		701.20	I 734	.00   710.00	307.0	1 301.9	000.00		(0 1)
7. Mean intern		•			oroo from T-1	ole O	Th4 (90)					(05)
Temperature of	•	•		•		oie 9	ini (°C)				21	(85)
Utilisation facto	<del></del>	$\overline{}$		Ť	<del></del>	Λ.	ug Sep	Oct	Nov	Dec		
Stroma FSAP 2012	Version! 1.d.	<u> 592 (S</u>	SAPP.192] - http://	Ww.	stromal.com <sup>ui</sup>	^	ug Sep	OCI	INOV	Dec	Page	5 of 7

(86)m=	0.99	0.99	0.98	0.97	0.94	0.87	0.76	0.79	0.91	0.97	0.99	0.99		(86)
Mean	internal	temper	ature in	living are	ea T1 (fc	ollow ste	ps 3 to 7	in Table	e 9c)				'	
(87)m=	18.54	18.73	19.08	19.63	20.13	20.6	20.83	20.8	20.45	19.81	19.13	18.57		(87)
Temp	erature	during h	eating p	eriods ir	rest of	dwelling	from Ta	ble 9, Ti	 h2 (°C)				1	
(88)m=	19.09	19.1	19.12	19.18	19.2	19.26	19.26	19.27	19.24	19.2	19.17	19.14		(88)
Utilisa	tion fac	tor for g	ains for	rest of d	welling, l	h2,m (se	e Table	9a)	•				1	
(89)m=	0.99	0.99	0.98	0.96	0.9	0.76	0.55	0.59	0.84	0.96	0.99	0.99		(89)
Mean	internal	temper	ature in	the rest	of dwelli	ng T2 (fo	ollow ste	eps 3 to 7	7 in Tabl	e 9c)			ı	
(90)m=	16.97	17.17	17.54	18.12	18.61	19.07	19.22	19.22	18.94	18.31	17.62	17.05		(90)
•									f	LA = Livin	g area ÷ (4	4) =	0.56	(91)
Mean	internal	temper	ature (fo	r the wh	ole dwel	lling) = fl	LA × T1	+ (1 – fL	A) × T2			!		_
(92)m=	17.85	18.05	18.41	18.97	19.46	19.93	20.12	20.11	19.79	19.15	18.47	17.9		(92)
Apply	adjustn	nent to t	ne mean	internal	tempera	ature fro	m Table	4e, whe	ere appro	priate				
(93)m=	17.85	18.05	18.41	18.97	19.46	19.93	20.12	20.11	19.79	19.15	18.47	17.9		(93)
8. Spa	ace hea	ting requ	uirement											
				•		ed at ste	ep 11 of	Table 9	b, so tha	t Ti,m=(	76)m an	d re-calc	ulate	
ine ui	Jan	Feb	Mar	using Ta Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	1	
l Utilisa	!		ains, hm	<u> </u>	iviay	Juli	Jui	Aug	Sep	Oct	INOV	Dec		
(94)m=	0.99	0.98	0.97	0.95	0.91	0.81	0.67	0.7	0.87	0.96	0.98	0.99	İ	(94)
Usefu	I I gains,	hmGm .	W = (94)	4)m x (84	4)m									
(95)m=	366.03	405.19	432.81	448.73	440.18	381.45	300.9	304.81	362.59	371.17	355.79	350.48		(95)
Month	nly avera	age exte	rnal tem	perature	from Ta	able 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)
Ī	1			al tempe	erature, l		<del>-`` /-</del>	x [(93)m	<u> </u>	ī			Ī	
` '	1551.64		1338.49		824.41	540.93	357.64	373.03	587.76	908.38		1511.96		(97)
· .	e heating 882.1	<u> </u>	ement fo 673.82	r each m	nonth, k\ 285.87	Wh/mont	$\frac{1}{0} = 0.02$	24 x [(97)	)m − (95 l	)m] x (4 399.69	<u> </u>	864.14	1	
(98)m=	882.1	730.17	673.82	454.01	285.87	0	U				630.26		4020.06	(98)
•					.,			Tota	ll per year	(KWII/yeai	) = Sum(9	<b>6)</b> 15,912 =	4920.06	╣`
Space	e heating	g require	ement in	kWh/m²	/year								102.39	(99)
			nts – Indi	ividual h	eating sy	ystems i	ncluding	micro-C	CHP)					
•	e heatin	_	ot from o	ooondon	/ounnio	montory	ovotom							7(201)
	•			econdar		mentary	•	(202) 4	(204)				0	(201)
	•			nain syst	. ,			(202) = 1 -		(200)]			1	(202)
			_	main sys				(204) = (204)	02) <b>x</b> [1 –	(203)] =			1	(204)
	•	•		ing syste									86.9	(206)
Efficie	ency of s	econda	ry/suppl	ementar	y heating	g system	າ, %					_	0	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/ye	ar
Space	i	· ·		alculate	i i				ı	1		ı	I	
	882.1	730.17	673.82	454.01	285.87	0	0	0	0	399.69	630.26	864.14		
(211)m				00 ÷ (20						1		ı	I	(211)
	1015.07	840.24	775.4	522.45	328.97	0	0	0 Tata	0	459.94	725.27	994.41		<b>7</b>
								rota	ıl (kWh/yea	ai) =0um(2	2 1 1) <sub>15,1012</sub>	2=	5661.75	(211)

Space heating fuel (secondary), kWh/month								
= {[(98)m x (201)] } x 100 ÷ (208)								
(215)m= 0 0 0 0 0	0 0	0	0	0	0	0		
		Total (F	kWh/year	r) =Sum(2	<sub>5,1012</sub>	F	0	(215)
Water heating								
Output from water heater (calculated above)  163.19	20.28 116.01	126.62 1	126.18	141.4	148.89	159.44	1	
Efficiency of water heater		10.0_					76.8	(216)
· · · · · · · · · · · · · · · · · · ·	76.8 76.8	76.8	76.8	84.01	84.77	85.16		」 (217)
Fuel for water heating, kWh/month		!						
$(219)$ m = $(64)$ m x $100 \div (217)$ m (219)m = $191.65$ $169.29$ $178.65$ $161.72$ $160.7$ $1$	56.61 151.06	164.86 1	164.29	168.31	175.64	187.23	1	
(213)11-131.33 103.23 170.33 101.72 100.7	30.01 131.00		Sum(219		170.04	107.20	2030.01	(219)
Annual totals					Nh/year	•	kWh/year	_(= : = /
Space heating fuel used, main system 1					-		5661.75	]
Water heating fuel used							2030.01	7
Electricity for pumps, fans and electric keep-hot								_
central heating pump:						30	]	(230c)
boiler with a fan-assisted flue						45	]	(230e)
Total electricity for the above, kWh/year		sum of	(230a)	.(230g) =			75	(231)
Electricity for lighting							297.81	(232)
12a. CO2 emissions – Individual heating system	s including m	icro-CHP						
	<b>Energy</b> kWh/year			<b>Emiss</b> i kg CO2	<b>ion fac</b> 2/kWh	tor	Emissions kg CO2/yea	ır
Space heating (main system 1)	(211) x		[	0.21	16	=	1222.94	(261)
Space heating (secondary)	(215) x		[	0.51	19	=	0	(263)
Water heating	(219) x		[	0.21	16	=	438.48	(264)
Space and water heating	(261) + (262)	+ (263) + (26	64) =				1661.42	(265)
Electricity for pumps, fans and electric keep-hot	(231) x			0.51	19	=	38.93	(267)
Electricity for lighting	(232) x		[	0.51	19	=	154.56	(268)
Total CO2, kg/year			sum of	(265)(2	271) =		1854.91	(272)
Dwelling CO2 Emission Rate			(272) ÷	(4) =			38.6	(273)

El rating (section 14)

(274)

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.12 Printed on 14 December 2020 at 08:05:28

Proiect Information:

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

Dwelling Details:

**NEW DWELLING DESIGN STAGE**Total Floor Area: 45.55m<sup>2</sup>

Site Reference: Green Plot Reference: Flat 2 - Base

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: Mains gas

Fuel factor: 1.00 (mains gas)

Target Carbon Dioxide Emission Rate (TER) 23.62 kg/m<sup>2</sup>

Dwelling Carbon Dioxide Emission Rate (DER) 38.87 kg/m<sup>2</sup> Fail

Excess emissions = 15.25 kg/m<sup>2</sup> (64.6 %)

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 64.2 kWh/m<sup>2</sup>

Dwelling Fabric Energy Efficiency (DFEE) 109.1 kWh/m²

Excess energy =  $44.92 \text{ kg/m}^2 (70.0 \%)$ 

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.28 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.22 (max. 0.25)	0.22 (max. 0.70)	OK
Roof	0.18 (max. 0.20)	0.18 (max. 0.35)	OK
Openings	1.60 (max. 2.00)	1.60 (max. 3.30)	OK

#### 2a Thermal bridging

Thermal bridging calculated using user-specified y-value of 0.15

3 Air permeability

Air permeability at 50 pascals 15.00 **OK** 

4 Heating efficiency

Main Heating system: Boiler systems with radiators or underfloor heating - mains gas

Data from manufacturer

Efficiency 86.0 % SEDBUK2009

Minimum 88.0 % Fail

Secondary heating system: None

#### 5 Cylinder insulation

Hot water Storage:

Fail

	Permitted by DBSCG:	1.89 kWh/day	OK
Primary pipework insulated:	Yes		OK
6 Controls			
Space heating controls	Programmer, room the	ermostat and TRVs	ОК
Hot water controls:	Cylinderstat		OK
	Independent timer for	DHW	OK
Boiler interlock:	Yes		ОК
7 Low energy lights			
Percentage of fixed lights with I	ow-energy fittings	75.0%	
Minimum		75.0%	OK
8 Mechanical ventilation			
Not applicable			
9 Summertime temperature			
Overheating risk (Thames valle	y):	Slight	OK
Based on:			
Overshading:		Average or unknown	
Windows facing: South West		4.09m²	
Windows facing: North East		0.81m²	
Windows facing: South East		2.05m²	
Ventilation rate:		3.00	
10 Key features			
Party Walls U-value		0 W/m²K	

		Hear	Details:						
A Nove -	Na il la ala ava	USEI		. NI	I		CTDO	040040	
Assessor Name: Software Name:	Neil Ingham Stroma FSAP 2012		Stroma Softwa	-				010943 on: 1.0.5.12	
Contware Hame.	01101110110111 2012	Property	Address:				V 01010	71. 1.0.0.12	
Address :		' '							
1. Overall dwelling dime	ensions:								
Ground floor			ea(m²)	(4.5)		ight(m)	<b>1</b> (0-)	Volume(m <sup>3</sup>	<u>-</u>
	\			(1a) x	2	.95	(2a) =	134.37	(3a)
Total floor area TFA = (1	a)+(1b)+(1c)+(1d)+(1e)+	(1n)	45.55	(4)					_
Dwelling volume				(3a)+(3b	)+(3c)+(3c	d)+(3e)+	.(3n) =	134.37	(5)
2. Ventilation rate:	main sec	ondary	other		total			m³ per hou	ır
N. arkana Callana	heating hea	iting		, ,			40		_
Number of chimneys	0 +	0 +	0	] = [	0		40 =	0	(6a)
Number of open flues	0 +	0 +	0	] = [	0		20 =	0	(6b)
Number of intermittent fa				L	2	X '	10 =	20	(7a)
Number of passive vents					0	X '	10 =	0	(7b)
Number of flueless gas fi	res				0	X 4	40 =	0	(7c)
							Air ch	anges per ho	our
Infiltration due to chimne	vs_flues and fans = (6a)+	·(6b)+(7a)+(7b)+	·(7c) =	Г	20		÷ (5) =	0.15	(8)
•	peen carried out or is intended,			ontinue fr			. (0) =	0.15	(0)
Number of storeys in the	he dwelling (ns)							0	(9)
Additional infiltration						[(9)	-1]x0.1 =	0	(10)
	.25 for steel or timber fra resent, use the value correspon			•	uction			0	(11)
deducting areas of openii		iding to the grea	iter wan ared	a (anter					
If suspended wooden f	floor, enter 0.2 (unsealed	) or 0.1 (seal	ed), else	enter 0				0	(12)
If no draught lobby, en								0	(13)
ŭ	s and doors draught strip	ped						0	(14)
Window infiltration			0.25 - [0.2		_	. (45)		0	(15)
Infiltration rate	250 averaged in autic		(8) + (10) -	, , ,	, , ,	, ,		0	(16)
If based on air permeabil	q50, expressed in cubic	•	•	•	etre of e	envelope	area	15	(17)
•	es if a pressurisation test has be				is beina u	sed		0.9	(18)
Number of sides sheltere			. g	,				0	(19)
Shelter factor			(20) = 1 - [	0.075 x (1	19)] =			1	(20)
Infiltration rate incorporat	ting shelter factor		(21) = (18)	x (20) =				0.9	(21)
Infiltration rate modified f	or monthly wind speed								
Jan Feb	Mar Apr May	Jun Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind sp	eed 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 = (2	2)m ∸ 4								
	<del></del>	0.95 0.95	0.92	1	1.08	1.12	1.18		
· · · — — — — — — — — — — — — — — — — —					<u> </u>	<u> </u>	<u> </u>	J	

Adjusted infiltra	tion rate (allow	ing for she	elter an	d wind s	peed) =	(21a) x	(22a)m					
1.15	1.12 1.1	0.99	0.97	0.85	0.85	0.83	0.9	0.97	1.01	1.06		
Calculate effect	•	rate for th	e appli	cable ca	se		!				·	1, ,
If mechanical	i ventilation: at pump using App	endiv N (23	h) - (23a	a) × Emy (e	auation (1	(15)) othe	rwica (23h	) = (232)			0	(23a)
	heat recovery: effic							) = (23a)			0	(23b)
		-	_					2h\ /	00h) [/	4 (OOs)	0 . 4001	(23c)
· ·	d mechanical ve	entilation v	with nea	at recove	ery (IVIVI	1R) (248	$\frac{1}{1} = \frac{2}{2}$	2b)m + ( <i>i</i>	23b) × [*	1 – (23c) 1 0	i ÷ 100] I	(24a)
( 27)												(244)
(24b)m= 0	d mechanical ve		o vitriout	neat rec	overy (r	0	0	0	230)	0	1	(24b)
		ļļ.		<u> </u>					0			(2.15)
,	ouse extract ver $< 0.5 \times (23b)$ ,		•	•				.5 × (23b	))			
(24c)m= 0	0 0	0	0	0	0	0	0	0	0	0		(24c)
	entilation or wh	nole house	e positiv	/e input	ventilatio	on from	oft			<u> </u>	l	
	= 1, then (24d)							0.5]			_	
(24d)m= 1.15	1.12 1.1	0.99	0.97	0.86	0.86	0.85	0.9	0.97	1.01	1.06		(24d)
Effective air o	change rate - e	nter (24a)	or (24b	o) or (24	c) or (24	d) in bo	x (25)				_	
(25)m= 1.15	1.12 1.1	0.99	0.97	0.86	0.86	0.85	0.9	0.97	1.01	1.06		(25)
3. Heat losses	and heat loss	paramete	r:									
ELEMENT	Gross area (m²)	Opening m <sup>2</sup>	js	Net Ar A ,r		U-val W/m2		A X U (W/I	<b>〈</b> )	k-value kJ/m²-l		A X k kJ/K
Doors	aroa (m.)	•••		1.89		1.6	 	3.024	, 	10/111		(26)
Windows Type	1			4.09	=	/[1/( 1.6 )+	!	6.15	╡			(27)
Windows Type				0.81	=	·	l l	1.22	=			(27)
Windows Type				2.05	_		l.	3.08	=			(27)
Floor				45.55	= "	0.22		10.021	=			(28)
Walls Type1	25.05	6.05	$\neg$		=				믁 ¦		╡	(29)
Walls Type2	35.85	6.95	=	28.9	=	0.28	=	8.09	북 片		╡	
Roof	28.18	1.89	=	26.29	=	0.25	=	6.57	亅 ¦		╡	(29)
	15.42	0		15.42	2 <u> </u>	0.18	= [	2.78				(30)
Total area of ele	ements, m-			125	=							(31)
Party wall				39.18	=	0	=	0			_	(32)
Party ceiling		- M 1		30.14		. (	15/4/11	) 0.041				(32b)
* for windows and r  ** include the areas					atea using	i tormula 1	/[(1/U-vail	ie)+0.04j a	is given in	paragrapr	1 3.2	
Fabric heat loss	s, W/K = S (A x	U)				(26)(30	) + (32) =				40.93	(33)
Heat capacity C							((28)	(30) + (32	2) + (32a).	(32e) =	12107.4	18 (34)
Thermal mass p	parameter (TMI	P = Cm ÷	TFA) ir	n kJ/m²K			Indica	tive Value:	: Medium		250	(35)
For design assessn			constructi	ion are no	t known pr	ecisely the	e indicative	values of	TMP in Ta	able 1f		
Thermal bridges			sing Ap	pendix I	<						18.75	(36)
if details of thermal				-								
Total fabric hea	it loss						(33) +	(36) =			59.68	(37)

Ventila	ition hea	at loss ca	alculated	l monthly	y				(38)m	= 0.33 × (	25)m x (5)	ı		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	50.82	49.82	48.83	43.85	42.87	38.34	38.34	37.5	40.08	42.87	44.84	46.83		(38)
Heat tr	ansfer c	oefficier	nt, W/K						(39)m	= (37) + (3	38)m			
(39)m=	110.5	109.51	108.51	103.53	102.56	98.02	98.02	97.18	99.77	102.56	104.52	106.52		
Heat Id	oss para	meter (H	HLP), W/	m²K				-		Average = = (39)m ÷		12 /12=	103.43	(39)
(40)m=	2.43	2.4	2.38	2.27	2.25	2.15	2.15	2.13	2.19	2.25	2.29	2.34		
Numbe	er of day	s in moi	nth (Tab	le 1a)						Average =	Sum(40) <sub>1</sub>	12 /12=	2.27	(40)
	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. Wa	iter heat	ing ene	rgy requi	irement:								kWh/ye	ear:	
		ıpancy, l										56		(42)
	A > 13.9 A £ 13.9		+ 1.76 x	[1 - exp	(-0.0003	849 x (TF	FA -13.9	)2)] + 0.0	0013 x (	ΓFA -13.	9)			
			ater usag hot water	,	•	•	_	` ,		o target e		.26		(43)
		-	not water person per	• •		-	-	io acriieve	a water ut	se largel o	1			
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot wate			day for ea	<u> </u>					ОСР	001	1101	DCC		
(44)m=	78.39	75.54	72.68	69.83	66.98	64.13	64.13	66.98	69.83	72.68	75.54	78.39		
` '								ļ		Total = Su	m(44) <sub>112</sub> =	! =	855.11	(44)
Energy o	content of	hot water	used - cal	culated mo	onthly $= 4$ .	190 x Vd,r	n x nm x E	OTm / 3600	) kWh/mor	nth (see Ta	bles 1b, 1	c, 1d)		_
(45)m=	116.24	101.67	104.91	91.46	87.76	75.73	70.18	80.53	81.49	94.97	103.67	112.58		
If instant	taneous w	ater heatii	ng at point	of use (no	hot water	r storage),	enter 0 in	boxes (46		Γotal = Su	m(45) <sub>112</sub> =	=	1121.19	(45)
(46)m=	17.44	15.25	15.74	13.72	13.16	11.36	10.53	12.08	12.22	14.25	15.55	16.89		(46)
	storage													
•		` ,	includin	•			•		ame ves	sel		150		(47)
Otherw	vise if no	stored	ind no ta hot wate		_			. ,	ers) ente	er '0' in (	47)			
	storage		eclared l	occ foct	or ic kno	wo (k\\/k	2/d2x/):							(40)
•					טווא פו וכ	wii (Kvvi	i/uay).					0		(48)
•			m Table					(48) x (49)	\ _			0		(49)
			storage eclared o	-		or is not		(40) X (49)	, =		1	50		(50)
•			factor fr	-							0.	.01		(51)
	-	_	ee secti	on 4.3										
		from Ta		Ol-								.93		(52)
			m Table					(4=)	(50)	<b>5</b> 0)		54		(53)
•		m water [54) in (5	storage	, KVVh/ye	ear			(47) x (51)	) x (52) x (	53) =	-	67		(54)
	` ,	, ,	ວງ culated f	for each	month			((56)m = (	55) × (41)	m	0.	67		(55)
(56)m=	20.88	18.86	20.88	20.2	20.88	20.2	20.88	20.88	20.2	20.88	20.2	20.88		(56)
(30)111=	20.00	10.00	20.00	20.2	20.00		20.00	20.00	20.2	20.00	20.2	20.00		(30)

If cylinder contain	ns dedicate	d solar sto	rage, (57)	m = (56)m	x [(50) – (	[H11)] ÷ (5	0), else (5	7)m = (56)	m where (	(H11) is fro	om Append	lix H	
(57)m= 20.88	18.86	20.88	20.2	20.88	20.2	20.88	20.88	20.2	20.88	20.2	20.88		(57)
Primary circuit	t loss (ar	nual) fro	m Table	 e 3	!	!	!	!	!	<u>'</u>	0		(58)
Primary circuit	`	,			59)m = (	(58) ÷ 36	65 × (41)	m				•	
(modified b	y factor f	rom Tab	le H5 if t	here is s	solar wat	ter heati	ng and a	cylinde	r thermo	stat)			
(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 ca	alculated	for each	month	(61)m =	(60) ÷ 36	65 × (41)	)m						
(61)m= 0	0	0	0	0	0	0	0	0	0	0	0		(61)
Total heat red	uired for	water h	eating ca	alculated	for eacl	h month	(62)m =	0.85 ×	(45)m +	(46)m +	(57)m +	(59)m + (61)m	
(62)m= 160.38	141.54	149.05	134.18	131.9	118.45	114.32	124.67	124.21	139.11	146.38	156.72		(62)
Solar DHW input	calculated	using App	endix G o	r Appendix	H (negati	ve quantity	/) (enter '0	if no sola	r contribut	ion to wate	er heating)	•	
(add additiona	al lines if	FGHRS	and/or \	<b>WHRS</b>	applies	, see Ap	pendix (	3)					
(63)m= 0	0	0	0	0	0	0	0	0	0	0	0		(63)
Output from v	vater hea	iter	-	-	-	-	-	-	-	-			
(64)m= 160.38	141.54	149.05	134.18	131.9	118.45	114.32	124.67	124.21	139.11	146.38	156.72		
							Outp	out from w	ater heate	r (annual)	112	1640.91	(64)
Heat gains fro	om water	heating,	kWh/m	onth 0.2	5 ´ [0.85	× (45)m	+ (61)m	n] + 0.8 x	k [(46)m	+ (57)m	+ (59)m	]	
(65)m= 73.96	65.7	70.2	64.59	64.49	59.35	58.65	62.09	61.27	66.89	68.64	72.74		(65)
include (57	m in cal	culation of	of (65)m	only if c	ylinder i	s in the	dwelling	or hot w	ater is fı	om com	munity h	leating	
5. Internal g	ains (se	e Table 5	and 5a	):									
Metabolic gai	ns (Table	e 5). Wat	ts										
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m= 78.02	78.02	78.02	78.02	78.02	78.02	78.02	78.02	78.02	78.02	78.02	78.02		(66)
Lighting gains	(calcula	ted in Ap	pendix	L, equat	ion L9 o	r L9a), a	lso see	Table 5	•	•	•		
(67)m= 16.09	14.29	11.62	8.8	6.58	5.55	6	7.8	10.47	13.29	15.51	16.54		(67)
Appliances ga	ains (calc	ulated ir	Append	dix L, eq	uation L	13 or L1	3a), also	see Ta	ble 5			•	
(68)m= 135.7	137.11	133.56	126	116.47	107.51	101.52	100.11	103.66	111.21	120.75	129.71		(68)
Cooking gains	s (calcula	ated in A	ppendix	L, equat	tion L15	or L15a	), also se	ee Table	5				
(69)m= 30.8	30.8	30.8	30.8	30.8	30.8	30.8	30.8	30.8	30.8	30.8	30.8		(69)
Pumps and fa	ans gains	(Table 5	 5a)	Į.	Į.	!	Į.	!	!				
(70)m= 3	3	3	3	3	3	3	3	3	3	3	3		(70)
Losses e.g. e	vaporatio	n (nega	tive valu	es) (Tab	le 5)		Į.						
(71)m= -62.42	-62.42	-62.42	-62.42	-62.42	-62.42	-62.42	-62.42	-62.42	-62.42	-62.42	-62.42		(71)
Water heating	g gains (T	rable 5)				•		•	•	•		•	
(72)m= 99.41	97.77	94.35	89.7	86.68	82.44	78.83	83.45	85.1	89.91	95.34	97.77		(72)
Total interna	Laoine -		•	•	(66)	)m + (67)m	n + (68)m -	+ (69)m +	(70)m + (7	(1)m + (72)	)m	•	
	ı yanıs =	•											
(73)m= 300.61	<del></del>	288.94	273.91	259.14	244.9	235.75	240.77	248.63	263.82	281	293.43		(73)
	298.57		273.91	259.14	244.9		240.77	248.63	263.82	281			(73)
(73)m= 300.61	298.57	288.94				235.75					293.43		(73)

Table 6a

Table 6b

Table 6c

m²

Table 6d

(W)

		, ,								_		_
Northeast <sub>0.9x</sub>	0.3	X	0.81	X	11.28	X	0.63	X	0.7	=	1.09	(75)
Northeast <sub>0.9x</sub>	0.3	X	0.81	X	22.97	X	0.63	X	0.7	=	2.22	(75)
Northeast <sub>0.9x</sub>	0.3	X	0.81	X	41.38	X	0.63	X	0.7	=	3.99	(75)
Northeast <sub>0.9x</sub>	0.3	X	0.81	X	67.96	X	0.63	X	0.7	=	6.55	(75)
Northeast <sub>0.9x</sub>	0.3	X	0.81	x	91.35	X	0.63	x	0.7	=	8.81	(75)
Northeast <sub>0.9x</sub>	0.3	X	0.81	X	97.38	X	0.63	X	0.7	=	9.39	(75)
Northeast 0.9x	0.3	X	0.81	x	91.1	x	0.63	x	0.7	=	8.79	(75)
Northeast <sub>0.9x</sub>	0.3	X	0.81	x	72.63	x	0.63	x	0.7	=	7	(75)
Northeast <sub>0.9x</sub>	0.3	X	0.81	x	50.42	х	0.63	x	0.7	=	4.86	(75)
Northeast 0.9x	0.3	x	0.81	x	28.07	x	0.63	x	0.7	=	2.71	(75)
Northeast <sub>0.9x</sub>	0.3	x	0.81	x	14.2	x	0.63	x	0.7	_ =	1.37	(75)
Northeast <sub>0.9x</sub>	0.3	x	0.81	x	9.21	x	0.63	×	0.7	=	0.89	(75)
Southeast 0.9x	0.77	x	2.05	x	36.79	x	0.63	X	0.7	=	23.05	(77)
Southeast 0.9x	0.77	x	2.05	x	62.67	x	0.63	x	0.7	_ =	39.27	(77)
Southeast 0.9x	0.77	x	2.05	x	85.75	x	0.63	×	0.7	=	53.72	(77)
Southeast 0.9x	0.77	x	2.05	x	106.25	x	0.63	X	0.7	=	66.57	(77)
Southeast 0.9x	0.77	x	2.05	x	119.01	x	0.63	x	0.7	=	74.56	(77)
Southeast 0.9x	0.77	x	2.05	x	118.15	x	0.63	×	0.7	=	74.02	(77)
Southeast 0.9x	0.77	x	2.05	x	113.91	x	0.63	X	0.7	=	71.36	(77)
Southeast 0.9x	0.77	x	2.05	x	104.39	x	0.63	x	0.7	=	65.4	(77)
Southeast 0.9x	0.77	x	2.05	x	92.85	x	0.63	×	0.7	=	58.17	(77)
Southeast 0.9x	0.77	x	2.05	x	69.27	x	0.63	x	0.7	=	43.4	(77)
Southeast 0.9x	0.77	x	2.05	x	44.07	x	0.63	x	0.7	=	27.61	(77)
Southeast 0.9x	0.77	x	2.05	x	31.49	x	0.63	×	0.7	=	19.73	(77)
Southwest <sub>0.9x</sub>	0.77	x	4.09	x	36.79	ĺ	0.63	×	0.7	<del>=</del>	45.99	(79)
Southwest <sub>0.9x</sub>	0.77	x	4.09	x	62.67	Ì	0.63	x	0.7	_ =	78.34	(79)
Southwest <sub>0.9x</sub>	0.77	x	4.09	x	85.75	ĺ	0.63	x	0.7	=	107.19	(79)
Southwest <sub>0.9x</sub>	0.77	x	4.09	x	106.25		0.63	x	0.7	=	132.81	(79)
Southwest <sub>0.9x</sub>	0.77	x	4.09	x	119.01		0.63	x	0.7	=	148.76	(79)
Southwest <sub>0.9x</sub>	0.77	x	4.09	x	118.15		0.63	x	0.7	=	147.68	(79)
Southwest <sub>0.9x</sub>	0.77	X	4.09	x	113.91		0.63	x	0.7	=	142.38	(79)
Southwest <sub>0.9x</sub>	0.77	x	4.09	x	104.39	ĺ	0.63	x	0.7	=	130.48	(79)
Southwest <sub>0.9x</sub>	0.77	x	4.09	x	92.85		0.63	x	0.7	=	116.06	(79)
Southwest <sub>0.9x</sub>	0.77	x	4.09	x	69.27	Ì	0.63	×	0.7	_ =	86.58	(79)
Southwest <sub>0.9x</sub>	0.77	x	4.09	x	44.07	ĺ	0.63	×	0.7	<u> </u>	55.09	(79)
Southwest <sub>0.9x</sub>	0.77	x	4.09	x	31.49	ĺ	0.63	X	0.7	=	39.36	(79)
_				-								_
Solar gains in y	vatts, calcul	ated	for each mon	th_		(83)m	n = Sum(74)m	.(82)m				
(83)m= 70.13		4.9	205.93 232.1		231.1 222.53	202	.89 179.1	132.69	84.07	59.97		(83)
Total gains – ir			<del>` `                                  </del>	<del></del>	<del></del>						l	
(84)m= 370.74	418.39 453	3.84	479.84 491.2	7	476 458.28	443	.66 427.72	396.5	365.07	353.4		(84)
7. Mean interr	nal temperat	ture (	heating seaso	n)								
Temperature	during heati	ng pe	eriods in the li	ving	area from Tal	ole 9	, Th1 (°C)				21	(85)
Utilisation fact	<u>_</u>	$\overline{}$	<del></del>	m (s	ee Table 9a)						 I	
Stroma FSA 2012	2 V <b>ERB</b> n. 1.d.	195 (s	SAP 9.52 - http://	Ww.	Jun stromal.com/ul	A	ug Sep	Oct	Nov	Dec	Page	5 of 7

(86)m=	0.99	0.99	0.98	0.97	0.93	0.85	0.74	0.76	0.9	0.97	0.99	0.99		(86)
Mean i	internal	temper	ature in	living are	ea T1 (fc	ollow ste	ps 3 to 7	in Table	e 9c)				•	
(87)m=	18.53	18.74	19.1	19.65	20.15	20.61	20.84	20.81	20.47	19.83	19.14	18.56		(87)
Tempe	erature o	during h	eating p	eriods ir	rest of	dwelling	from Ta	ble 9, Ti	 h2 (°C)				•	
(88)m=	19.06	19.08	19.09	19.16	19.17	19.23	19.23	19.25	19.21	19.17	19.14	19.12		(88)
Utilisat	tion fact	or for g	ains for	rest of d	welling, l	h2,m (se	e Table	9a)					•	
(89)m=	0.99	0.98	0.97	0.95	0.89	0.74	0.52	0.56	0.82	0.95	0.98	0.99		(89)
Mean i	internal	temper	ature in	the rest	of dwelli	na T2 (fo	ollow ste	eps 3 to 7	7 in Tabl	e 9c)				
(90)m=	16.95	17.16	17.53	18.12	18.61	19.06	19.2	19.2	18.93	18.31	17.61	17.02		(90)
_									f	LA = Livin	g area ÷ (4	4) =	0.55	(91)
Mean i	internal	tempera	ature (fo	r the wh	ole dwel	lina) = fl	A × T1	+ (1 – fL	A) x T2			!		_
	17.81	18.02	18.39	18.95	19.45	19.91	20.09	20.08	19.77	19.14	18.44	17.86		(92)
Apply a	adjustm	ent to the	ne mean	internal	tempera	ature fro	m Table	4e, whe	ere appro	priate	ļ.	ļ.		
(93)m=	17.81	18.02	18.39	18.95	19.45	19.91	20.09	20.08	19.77	19.14	18.44	17.86		(93)
8. Spa	ce heat	ing requ	uirement											
				•		ed at ste	ep 11 of	Table 9	o, so tha	t Ti,m=(	76)m an	d re-calc	culate	
the util		Feb		using Ta		Jun	Jul	Λιια	Con	Oot	Nov	Doo		
_ Lltilisat	Jan   tion fact		Mar ains, hm	Apr ·	May	Jun	Jui	Aug	Sep	Oct	Nov	Dec		
(94)m=	0.99	0.98	0.97	0.95	0.9	0.79	0.64	0.67	0.85	0.95	0.98	0.99		(94)
` ′ _	gains, l	لــــــــــــ , hmGm	W = (94	4)m x (84	 1)m						<u> </u>	<u> </u>		
_	365.87	410.3	440.03	454.09	440.97	376.83	293.13	298.5	363.89	376.43	357.78	349.44		(95)
Monthl	ly avera	ge exte	rnal tem	perature	from Ta	able 8							ı	
(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)
_				al tempe		Lm , W =	-` /	x [(93)m	– (96)m	ī			Ī	
(97)m= 1		1436.85		1040.93	794.57	520.17	342.33	357.49	566.11	875.63	1185.6	1455.12		(97)
· -				r each m				<del></del>	<del>`</del>	<u> </u>	ŕ	000 00	I	
(98)m=	838.59	689.84	632.47	422.53	263.08	0	0	0 T-1-	0	371.4	596.03	822.62	4000.50	7(00)
_								Tota	l per year	(kWh/year	r) = Sum(9	8)15,912 =	4636.56	(98)
Space	heating	g require	ement in	kWh/m²	/year								101.79	(99)
9a. Ene	rgy req	uiremen	its – Indi	ividual h	eating sy	/stems i	ncluding	micro-C	CHP)					
•	heatin	_	4 fueros es		ما مساما،									7(204)
				econdary		mentary	•	(000) 4	(204)				0	(201)
				nain syst	, ,			(202) = 1 -		(0.00)			1	(202)
			_	main sys				(204) = (204)	02) <b>x</b> [1 –	(203)] =			1	(204)
	•	-		ing syste									86.9	(206)
Efficier	ncy of s	econda	ry/suppl	ementar	y heating	g system	າ, %				_	_	0	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/ye	ar
· -	Ť		<u> </u>	alculate									Ī	
Ĺ	838.59	689.84	632.47	422.53	263.08	0	0	0	0	371.4	596.03	822.62		
(211)m	· · · · · ·					-		1	1		ı	ı	ı	(211)
L	965.01	793.83	727.81	486.22	302.74	0	0	0	0	427.39	685.88	946.63		٦.
								lota	l (kWh/yea	ar) =5um(2	۲۱) <sub>15,1012</sub>	=	5335.51	(211)

Space heating fuel (secondary), kWh/month = {[(98)m x (201)]} x 100 ÷ (208)									
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	0	0	0	0	0	0	0		
			Tota	I (kWh/yea	ar) =Sum(2	215) <sub>15,1012</sub>		0	(215)
Water heating							•		_
Output from water heater (calculated above)  160.38 141.54 149.05 134.18 131.9	118.45	114.32	124.67	124.21	139.11	146.38	156.72		
Efficiency of water heater						0.00		76.8	(216)
(217)m= 85.1 85 84.77 84.23 83.24	76.8	76.8	76.8	76.8	83.89	84.7	85.11		(217)
Fuel for water heating, kWh/month	•								
$(219)$ m = $(64)$ m x $100 \div (217)$ m (219)m = $188.46$ $166.52$ $175.82$ $159.3$ $158.45$	154.23	148.85	162.33	161.73	165.82	172.82	184.14		
	!		Tota	I = Sum(2	19a) <sub>112</sub> =			1998.47	(219)
Annual totals					k\	Nh/year		kWh/year	
Space heating fuel used, main system 1							إ	5335.51	
Water heating fuel used								1998.47	
Electricity for pumps, fans and electric keep-hot									
central heating pump:							30		(230c)
boiler with a fan-assisted flue							45		(230e)
Total electricity for the above, kWh/year			sum	of (230a).	(230g) =			75	(231)
Electricity for lighting								284.13	(232)
12a. CO2 emissions – Individual heating system	ns inclu	ıding mi	cro-CHP	)					
		<b>ergy</b> 'h/year			Emiss kg CO	<b>ion fac</b> 2/kWh	tor	Emissions kg CO2/yea	
Space heating (main system 1)	(211	) x			0.2	16	= [	1152.47	(261)
Space heating (secondary)	(215	5) x			0.5	19	= [	0	(263)
Water heating	(219	9) x			0.2	16	= [	431.67	(264)
Space and water heating	(261	) + (262) -	+ (263) + (	264) =			[	1584.14	(265)
Electricity for pumps, fans and electric keep-hot	(231	) x			0.5	19	= [	38.93	(267)
Electricity for lighting	(232	2) x			0.5	19	= [	147.46	(268)
Total CO2, kg/year				sum o	f (265)(2	271) =	[	1770.53	(272)
Dwelling CO2 Emission Rate				(272)					_

El rating (section 14)

(274)

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Project Information:

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

Dwelling Details:

**NEW DWELLING DESIGN STAGE** 

Total Floor Area: 76.27m<sup>2</sup>

Site Reference: **Plot Reference:** Green Flat 3 - Base

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: Mains gas

Fuel factor: 1.00 (mains gas)

16.5 kg/m<sup>2</sup> Target Carbon Dioxide Emission Rate (TER)

Dwelling Carbon Dioxide Emission Rate (DER) 31.49 kg/m<sup>2</sup> Fail

Excess emissions = 14.99 kg/m<sup>2</sup> (90.8 %)

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 43.7 kWh/m<sup>2</sup>

92.1 kWh/m<sup>2</sup> Dwelling Fabric Energy Efficiency (DFEE)

Excess energy =  $48.43 \text{ kg/m}^2 (111.0 \%)$ 

2 Fabric U-values

Element	Average	Highest	
External wall	0.28 (max. 0.30)	0.30 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.22 (max. 0.25)	0.22 (max. 0.70)	OK
Roof	0.18 (max. 0.20)	0.18 (max. 0.35)	OK
Openings	2.98 (max. 2.00)	3.10 (max. 3.30)	Fail

#### 2a Thermal bridging

Thermal bridging calculated using user-specified y-value of 0.15

3 Air permeability

Air permeability at 50 pascals 15.00 **OK** 

4 Heating efficiency

Main Heating system: Boiler systems with radiators or underfloor heating - mains gas

Data from manufacturer

Efficiency 86.0 % SEDBUK2009

Minimum 88.0 % Fail

Secondary heating system: None

5 Cylinder insulation

Hot water Storage:

Fail

	Measured cylinder loss: 1.25 kWh/d	· ·	ОК
Primary pipework insulated:	Yes	<b>- ,</b>	OK
6 Controls			
Space heating controls	Programmer, room thermostat and	TRVs	ок
Hot water controls:	Cylinderstat		OK
	Independent timer for DHW		OK
Boiler interlock:	Yes		OK
7 Low energy lights			
Percentage of fixed lights with lo	w-energy fittings	75.0%	
Minimum		75.0%	OK
8 Mechanical ventilation			
Not applicable			
9 Summertime temperature			
Overheating risk (Thames valley	r):	Slight	OK
Based on:	,	· ·	
Overshading:		Average or unknown	
Windows facing: South West		8.14m²	
Windows facing: North East		12.82m²	
Ventilation rate:		6.00	
10 Key features			
Party Walls U-value		0 W/m <sup>2</sup> K	

		Heor	Details:						
A No	Noil le place	Osei		- M	l		CTDO	040040	
Assessor Name: Software Name:	Neil Ingham Stroma FSAP 2012		Stroma Softwa					010943 on: 1.0.5.12	
Contware Hame.	Ottoma 1		Address				VOIOIC	71. 1.0.0.12	
Address :		, ,							
1. Overall dwelling dime	ensions:								
Ground floor		Are	ea(m²)	(4-)		ight(m)	7(0-)	Volume(m <sup>3</sup>	<u>-</u>
				(1a) x	2	2.35	(2a) =	179.23	(3a)
Total floor area TFA = (1	a)+(1b)+(1c)+(1d)+(1e)+	(1n)	76.27	(4)					
Dwelling volume				(3a)+(3b)	)+(3c)+(3c	d)+(3e)+	(3n) =	179.23	(5)
2. Ventilation rate:	main	ondom.	other		40401			m³ nor hou	•
	heating he	ondary ating	otner	, –	total			m³ per hou	_
Number of chimneys	0 +	0 +	0	<u> </u>	0	X 4	40 =	0	(6a)
Number of open flues	0 +	0 +	0	] = [	0	x 2	20 =	0	(6b)
Number of intermittent fa	ins				3	<b>X</b>	10 =	30	(7a)
Number of passive vents	•				0	X ·	10 =	0	(7b)
Number of flueless gas fi	res			Ī	0	X 4	40 =	0	(7c)
				_					
							Air ch	nanges per ho	our 
Infiltration due to chimne					30		÷ (5) =	0.17	(8)
Number of storeys in the	een carried out or is intended, he dwelling (ns)	proceed to (17)	otnerwise o	ontinue tr	om (9) to	(16)		0	(9)
Additional infiltration	io awaiiing (no)					[(9)	-1]x0.1 =	0	(10)
Structural infiltration: 0	.25 for steel or timber fra	ame or 0.35 fo	or masonr	y constr	ruction			0	(11)
	resent, use the value correspo	onding to the grea	ater wall are	a (after					
deducting areas of opening	ngs); if equal user 0.35 floor, enter 0.2 (unsealed	d) or 0.1 (sea	ed), else	enter 0				0	(12)
If no draught lobby, en		a) 0. 0 (00a	, o, o	011101 0				0	(13)
• •	s and doors draught strip	oped						0	(14)
Window infiltration			0.25 - [0.2	x (14) ÷ 1	00] =			0	(15)
Infiltration rate			(8) + (10)	+ (11) + (1	12) + (13)	+ (15) =		0	(16)
	q50, expressed in cubic	•	•	•	etre of e	envelope	area	15	(17)
If based on air permeabil	-				. , .	,		0.92	(18)
Number of sides sheltere	es if a pressurisation test has b ad	een done or a d	egree air pei	meability	is being u	sed		0	(19)
Shelter factor	,		(20) = 1 -	0.075 x (1	19)] =			1	(20)
Infiltration rate incorporat	ting shelter factor		(21) = (18)	x (20) =				0.92	(21)
Infiltration rate modified f	or monthly wind speed								
Jan Feb	Mar Apr May	Jun Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind sp	eed 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 = (2	2)m ∸ 4								
	1.23 1.1 1.08	0.95 0.95	0.92	1	1.08	1.12	1.18	]	
· · · — — — — — — — — — — — — — — — — —								J	

Adjusted infiltra	ation rate	e (allowi	ng for sh	nelter an	d wind s	speed) =	(21a) x	(22a)m				-	
1.17 Calculate effect	1.15	1.12	1.01	0.99	0.87	0.87	0.85	0.92	0.99	1.03	1.08		
If mechanica			iale ioi l	пе аррп	cable ca	130						0	(23
If exhaust air he	eat pump u	sing Appe	endix N, (2	3b) = (23a	a) × Fmv (e	equation (I	N5)) , othe	rwise (23b	) = (23a)			0	(23
If balanced with	heat recov	very: effic	iency in %	allowing f	for in-use f	actor (fron	n Table 4h	) =				0	(23
a) If balance	d mecha	nical ve	entilation	with he	at recov	ery (MVI	HR) (24a	a)m = (22)	2b)m + (	23b) × [	1 – (23c)	÷ 100]	
(24a)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24
b) If balance	d mecha	nical ve	entilation	without	heat red	covery (N	MV) (24b	o)m = (22	2b)m + (2	23b)			
(24b)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24
c) If whole he if (22b)m				•					.5 × (23b	))			
(24c)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24
d) If natural v									0.5]		•	_	
(24d)m= 1.17	1.15	1.12	1.01	0.99	0.88	0.88	0.86	0.92	0.99	1.03	1.08		(24
Effective air	change r	rate - er	nter (24a	) or (24b	o) or (24	c) or (24	d) in bo	x (25)	•	•	•	•	
(25)m= 1.17	1.15	1.12	1.01	0.99	0.88	0.88	0.86	0.92	0.99	1.03	1.08		(25
3. Heat losses	s and he	at loss r	paramete	er:									
ELEMENT	Gros area (	S	Openin m	gs	Net Ar A ,r		U-val W/m2		A X U (W/I	<b>&lt;</b> )	k-value kJ/m²-l		A X k kJ/K
Doors		` ,			1.89		1.6		3.024	<u></u>			(26
Windows Type	: 1				8.14	, x1,	/[1/( 3.1 )+	0.04] =	22.45				(27
Windows Type	2				12.82	<u>2</u> x1	/[1/( 3.1 )+	0.04] =	35.36				(27
Floor					5.62	X	0.22	─	1.2364	<b>=</b> [			(28
Walls Type1	49.96	6	20.90	6	29	X	0.3	<b>=</b> i	8.7	T i		<b>7</b>	(29
Walls Type2	24.47	7	1.89		22.58	3 X	0.25	<u> </u>	5.64	T i			(29
Roof	13.31	1	0		13.3	1 X	0.18	<del>-</del>	2.4	T i		<b>-</b>	(30
Total area of e	lements,	m²			93.36	<u></u>							(31
Party wall					51.46	5 X	0	=	0				(32
Party ceiling					62.97	7							(32
* for windows and ** include the area						lated using	g formula 1	/[(1/U-valu	ıe)+0.04] a	ns given in	paragraph	1 3.2	
Fabric heat los	s, W/K =	S (A x	U)				(26)(30	) + (32) =				78.8	1 (33
Heat capacity	Cm = S(	Axk)						((28).	(30) + (32	2) + (32a).	(32e) =	7648.	39 (34
Thermal mass	paramet	ter (TMF	P = Cm ÷	- TFA) ir	n kJ/m²K			Indica	tive Value	Medium		250	(35
For design assess can be used instea				construct	ion are no	t known pr	recisely the	e indicative	e values of	TMP in Ta	able 1f		_
Thermal bridge	es : S (L :	x Y) cal	culated (	using Ap	pendix l	K						14	(36
if details of therma		are not kn	own (36) =	= 0.05 x (3	31)			(00)	(00)			Γ	
Total fabric hea		ا عدایاما	المصمطا						(36) =	QE\r= -: (E\		92.8	(37
Ventilation hea					1	11	<b>1</b>	<del>- ` ` ` </del>	= 0.33 × (	<u> </u>		1	
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		

(00)	1						T == ==						(00)
(38)m= 69.18	67.83	66.47	59.69	58.34	52.04	52.04	50.87	54.46	58.34	61.04	63.76		(38)
Heat transfer							1	· · · ·	= (37) + (	<del></del>	1		
(39)m= 161.99	160.64	159.28	152.5	151.15	144.85	144.85	143.68	147.27	151.15	153.85	156.57	450.04	(39)
Heat loss para	ameter (I	HLP), W/	m²K						= (39)m ÷	Sum(39) <sub>1</sub> .	12 /12=	152.31	(39)
(40)m= 2.12	2.11	2.09	2	1.98	1.9	1.9	1.88	1.93	1.98	2.02	2.05		_
Number of day	ys in mo	nth (Tab	le 1a)					,	Average =	Sum(40) <sub>1</sub>	12 /12=	2	(40)
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 hea	iting ene	rgy requi	irement:								kWh/ye	ar:	
Assumed occ	unancv	N									20		(42)
if TFA > 13. if TFA £ 13.	.9, N = 1		[1 - exp	(-0.0003	849 x (TF	A -13.9	)2)] + 0.0	0013 x (	ΓFA -13.		39		(42)
Annual averag	•	ater usag	ge in litre	es per da	ay Vd,av	erage =	(25 x N)	+ 36		90	.92		(43)
Reduce the annu	_		• .		-	-	to achieve	a water us	se target o	f			
not more that 125						<u> </u>		_		·			
Jan Hot water usage	Feb	Mar r day for ea	Apr	$\frac{\text{May}}{\text{Vd } m = fa}$	Jun	Jul Table 1c x	Aug	Sep	Oct	Nov	Dec		
	· ·		1		1	1	· <i>'</i>	90.4	00.74	06.20	100.01		
(44)m= 100.01	96.38	92.74	89.1	85.47	81.83	81.83	85.47	89.1	92.74	96.38 m(44) <sub>112</sub> =	100.01	1091.06	(44)
Energy content of	f hot water	used - cal	culated m	onthly $= 4$ .	190 x Vd,r	n x nm x D	OTm / 3600			· /	L	1091.00	(++)
(45)m= 148.32	129.72	133.86	116.7	111.98	96.63	89.54	102.75	103.98	121.17	132.27	143.64		
If in atomton a cus	votor booti	ing at naint	of upo (no	hot water	r otorogo)	antar O in	haves (46		Total = Su	m(45) <sub>112</sub> =	=	1430.55	(45)
If instantaneous v		1								1			(40)
(46)m= 22.25 Water storage	19.46 2 loss:	20.08	17.51	16.8	14.49	13.43	15.41	15.6	18.18	19.84	21.55		(46)
Storage volum		) includin	ng any so	olar or W	/WHRS	storage	within sa	ame ves	sel		150		(47)
If community I	heating a	and no ta	ınk in dw	/elling, e	nter 110	litres in	(47)						
Otherwise if n		hot wate	er (this in	ncludes i	nstantar	neous co	mbi boil	ers) ente	er '0' in (	47)			
Water storage					(1.18/1	/ I \							
a) If manufac				or is kno	wn (kvvr	n/day):					0		(48)
Temperature f							(10)				0		(49)
Energy lost from b) If manufact		_			or is not		(48) x (49)	) =		1	50		(50)
Hot water stor			•							0.	01		(51)
If community I	_		on 4.3										
Volume factor			01								93		(52)
Temperature t										0.	54		(53)
Energy lost from Enter (50) or		_	, kWh/ye	ear			(47) x (51)	) x (52) x (	53) =		67		(54)
			for oach	month			((56)m = (	55) × (41):	<b>m</b>	0.	67		(55)
Water storage						ı	· · · · ·	, , ,					(50)
(56)m= 20.88 If cylinder contain	18.86	20.88	20.2	m = (56)m	20.2 x [(50) = (	20.88 H11)] ÷ (5)	20.88 0) else (5	20.2 7)m = (56)	20.88 m where (	20.2 H11) is fro	20.88 m Appendi	x H	(56)
	1		1		1	1						X11	(E7)
(57)m= 20.88	18.86	20.88	20.2	20.88	20.2	20.88	20.88	20.2	20.88	20.2	20.88		(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 thermosta	at)
(59)m= 23.26 21.01 23.26 22.51 23.26 22.51 23.26 23.26 22.51 23.26 2	22.51 23.26 (59)
Combi loss calculated for each month $(61)m = (60) \div 365 \times (41)m$	
(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 = $0.85 \times (45)$ m + $(46)$ m = $(46$	5)m + (57)m + (59)m + (61)m
	74.99 187.78 (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)	3,
(63)m= 0 0 0 0 0 0 0 0 0 0	0 0 (63)
Output from water heater	
	74.99 187.78
Output from water heater (al	nnual) <sub>112</sub> 1950.27 (64)
Heat gains from water heating, kWh/month 0.25 $^{'}$ [0.85 $\times$ (45)m + (61)m] + 0.8 $\times$ [(46)m + (	(57)m + (59)m l
	78.15 83.07 (65)
include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from	. ,
· · · · · · · · · · · · · · · · · · ·	r community fleating
5. Internal gains (see Table 5 and 5a):	
Metabolic gains (Table 5), Watts	Nov. Dec
Jan         Feb         Mar         Apr         May         Jun         Jul         Aug         Sep         Oct	Nov Dec 19.41 119.41 (66)
	19.41 119.41 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	(07)
	22.72 24.22 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	
	88.17 202.14 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	
(69)m= 34.94 34.94 34.94 34.94 34.94 34.94 34.94 34.94 34.94 34.94 34.94 34.94 34.94	34.94 34.94 (69)
Pumps and fans gains (Table 5a)	
(70)m= 3 3 3 3 3 3 3 3 3 3	3 3 (70)
Losses e.g. evaporation (negative values) (Table 5)	
(71)m= -95.53 -95.53 -95.53 -95.53 -95.53 -95.53 -95.53 -95.53 -95.53 -95.53 -95.53	95.53 -95.53 (71)
Water heating gains (Table 5)	
(72)m= 113.75 111.65 107.29 101.36 97.51 92.09 87.48 93.38 95.48 101.62 10	08.55 111.66 (72)
Total internal gains = $(66)m + (67)m + (68)m + (69)m + (70)m + (71)m$	n + (72)m
(73)m= 410.61 408.07 394.27 372.43 350.47 329.58 316.3 322.64 334.17 356.22 3	81.26 399.84 (73)
6. Solar gains:	
Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable of	orientation.
<b>5</b> _	FF Gains
Table 6d m² Table 6a Table 6b Tabl	le 6c (W)
Northeast 0.9x 0.77 x 12.82 x 11.28 x 0.63 x	0.7 = 44.21 (75)
Northeast 0.9x 0.77 x 12.82 x 22.97 x 0.63 x	0.7 = 89.98 (75)

Northoost a a [					г			1			_				
Northeast <sub>0.9x</sub>	0.77	X	12.	82	×	4	1.38	X		0.63	×	0.7	_  =	162.12	(75)
Northeast <sub>0.9x</sub>	0.77	X	12.	82	× L	6	7.96	X		0.63	X	0.7	=	266.25	(75)
Northeast <sub>0.9x</sub>	0.77	X	12.	82	X	9	1.35	X	(	0.63	X	0.7	=	357.89	(75)
Northeast 0.9x	0.77	X	12.	82	X	9	7.38	X		0.63	X	0.7	=	381.55	(75)
Northeast <sub>0.9x</sub>	0.77	X	12.	82	X	9	1.1	X		0.63	X	0.7	=	356.93	(75)
Northeast <sub>0.9x</sub>	0.77	X	12.	82	x	72	2.63	X		0.63	X	0.7	=	284.55	(75)
Northeast 0.9x	0.77	X	12.	82	x	50	0.42	X		0.63	X	0.7	=	197.55	(75)
Northeast <sub>0.9x</sub>	0.77	X	12.	82	x	28	8.07	X	(	0.63	X	0.7	=	109.97	(75)
Northeast <sub>0.9x</sub>	0.77	X	12.	82	x	1	4.2	X	(	0.63	X	0.7	=	55.62	(75)
Northeast 0.9x	0.77	X	12.	82	x	9	).21	x		0.63	X	0.7	=	36.1	(75)
Southwest <sub>0.9x</sub>	0.77	Х	8.1	4	x	3(	6.79	]		0.63	x	0.7	=	91.53	(79)
Southwest <sub>0.9x</sub>	0.77	X	8.1	4	x	62	2.67		(	0.63	x	0.7	=	155.91	(79)
Southwest <sub>0.9x</sub>	0.77	х	8.1	4	x	8	5.75	]		0.63	x	0.7	=	213.33	(79)
Southwest <sub>0.9x</sub>	0.77	х	8.1	4	x	10	06.25	]		0.63	x	0.7	_ =	264.32	(79)
Southwest <sub>0.9x</sub>	0.77	X	8.1	4	x	11	9.01	ĺ		0.63	x	0.7	-	296.06	(79)
Southwest <sub>0.9x</sub>	0.77	x	8.1	4	x	11	8.15	ĺ		0.63	x	0.7	╡ -	293.92	(79)
Southwest <sub>0.9x</sub>	0.77	x	8.1	4	x	11	3.91	ĺ	(	0.63	x	0.7	<del>=</del>	283.37	(79)
Southwest <sub>0.9x</sub>	0.77	х	8.1	4	x	10	)4.39	ĺ		0.63	x	0.7		259.69	(79)
Southwest <sub>0.9x</sub>	0.77	X	8.1	4	x [	92	2.85	ĺ		0.63	×	0.7		230.99	(79)
Southwest <sub>0.9x</sub>	0.77	X	8.1	4	x [	69	9.27	ĺ		0.63	x	0.7		172.32	(79)
Southwest <sub>0.9x</sub>	0.77	X	8.1	4	x [	4	4.07	ĺ	(	0.63	×	0.7	_ =	109.63	(79)
Southwest <sub>0.9x</sub>	0.77	X	8.1	4	x [	3	1.49	ĺ		0.63	×	0.7	_ =	78.33	(79)
•					_			•			_				
Solar gains in	watts, ca	lculated	for eac	h month				(83)m	n = Sun	n(74)m .	(82)m			_	
(83)m= 135.74	245.89	375.45	530.57	653.95	675	5.47	640.3	544	.24	428.53	282.2	3 165.26	114.43		(83)
Total gains – i	nternal ar	nd solar	(84)m =	= (73)m -	+ (8	3)m ,	watts							_	
(84)m= 546.34	653.96	769.71	903	1004.42	100	5.05	956.6	866	.88	762.71	638.5	546.52	514.27		(84)
7. Mean inter	rnal temp	erature (	(heating	season	)										
Temperature	during he	eating p	eriods ir	the livin	ng a	rea f	rom Tab	ole 9	, Th1	(°C)				21	(85)
Utilisation fac	ctor for ga	ins for l	iving are	ea, h1,m	(se	e Tal	ble 9a)								
Jan	Feb	Mar	Apr	May	J	lun	Jul	Α	ug	Sep	Oct	Nov	Dec		
(86)m= 1	0.99	0.98	0.95	0.88	0.	.74	0.6	0.6	66	0.87	0.97	0.99	1		(86)
Mean interna	al tempera	ature in I	living are	ea T1 (fo	ollov	v ster	os 3 to 7	7 in T	able	9c)			-	_	
(87)m= 18.74	18.97	19.36	19.95	20.44	1	0.8	20.93	20		20.62	19.98	19.3	18.76	7	(87)
Temperature	during h	aating n	ariade ir	rest of	dwe	lling	from Ta	عاما	a Thí	2 (°C)				_	
(88)m= 19.25	19.26	19.28	19.33	19.35		9.4	19.4	19.		19.38	19.35	19.32	19.3	7	(88)
	ļ ļ	!						<u> </u>						_	, ,
Utilisation fac	ctor for ga	0.97	0.93	welling, 0.82		n (se . <sub>62</sub>	e l able 0.41	9a) 0.4	1 <u>0</u>	0.78	0.95	0.99	0.99	٦	(89)
	ļ ļ	<u>l</u>			<u> </u>							0.99	0.99	_	(00)
Mean interna	<del></del>	1			Ť	<u> </u>		r <del>i</del>	- 1			-	T	٦	(0.5)
(90)m= 17.29	17.52	17.92	18.53	18.99	19	.32	19.39	19.	39	19.18	18.58		17.34		(90)
										f	LA = Li	ving area ÷ (	4) =	0.48	(91)

Manage Catanage Literature	// ()	Late II a	III \ (1		. (4 (1	A) TO					
Mean internal temperatu (92)m= 17.99 18.22 1	8.62 19.22		$\frac{1}{20.04}$	20.13	+ (1 – TL 20.12	19.88	19.26	18.58	18.03		(92)
` '								10.56	16.03		(92)
Apply adjustment to the (93)m= 17.99 18.22 1	8.62 19.22	<del></del>	20.04	20.13	20.12	19.88	19.26	18.58	18.03		(93)
8. Space heating require		15.05	20.04	20.13	20.12	13.00	13.20	10.50	10.03		(00)
Set Ti to the mean intern		turo obtoir	and at et	op 11 of	Table 0	h so tha	t Ti m_/	76)m an	d ro colo	ulata	
the utilisation factor for g	•		ieu ai sii	ерттог	Table 9	0, 50 tria	ı. 11,111=(	rojili ali	u re-caic	uiale	
	Mar Apı	$\neg$	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation factor for gain			Į					Į.			
	0.97 0.93	0.83	0.67	0.5	0.57	0.81	0.95	0.99	0.99		(94)
Useful gains, hmGm , W	I = (94) m x	(84)m							<u> </u>		
(95)m= 541.54 643.64 74	45.17 835.8	1 838.38	676.15	482.4	491.22	619.99	607.28	538.55	510.62		(95)
Monthly average externa	al temperati	re from T	able 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 tem	perature,	Lm , W =	=[(39)m :	x [(93)m	– (96)m	]				
(97)m= 2217.57 2139.78 19	930.5 1573.	2 1207.99	787.68	512	534.87	850.88	1308.8	1765.71	2164.82		(97)
Space heating requirement	ent for each	month, k	Wh/mon	th = 0.02	24 x [(97	)m – (95	)m] x (4	1)m			
(98)m= 1246.96 1005.41 88	81.88 530.8	6 274.99	0	0	0	0	521.93	883.55	1230.73		
					Tota	l per year	(kWh/year	r) = Sum(9	8) <sub>15,912</sub> =	6576.31	(98)
Space heating requireme	ent in kWh/	m²/year							Ì	86.22	(99)
9a. Energy requirements			veteme i	ncluding	micro-C	'HDI			L		
Space heating:	— marviduai	ricalling s	ysterns i	ricidaling	i illicio-c	71 IF <i>)</i>					
Fraction of space heat fr	rom second	arv/supple	ementary	svstem					[	0	(201)
Fraction of space heat fr			,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	•	(202) = 1	- (201) =			<u> </u>	1	(202)
·	•	, ,				02) × [1 –	(203)] =		l I		╡
Fraction of total heating		-			(204) - (2	02) 🗶 [1 —	(200)] =			1	(204)
Efficiency of main space									ļ	86.9	(206)
Efficiency of secondary/s	supplement	ary heatin	g systen	า, %						0	(208)
Jan Feb	Mar Apı	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/ye	ar
Space heating requirement	ent (calcula	ted above	)		_		_				
1246.96 1005.41 88	81.88 530.8	6 274.99	0	0	0	0	521.93	883.55	1230.73		
$(211)m = \{[(98)m \times (204)]\}$	} x 100 ÷ (	206)									(211)
1434.94 1156.97 10	014.82 610.8	9 316.45	0	0	0	0	600.61	1016.75	1416.25		
		-	•		Tota	l (kWh/yea	ar) =Sum(2	211) <sub>15,1012</sub>	F	7567.68	(211)
Space heating fuel (seco	ondary), kW	h/month							•		_
$= \{[(98)m \times (201)]\} \times 100$	÷ (208)						_				
(215)m= 0 0	0 0	0	0	0	0	0	0	0	0		
					Tota	l (kWh/yea	ar) =Sum(2	215) <sub>15,1012</sub>	=	0	(215)
Water heating									•		
Output from water heater	(calculated	above)	•								
	178 159.4	2 156.12	139.35	133.68	146.89	146.69	165.31	174.99	187.78		_
Efficiency of water heater	·		,							76.8	(216)
	35.02 84.34	82.95	76.8	76.8	76.8	76.8	84.24	85.05	85.41		(217)
(217)m= 85.4 85.28 8											
Fuel for water heating, kV		-1		•	•		•				
Fuel for water heating, kV (219)m = (64)m x 100 ÷	(217)m	2 400 04	104.44	474.00	404.00	404.04	100.05	205.74			
Fuel for water heating, kV (219)m = (64)m x 100 ÷		2 188.21	181.44	174.06	191.26	191.01	196.25	205.74	219.85	2370.43	(219)

Annual totals		kWh/year	kWh/year_
Space heating fuel used, main system 1			7567.68
Water heating fuel used			2370.43
Electricity for pumps, fans and electric keep-hot			
central heating pump:		30	(230c)
boiler with a fan-assisted flue		45	(230e)
Total electricity for the above, kWh/year	sum of (230a	a)(230g) =	75 (231)
Electricity for lighting			416.18 (232)
12a. CO2 emissions – Individual heating systems	s including micro-CHP		
	<b>Energy</b> kWh/year	Emission factor kg CO2/kWh	<b>Emissions</b> kg CO2/year
Space heating (main system 1)	<b>.</b>		
Space heating (main system 1) Space heating (secondary)	kWh/year	kg CO2/kWh	kg CO2/year
	kWh/year (211) x	kg CO2/kWh  0.216 =	kg CO2/year
Space heating (secondary)	kWh/year (211) x (215) x	kg CO2/kWh  0.216 =  0.519 =	kg CO2/year  1634.62 (261)  0 (263)
Space heating (secondary) Water heating	kWh/year (211) x (215) x (219) x	kg CO2/kWh  0.216 =  0.519 =	kg CO2/year  1634.62 (261)  0 (263)  512.01 (264)
Space heating (secondary) Water heating Space and water heating	kWh/year (211) x (215) x (219) x (261) + (262) + (263) + (264) =	kg CO2/kWh  0.216 =  0.519 =  0.216 =	kg CO2/year  1634.62 (261)  0 (263)  512.01 (264)  2146.63 (265)
Space heating (secondary) Water heating Space and water heating Electricity for pumps, fans and electric keep-hot	kWh/year (211) x (215) x (219) x (261) + (262) + (263) + (264) = (231) x (232) x	kg CO2/kWh  0.216 =  0.519 =  0.519 =	kg CO2/year  1634.62 (261)  0 (263)  512.01 (264)  2146.63 (265)  38.93 (267)

El rating (section 14)

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.12 Printed on 14 December 2020 at 08:05:26

Project Information:

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

Total Floor Area: 81.65m<sup>2</sup>

Dwelling Details:

Site Reference:

**NEW DWELLING DESIGN STAGE** 

**Plot Reference:** Green Flat 4 - Base

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: Mains gas

Fuel factor: 1.00 (mains gas)

16.72 kg/m<sup>2</sup> Target Carbon Dioxide Emission Rate (TER)

Dwelling Carbon Dioxide Emission Rate (DER) 27.49 kg/m<sup>2</sup> Fail

Excess emissions = 10.77 kg/m<sup>2</sup> (64.4 %)

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 47.0 kWh/m<sup>2</sup>

77.5 kWh/m<sup>2</sup> Dwelling Fabric Energy Efficiency (DFEE)

Excess energy =  $30.53 \text{ kg/m}^2 (65.0 \%)$ 

2 Fabric U-values

Element	Average	Highest	
External wall	0.28 (max. 0.30)	0.28 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.22 (max. 0.25)	0.22 (max. 0.70)	OK
Roof	0.18 (max. 0.20)	0.18 (max. 0.35)	OK
Openings	1.60 (max. 2.00)	1.60 (max. 3.30)	OK

#### 2a Thermal bridging

Thermal bridging calculated using user-specified y-value of 0.15

3 Air permeability

Air permeability at 50 pascals 15.00 **OK** 

4 Heating efficiency

Main Heating system: Boiler systems with radiators or underfloor heating - mains gas

Data from manufacturer

Efficiency 86.0 % SEDBUK2009

Minimum 88.0 % Fail

Secondary heating system: None

5 Cylinder insulation

Hot water Storage:

Fail

	Measured cylinder los Permitted by DBSCG		OK
Primary pipework insulated:	Yes	. 1.09 KWII/day	OK
6 Controls	100		
Space heating controls	Programmer, room th	nermostat and TRVs	ок
Hot water controls:	Cylinderstat		OK
	Independent timer for	r DHW	OK
Boiler interlock:	Yes		OK
7 Low energy lights			
Percentage of fixed lights with le	ow-energy fittings	75.0%	
Minimum		75.0%	OK
8 Mechanical ventilation			
Not applicable			
9 Summertime temperature			
Overheating risk (Thames valle	y):	Slight	oK
Based on:			
Overshading:		Average or unknown	
Windows facing: South West		5.92m²	
Windows facing: North East		5.92m²	
Roof windows facing: Horizonta	ıl	4.3m²	
Ventilation rate:		8.00	
10 Key features			
Party Walls U-value		0 W/m²K	

		User Details:				
Assessor Name:	Neil Ingham	Stroma Nun	nber:	STRO	010943	
Software Name:	Stroma FSAP 2012	Software Ve	rsion:	Versio	n: 1.0.5.12	
		Property Address: Flat 4	- Base			
Address :						
1. Overall dwelling dimer	nsions:					
Crown d floor		Area(m²)	Av. Height(m)	1, <sub>0</sub> , [	Volume(m³)	_
Ground floor		5.28 (1a) x	2.55	(2a) =	13.46	(3a)
First floor		76.37 (1b) x	2.1	(2b) =	160.38	(3b)
Total floor area TFA = (1a	ı)+(1b)+(1c)+(1d)+(1e)+(1	n) 81.65 (4)				
Dwelling volume		(3a)+(3l	o)+(3c)+(3d)+(3e)+	.(3n) =	173.84	(5)
2. Ventilation rate:						
	main seconda heating heating	ary other	total		m³ per hou	r
Number of chimneys	0 + 0	+ 0 =	0 ×	40 =	0	(6a)
Number of open flues	0 + 0	+ 0 =	0 x:	20 =	0	(6b)
Number of intermittent far	ns		3 x	10 =	30	(7a)
Number of passive vents		Ţ	0 x	10 =	0	(7b)
Number of flueless gas fire	es	Ţ	0 x 4	40 =	0	(7c)
				L		
				Air ch	anges per ho	ur
•	rs, flues and fans = (6a)+(6b)+			Air ch ÷ (5) =	anges per ho	our (8)
If a pressurisation test has be	een carried out or is intended, proce			ī	0.17	(8)
If a pressurisation test has be Number of storeys in the	een carried out or is intended, proce		rom (9) to (16)	÷ (5) =	0.17	(8)
If a pressurisation test has be Number of storeys in the Additional infiltration	een carried out or is intended, proce e dwelling (ns)	ed to (17), otherwise continue	from (9) to (16)	ī	0.17	(8) (9) (10)
If a pressurisation test has be Number of storeys in the Additional infiltration Structural infiltration: 0.2	een carried out or is intended, proce	ed to (17), otherwise continue of	from (9) to (16)	÷ (5) =	0.17	(8)
If a pressurisation test has be Number of storeys in the Additional infiltration Structural infiltration: 0.2 if both types of wall are prededucting areas of opening	een carried out or is intended, proce e dwelling (ns) 25 for steel or timber frame of esent, use the value corresponding gs); if equal user 0.35	ed to (17), otherwise continue in the continue	ruction	÷ (5) =	0.17	(8) (9) (10) (11)
If a pressurisation test has be Number of storeys in the Additional infiltration  Structural infiltration: 0.2 if both types of wall are prededucting areas of opening If suspended wooden fle	een carried out or is intended, proce e dwelling (ns)  25 for steel or timber frame of esent, use the value corresponding gs); if equal user 0.35 oor, enter 0.2 (unsealed) or 0	ed to (17), otherwise continue in the continue	ruction	÷ (5) =	0.17	(8) (9) (10) (11)
If a pressurisation test has be Number of storeys in the Additional infiltration  Structural infiltration: 0.2 if both types of wall are prededucting areas of opening If suspended wooden fle If no draught lobby, enter	een carried out or is intended, proce e dwelling (ns)  25 for steel or timber frame of esent, use the value corresponding gs); if equal user 0.35 oor, enter 0.2 (unsealed) or 0 er 0.05, else enter 0	ed to (17), otherwise continue in the continue	ruction	÷ (5) =	0.17 0 0 0	(8) (9) (10) (11) (12) (13)
If a pressurisation test has been Number of storeys in the Additional infiltration. Structural infiltration: 0.2 if both types of wall are prededucting areas of opening. If suspended wooden flet if no draught lobby, enter Percentage of windows.	een carried out or is intended, proce e dwelling (ns)  25 for steel or timber frame of esent, use the value corresponding gs); if equal user 0.35 oor, enter 0.2 (unsealed) or 0	ed to (17), otherwise continue in the continue in the continue in the greater wall area (after 0.1 (sealed), else enter 0	ruction	÷ (5) =	0.17 0 0 0 0 0 0	(8) (9) (10) (11) (12) (13) (14)
If a pressurisation test has been umber of storeys in the Additional infiltration. Structural infiltration: 0.2 if both types of wall are prededucting areas of opening. If suspended wooden flet if no draught lobby, enter the Percentage of windows. Window infiltration.	een carried out or is intended, proce e dwelling (ns)  25 for steel or timber frame of esent, use the value corresponding gs); if equal user 0.35 oor, enter 0.2 (unsealed) or 0 er 0.05, else enter 0	ed to (17), otherwise continue of 0.35 for masonry consists to the greater wall area (after 0.1 (sealed), else enter 0	rom (9) to (16)  [(9) ruction	÷ (5) =	0.17 0 0 0 0 0 0 0	(8) (9) (10) (11) (12) (13) (14) (15)
If a pressurisation test has be Number of storeys in the Additional infiltration  Structural infiltration: 0.2 if both types of wall are prededucting areas of opening If suspended wooden fle If no draught lobby, enter Percentage of windows Window infiltration Infiltration rate	een carried out or is intended, proce e dwelling (ns)  25 for steel or timber frame of esent, use the value corresponding gs); if equal user 0.35 oor, enter 0.2 (unsealed) or 0 er 0.05, else enter 0 and doors draught stripped	or 0.35 for masonry consists to the greater wall area (after 0.1 (sealed), else enter 0  0.25 - [0.2 x (14) ÷ (8) + (10) + (11) + (	rom (9) to (16)  [(9)  ruction  100] =  12) + (13) + (15) =	÷ (5) = [ -1]x0.1 = [	0.17 0 0 0 0 0 0 0 0	(8) (9) (10) (11) (12) (13) (14) (15) (16)
If a pressurisation test has been number of storeys in the Additional infiltration. Structural infiltration: 0.2 if both types of wall are prededucting areas of opening. If suspended wooden flet if no draught lobby, enter the Percentage of windows. Window infiltration Infiltration rate. Air permeability value, or	een carried out or is intended, proceed welling (ns)  25 for steel or timber frame of esent, use the value corresponding gas); if equal user 0.35  oor, enter 0.2 (unsealed) or 0 er 0.05, else enter 0  and doors draught stripped	or 0.35 for masonry consists to the greater wall area (after 0.1 (sealed), else enter 0  0.25 - [0.2 x (14) ÷ (8) + (10) + (11)	rom (9) to (16)  [(9)  ruction  100] =  12) + (13) + (15) =	÷ (5) = [ -1]x0.1 = [	0.17 0 0 0 0 0 0 0 0 0 15	(8) (9) (10) (11) (12) (13) (14) (15) (16) (17)
If a pressurisation test has been Number of storeys in the Additional infiltration. Structural infiltration: 0.2 if both types of wall are presented deducting areas of opening. If suspended wooden flet if no draught lobby, enter the Percentage of windows. Window infiltration infiltration rate. Air permeability value, of the Infiltration is stored in the Infiltration in the Infiltration are the Infiltratio	een carried out or is intended, proce e dwelling (ns)  25 for steel or timber frame of esent, use the value corresponding gs); if equal user 0.35  oor, enter 0.2 (unsealed) or 0 er 0.05, else enter 0  and doors draught stripped  q50, expressed in cubic metrity value, then (18) = [(17) ÷ 20]+	ed to (17), otherwise continue in the greater wall area (after 0.1 (sealed), else enter 0 0.25 - [0.2 x (14) ÷ (8) + (10) + (11) + (10) es per hour per square in (8), otherwise (18) = (16)	rom (9) to (16)  [(9)  ruction  100] =  12) + (13) + (15) =  netre of envelope	÷ (5) = [ -1]x0.1 = [	0.17 0 0 0 0 0 0 0 0	(8) (9) (10) (11) (12) (13) (14) (15) (16)
If a pressurisation test has been Number of storeys in the Additional infiltration. Structural infiltration: 0.2 if both types of wall are presented deducting areas of opening. If suspended wooden flet if no draught lobby, enter the Percentage of windows. Window infiltration infiltration rate. Air permeability value, of the Infiltration is stored in the Infiltration in the Infiltration are the Infiltratio	een carried out or is intended, procese dwelling (ns)  25 for steel or timber frame of esent, use the value corresponding (gs); if equal user 0.35  oor, enter 0.2 (unsealed) or 0 er 0.05, else enter 0  and doors draught stripped  q50, expressed in cubic metrology (17) expressed	ed to (17), otherwise continue in the greater wall area (after 0.1 (sealed), else enter 0 0.25 - [0.2 x (14) ÷ (8) + (10) + (11) + (10) es per hour per square in (8), otherwise (18) = (16)	rom (9) to (16)  [(9)  ruction  100] =  12) + (13) + (15) =  netre of envelope	÷ (5) = [ -1]x0.1 = [	0.17 0 0 0 0 0 0 0 0 0 0 15 0.92	(8) (9) (10) (11) (12) (13) (14) (15) (16) (17) (18)
If a pressurisation test has been Number of storeys in the Additional infiltration. Structural infiltration: 0.2 if both types of wall are prededucting areas of opening. If suspended wooden flet if no draught lobby, enter Percentage of windows. Window infiltration Infiltration rate. Air permeability value, of the suspended wooden flet in the permeability value, of the suspended wooden flet in the permeability value, of the suspended wooden flet in the permeability value applies.	een carried out or is intended, procese dwelling (ns)  25 for steel or timber frame of esent, use the value corresponding (gs); if equal user 0.35  oor, enter 0.2 (unsealed) or 0 er 0.05, else enter 0  and doors draught stripped  q50, expressed in cubic metrology (17) expressed	ed to (17), otherwise continue in the greater wall area (after 0.1 (sealed), else enter 0 0.25 - [0.2 x (14) ÷ (8) + (10) + (11) + (10) es per hour per square in (8), otherwise (18) = (16)	[(9) ruction  100] = 12) + (13) + (15) = netre of envelope r is being used	÷ (5) = [ -1]x0.1 = [	0.17 0 0 0 0 0 0 0 0 0 15	(8) (9) (10) (11) (12) (13) (14) (15) (16) (17)
If a pressurisation test has been Number of storeys in the Additional infiltration. Structural infiltration: 0.2 if both types of wall are prededucting areas of opening. If suspended wooden flet of the first of the precentage of windows. Window infiltration. Infiltration rate. Air permeability value, of the permeability value applies. Number of sides sheltered.	een carried out or is intended, procese dwelling (ns)  25 for steel or timber frame of esent, use the value corresponding (gs); if equal user 0.35  oor, enter 0.2 (unsealed) or 0 er 0.05, else enter 0  and doors draught stripped  q50, expressed in cubic metrology (17) expressed in cubic metrology (17) expressed in cubic metrology (18) er (18) = [(17) ÷ 20] er (18)	or 0.35 for masonry consists to the greater wall area (after 0.1 (sealed), else enter 0  0.25 - [0.2 x (14) ÷ (8) + (10) + (11) + (10)	rom (9) to (16)  [(9)  ruction  100] =  12) + (13) + (15) =  netre of envelope  v is being used  19)] =	÷ (5) = [ -1]x0.1 = [	0.17  0 0 0 0 0 0 0 0 0 15 0.92	(8) (9) (10) (11) (12) (13) (14) (15) (16) (17) (18)
If a pressurisation test has been Number of storeys in the Additional infiltration. Structural infiltration: 0.2 if both types of wall are prededucting areas of opening. If suspended wooden flet if no draught lobby, enter Percentage of windows. Window infiltration Infiltration rate. Air permeability value, of the suspended wooden flet in the permeability value, of the suspended wooden flet in the permeability value, of the suspended wooden flet in the permeability value applies. Number of sides sheltered shelter factor.	een carried out or is intended, proce e dwelling (ns)  25 for steel or timber frame of esent, use the value corresponding (gs); if equal user 0.35  oor, enter 0.2 (unsealed) or 0 er 0.05, else enter 0  and doors draught stripped  q50, expressed in cubic metric ty value, then (18) = [(17) ÷ 20]+  is if a pressurisation test has been do	or 0.35 for masonry consists to the greater wall area (after 0.1 (sealed), else enter 0  0.25 - [0.2 x (14) ÷ (8) + (10) + (11) + (10)	rom (9) to (16)  [(9)  ruction  100] =  12) + (13) + (15) =  netre of envelope  v is being used  19)] =	÷ (5) = [ -1]x0.1 = [	0.17  0 0 0 0 0 0 0 0 0 15 0.92	(8) (9) (10) (11) (12) (13) (14) (15) (16) (17) (18) (19) (20)
If a pressurisation test has been Number of storeys in the Additional infiltration. Structural infiltration: 0.2 if both types of wall are prededucting areas of opening. If suspended wooden flet of the first of the precentage of windows. Window infiltration. Infiltration rate. Air permeability value applies. Number of sides sheltered. Shelter factor. Infiltration rate modified for the process of the precentage of the precentage of the permeability value applies. Number of sides sheltered. Shelter factor.	een carried out or is intended, proce e dwelling (ns)  25 for steel or timber frame of esent, use the value corresponding (gs); if equal user 0.35  oor, enter 0.2 (unsealed) or 0 er 0.05, else enter 0  and doors draught stripped  q50, expressed in cubic metric ty value, then (18) = [(17) ÷ 20]+  is if a pressurisation test has been do	or 0.35 for masonry consists to the greater wall area (after 0.1 (sealed), else enter 0  0.25 - [0.2 x (14) ÷ (8) + (10) + (11) + (10)	rom (9) to (16)  [(9)  ruction  100] =  12) + (13) + (15) =  netre of envelope  v is being used  19)] =	÷ (5) = [ -1]x0.1 = [	0.17  0 0 0 0 0 0 0 0 0 15 0.92	(8) (9) (10) (11) (12) (13) (14) (15) (16) (17) (18) (19) (20)

4.9

4.4

4.3

3.8

3.8

3.7

4.3

4.5

4.7

5

(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		
^ diusto	d infiltr	ation rate	o (allowi	ng for sh	oltor on	d wind o	rpood) –	(21a) v	(22a)m	•		-	-	
Tujusie	1.18	1.15	1.13	1.01	0.99	0.88	0.88	0.85	0.92	0.99	1.04	1.08	1	
	te effec	ctive air	change	rate for t									<u> </u>	
		al ventila											0	(23a
			0 11	endix N, (2	, (	, ,	• •	,, .	`	o) = (23a)			0	(23b
			-	iency in %	_								0	(230
· · -	oalance 0	d mecha	anical ve	entilation 0	with he	at recove	ery (MVI	TR) (248	$\frac{a)m = (2)}{a}$	2b)m + ( 0	23b) × [	1 – (23c)	) ÷ 100] ]	(24a
(24a)m=							ļ		<u> </u>	<u>l</u>			]	(246
(24b)m=	oalance 0	o mecha	anicai ve	entilation 0	without 0	neat red		0 (24)	$\int_{0}^{\infty} \int_{0}^{\infty} dx = (2x)^{2}$	26)m + (   0	230)	0	1	(24b
· L				tilation o									J	(240
				hen (240	-	-				.5 × (23b	o)			
(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	1	(240
d) If r	natural v	ventilatio	on or wh	ole hous	e positiv	/e input	ventilatio	on from	loft				4	
í	(22b)n	n = 1, the	en (24d)	m = (22b)	o)m othe	erwise (2	24d)m =	0.5 + [(2	2b)m² x	0.5]	,		-	
(24d)m=	1.18	1.15	1.13	1.01	0.99	0.88	0.88	0.86	0.93	0.99	1.04	1.08	]	(240
				/0.1-	\ ~ = /O /k	.) (04	.) (0.4	.15 *	v (25)					
Effec		change	rate - er	iter (24a	) or (24t	o) or (24)	c) or (24	a) in bo	X (23)				1	
Effect (25)m=	tive air 1.18	change 1.15	1.13	1.01	0.99	0.88	0.88	0.86	0.93	0.99	1.04	1.08	]	(25)
(25)m=	1.18	1.15	1.13	<del>`</del>	0.99	<del>``</del>	<del>ŕ `</del>	<del>ŕ –</del>	<del>`</del>	0.99	1.04	1.08		(25)
(25)m= 3. Hea	1.18	1.15 s and he	1.13 eat loss p	1.01 Daramete Openin	0.99 er: gs	0.88 Net Ar	0.88 ea	0.86 U-val	0.93 ue	AXU		k-valu		ΑΧk
(25)m= [ 3. Hea <b>ELEM</b>	1.18	1.15 s and he	1.13 eat loss p	1.01 paramete	0.99 er: gs	0.88 Net Ar A ,r	0.88 rea m²	0.86 U-val W/m2	0.93 ue 2K	A X U (W/				A X k kJ/K
3. Hea ELEM Doors	1.18 at losses	1.15 s and he Gros area	1.13 eat loss p	1.01 Daramete Openin	0.99 er: gs	0.88 Net Ar A ,r	o.88	0.86 U-val W/m2	0.93	A X U (W/ 3.024		k-valu		A X k kJ/K (26)
3. Hea ELEM Doors Window	1.18  It losses  ENT  Vs Type	1.15 s and he Gros area	1.13 eat loss p	1.01 Daramete Openin	0.99 er: gs	0.88  Net Ar A ,r  1.89	0.88 rea m² x1	0.86 U-val W/m2 1.6 /[1/( 1.6 )+	0.93 ue eK = 0.04] =	A X U (W/ 3.024 8.9		k-valu		A X k kJ/K (26) (27)
3. Hea ELEM Doors Window Window	1.18 It losses ENT It states the states of t	1.15 s and he Gros area	1.13 eat loss p	1.01 Daramete Openin	0.99 er: gs	0.88  Net Ar A ,r  1.89  5.92	0.88  ea m² x1 x1	U-val W/m2 1.6 /[1/( 1.6 )+	0.93  ue 2K  =   0.04] =   0.04] =	A X U (W/ 3.024 8.9	K)	k-valu		A X k kJ/K (26) (27)
3. Hea ELEM Doors Window Window Roofligh	1.18 It losses ENT It states the states of t	1.15 s and he Gros area	1.13 eat loss p	1.01 Daramete Openin	0.99 er: gs	0.88  Net Ar A ,r 1.89 5.92 5.92 4.3	0.88  rea m² x1/ x1/	U-val W/m2 1.6 /[1/( 1.6 )+ /[1/( 1.6 )+	0.93  ue 2K  0.04] =  0.04] =  0.04] =	A X U (W/ 3.024 8.9 8.9 6.88000	K)	k-valu		A X k kJ/K (26) (27) (27)
3. Hea  ELEM  Doors  Window  Window  Roofligh  Floor	1.18  It losses  ENT  Its Type	1.15 S and he Gros area	1.13 eat loss pass (m²)	1.01  Openin m	0.99 er: gs	0.88  Net Ar A ,r 1.89 5.92 5.92 4.3 9.73	0.88  rea m² x1/ x1/ x1/ x1/	0.86 U-val W/m2 1.6 /[1/( 1.6 )+ /[1/( 1.6 ) +	0.93  ue 2K  = 0.04] = 0.04] = 0.04] = 0.04] = 0.04	A X U (W/ 3.024 8.9 8.9 6.88000 2.1406	K)	k-valu		A X k kJ/K (26) (27) (27) (27)
3. Head ELEM Doors Window Window Roofligh Floor Walls T	t losses ENT  's Type 's Type nts	1.15 S and he Gros area 1.2 36.7	1.13 eat loss pass (m²)	1.01  Openin m	0.99 er: gs	0.88  Net Ar A ,r 1.89 5.92 5.92 4.3	0.88  rea m² x1/ x1/ x1/ x1/	U-val W/m2 1.6 /[1/( 1.6 )+ /[1/( 1.6 )+	0.93  ue 2K  0.04] =  0.04] =  0.04] =	A X U (W/ 3.024 8.9 8.9 6.88000	K)	k-valu		A X k kJ/K (26) (27) (27) (27) (28) (29)
3. Head ELEM  Doors  Window Window Roofligh Floor Walls T  Walls T	1.18 It losses ENT It s Type It s Ty	1.15 S and he Gros area	1.13 eat loss pass (m²)	1.01  Openin m	0.99 er: gs	0.88  Net Ar A ,r 1.89 5.92 5.92 4.3 9.73	0.88  rea m²	0.86 U-val W/m2 1.6 /[1/( 1.6 )+ /[1/( 1.6 ) +	0.93  ue 2K  = 0.04] = 0.04] = 0.04] = 0.04] = 0.04	A X U (W/ 3.024 8.9 8.9 6.88000 2.1406	K)	k-valu		A X k kJ/K (26) (27) (27) (27) (28) (29)
3. Head ELEM  Doors Window Window Roofligh Floor Walls T Walls T	1.18 It losses ENT It s Type It s Ty	1.15 S and he Gros area 1.2 36.7	1.13 eat loss part los	1.01  Openin m	0.99 er: gs <sub>1</sub> 2	0.88  Net Ar A ,r  1.89  5.92  5.92  4.3  9.73  36.78	0.88  rea m² x1 x1 x1 x1 x1 x1 x1	U-val W/m2 1.6 /[1/( 1.6 )+ /[1/( 1.6 ) + 0.22 0.28	0.93  ue 2K  = 0.04] = 0.04] = 0.04] = = = = = = = = = = = = = = = = = = =	A X U (W/ 3.024 8.9 8.9 6.88000 2.1406	K)	k-valu		A X k kJ/K (26) (27) (27) (27b (28) (29) (29)
3. Hea  ELEM  Doors  Window  Window  Roofligh  Floor  Walls T  Walls T  Roof	t losses ENT  vs Type vs Type nts  ype1 ype2 ype3	1.15 s and he Gros area 1 1.2 36.7 8.56.2 46.1	1.13 eat loss part los part loss part los p	1.01  Openin m  0  1.89	0.99 er: gs <sub>1</sub> 2	0.88  Net Ar A ,r  1.89  5.92  5.92  4.3  9.73  36.78  6.66	0.88  rea m²	U-val W/m2 1.6 /[1/( 1.6 )+ /[1/(1.6) + 0.22 0.28	0.93  ue 2K  = 0.04] =   0.04] =   0.04] =   = =   = =	A X U (W/ 3.024 8.9 8.9 6.88000 2.1406 10.3	K)	k-valu		A X k kJ/K (26) (27) (27) (27b (28) (29) (29)
3. Hea 3. Hea ELEM Doors Window Window Roofligh Floor Walls T Walls T Walls T Roof Total ar	t losses ENT  's Type 's Type nts  ype1 ype2 ype3 rea of e	1.15 S and he Gros area 1 2 36.7 8.55 56.2	1.13 eat loss part los part loss part los p	1.01  Openin  m  1.89	0.99 er: gs <sub>1</sub> 2	0.88  Net Ar A ,r 1.89 5.92 5.92 4.3 9.73 36.78 6.66 44.43	0.88  rea m² x1/ x1/ x1/ x3 x x x x x x x x x x x x x x x x x x	0.86  U-val W/m2  1.6 /[1/( 1.6 )+ /[1/(1.6) +  0.22  0.28  0.25  0.28	0.93  ue 2K  = 0.04] =   0.04] =   0.04] =   = =   = =	A X U (W/ 3.024 8.9 6.88000 2.1406 10.3 1.66	K)	k-valu		A X k kJ/K (26) (27) (27) (27) (28) (29) (29) (30) (31)
3. Head ELEM  Doors Window Window Roofligh Floor Walls T Walls T Walls T Roof Total ar Party w	t losses ENT  's Type 's Type nts  ype1 ype2 ype3 rea of e all	1.15  s and he  Gros area  1.15  36.7  8.56  56.2  46.1  lements	1.13 eat loss page (m²)  8 7 9 , m²	1.01  Openin  m  1.89  11.84  4.3	0.99 er: gs <sub>12</sub>	0.88  Net Ar A ,r 1.89 5.92 5.92 4.3 9.73 36.78 6.66 44.43 41.89 157.5	0.88  ea m² x1/  x1/  x1/  x1/  x2/  x2/  x2/  x2/  x2/  x2/  x2/  x3/  x4/  x4/  x4/  x4/  x4/  x4/  x4/  x4	0.86  U-val W/m2  1.6 /[1/( 1.6 )+ /[1/( 1.6 )+  0.22  0.28  0.25  0.18	0.93  ue 2K  = 0.04] =	A X U (W/ 3.024 8.9 6.88000 2.1406 10.3 1.66 12.44 7.54	K)	k-valu kJ/m²-	K	A X k kJ/K (26) (27) (27) (27) (28) (29) (29) (30) (31)
3. Head ELEM  Doors Window Window Roofligh Floor Walls T Walls T Walls T Roof Total ar Party w * for wind	t losses ENT  Is Type Its Type	1.15  s and he  Gros area  1.15  36.7  8.56  56.2  46.1  lements	1.13 eat loss page (m²)  8 7 9 , m²	1.01  Openin  0  1.89  11.84  4.3	0.99 er: gs 12	0.88  Net Ar A ,r 1.89 5.92 5.92 4.3 9.73 36.78 6.66 44.43 41.89 157.5 38.99	0.88  ea m² x1/  x1/  x1/  x1/  x2/  x2/  x2/  x2/  x2/  x2/  x2/  x3/  x4/  x4/  x4/  x4/  x4/  x4/  x4/  x4	0.86  U-val W/m2  1.6 /[1/( 1.6 )+ /[1/( 1.6 )+  0.22  0.28  0.25  0.18	0.93  ue 2K  = 0.04] =	A X U (W/ 3.024 8.9 6.88000 2.1406 10.3 1.66 12.44 7.54	K)	k-valu kJ/m²-	K	A X k kJ/K (26) (27) (27) (27) (28) (29) (29) (30) (31)
3. Hea ELEM Doors Window Window Roofligh Floor Walls T Walls T Walls T Roof Total ar Party w * for wind ** include	t losses ENT  Is Type Is Type Its  Its  Is Type Its  Is Type Its  Is Type Its  Is Type Its  Is T	1.15  s and he  Gros area  1.15  36.7  8.56  56.2  46.1  lements	1.13  eat loss part los part	1.01  Openin  m  1.89  11.84  4.3	0.99 er: gs 12	0.88  Net Ar A ,r 1.89 5.92 5.92 4.3 9.73 36.78 6.66 44.43 41.89 157.5 38.99	0.88  rea m² x1/ x1/ x1/ x2/ x2/ x2/ x4/ x4/ x4/ x4/ x4/ x4/ x4/ x4/ x4/ x4	0.86  U-val W/m2  1.6 /[1/( 1.6 )+ /[1/( 1.6 )+  0.22  0.28  0.25  0.18	0.93  ue 2K  =   0.04] =   0.04] =   0.04] =   =   =   =   =	A X U (W/ 3.024 8.9 6.88000 2.1406 10.3 1.66 12.44 7.54	K)	k-valu kJ/m²-	K	A X k kJ/K  (26) (27) (27) (27) (28) (29) (29) (30) (31) (32)
3. Head ELEM  Doors Window Window Roofligh Floor Walls T Walls T Roof Total ar Party w * for wind ** include Fabric h	t losses ENT  Is Type Its Type	1.15 s and he Gros area 1 1.2 36.7 8.56 56.2 46.1 lements	1.13  eat loss part los part	1.01  Openin  m  1.89  11.84  4.3	0.99 er: gs 12	0.88  Net Ar A ,r 1.89 5.92 5.92 4.3 9.73 36.78 6.66 44.43 41.89 157.5 38.99	0.88  rea m² x1/ x1/ x1/ x2/ x2/ x2/ x4/ x4/ x4/ x4/ x4/ x4/ x4/ x4/ x4/ x4	0.86  U-val W/m2  1.6  /[1/(1.6)+ /[1/(1.6)+  0.22  0.28  0.25  0.18	0.93  ue 2K  = 0.04] =   0.04] =   0.04] =   =   =   =   =	A X U (W/ 3.024 8.9 6.88000 2.1406 10.3 1.66 12.44 7.54	K)	k-valuu kJ/m²-	K	A X k kJ/K  (26) (27) (27) (27) (28) (29) (29) (30) (31) (32)

can be used instead of a detailed calculation.

Therm	al bridge	es : S (L	x Y) cal	culated (	using Ap	pendix I	<					[	23.63	(36)
	of therma	0 0	are not kn	own (36) =	= 0.05 x (3	1)						,		_
Total f	abric he	at loss							(33) +	` '			85.01	(37)
Ventila	ation hea	at loss ca	alculated	monthly	У				(38)m	= 0.33 × (	(25)m x (5)			
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	67.48	66.16	64.83	58.22	56.9	50.72	50.72	49.57	53.1	56.9	59.54	62.19		(38)
Heat to	ransfer c	coefficier	nt, W/K						(39)m	= (37) + (37)	38)m			
(39)m=	152.49	151.16	149.84	143.22	141.9	135.72	135.72	134.58	138.1	141.9	144.55	147.19		
Heat lo	oss para	meter (H	HLP), W	m²K						Average = = (39)m ÷	Sum(39) <sub>1.</sub> - (4)	12 /12=	143.03	(39)
(40)m=	1.87	1.85	1.84	1.75	1.74	1.66	1.66	1.65	1.69	1.74	1.77	1.8		
			ļ.			Į.	Į.		ļ	Average =	Sum(40) <sub>1</sub> .	12 /12=	1.75	(40)
Numbe	er of day	s in moi	nth (Tab	le 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. Wa	ater heat	ing ene	rgy requ	irement:								kWh/ye	ear:	
	ned occu			[1 - eyn	( <u>-</u> 0 0003	240 v (TE	-Δ -13 0	)2)] + 0.0	\\\13 v (T	Γ <b>F</b> Δ <b>-</b> 13		49		(42)
	A £ 13.9		1 1.70 %	i cxp	( 0.000	73 X (11	A 10.0	/2/] 1 0.0	/010 X (1	1174 10.	.5)			
								(25 x N)				.42		(43)
	the annua e that 125	-		• .		-	-	to achieve	a water us	e target o	of Total			
not mon			· ·			1	· ·	<u> </u>		_		<u> </u>		
Hot wat	Jan	Feb	Mar	Apr	May	Jun	Jul Table 10 Y	Aug	Sep	Oct	Nov	Dec		
noi waii	er usage ii		t day for ea	acri monui	vu,III = Ia	Clor Irom I	таріе тс х	(43)			1	т т		
(44)m=	102.76	99.02	95.29	91.55	87.81	84.08	84.08	87.81	91.55	95.29	99.02	102.76		<b>-</b>
Eneray	content of	hot water	used - cal	culated mo	onthly – 4	190 x Vd r	пуптуГ	Tm / 3600			m(44) <sub>112</sub> = ables 1b, 1	L	1121.03	(44)
•					,				-	,				
(45)m=	152.39	133.28	137.54	119.91	115.05	99.28	92	105.57	106.83	124.5	135.9	147.58	4400.04	(45)
If instan	taneous w	ater heatii	ng at point	of use (no	hot water	storage),	enter 0 in	boxes (46)		iotai = Su	m(45) <sub>112</sub> =	= [	1469.84	(43)
(46)m=	22.86	19.99	20.63	17.99	17.26	14.89	13.8	15.84	16.02	18.68	20.39	22.14		(46)
	storage		20.00	17.55	17.20	14.03	10.0	10.04	10.02	10.00	20.00	22.17		(10)
Storag	je volum	e (litres)	includir	ng any so	olar or W	/WHRS	storage	within sa	me vess	sel		150		(47)
If com	munity h	eating a	ınd no ta	ınk in dw	elling, e	nter 110	litres in	(47)				J		
	•	•			•			mbi boile	ers) ente	er '0' in (	(47)			
Water	storage	loss:												
a) If m	nanufact	urer's de	eclared I	oss facto	or is kno	wn (kWł	n/day):					0		(48)
Tempe	erature f	actor fro	m Table	2b								0		(49)
Energy	y lost fro	m water	storage	, kWh/ye	ear			(48) x (49)	=		15	50		(50)
•	nanufact			-										
	ater stora	-			e 2 (kWl	h/litre/da	ıy)				0.	01		(51)
	munity h e factor	_		on 4.3										(50)
	e ractor erature fa			2h								93		(52) (53)
rompe	J. atai C I	40101 110	rabic	_5							<u> </u>	54		(33)

Energy lost from wate	r storage,	kWh/ye	ear			(47) x (51)	) x (52) x (	53) =	0.	67		(54)
Enter (50) or (54) in (	55)	•							0.	67		(55)
Water storage loss ca	lculated fo	or each	month			((56)m = (	(55) × (41)r	m				
(56)m= 20.88 18.86	20.88	20.2	20.88	20.2	20.88	20.88	20.2	20.88	20.2	20.88		(56)
If cylinder contains dedicate	ed solar stora	age, (57)r	n = (56)m	x [(50) – (	H11)] ÷ (5	0), else (5	7)m = (56)	m where (	H11) is fro	m Append	ix H	
(57)m= 20.88 18.86	20.88	20.2	20.88	20.2	20.88	20.88	20.2	20.88	20.2	20.88		(57)
Primary circuit loss (a	nnual) fron	m Table	3							0		(58)
Primary circuit loss ca	lculated fo	or each	month (	59)m = (	(58) ÷ 36	65 × (41)	m					
(modified by factor f	rom Table	H5 if t	here is s	olar wat	ter heatii	ng and a	cylinde	thermo	stat)			
(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 r	month (	61)m =	(60) ÷ 36	65 × (41)	)m						
(61)m= 0 0	0	0	0	0	0	0	0	0	0	0		(61)
Total heat required for	water hea	ating ca	alculated	for eac	h month	(62)m =	0.85 × (	45)m +	(46)m +	(57)m +	(59)m + (61)m	
(62)m= 196.53 173.15	181.68	162.62	159.19	142	136.14	149.71	149.55	168.64	178.62	191.72		(62)
Solar DHW input calculated	l using Appe	ndix G or	Appendix	H (negati	ve quantity	/) (enter '0	' if no sola	r contributi	ion to wate	er heating)		
(add additional lines if	FGHRS a	and/or V	VWHRS	applies	, see Ap	pendix (	3)					
(63)m= 0 0	0	0	0	0	0	0	0	0	0	0		(63)
Output from water hea	ater					•				•		
(64)m= 196.53 173.15	181.68	162.62	159.19	142	136.14	149.71	149.55	168.64	178.62	191.72		1
						Outp	out from wa	ater heate	r (annual)₁	12	1989.56	(64)
Heat gains from water	heating, k	kWh/mo	onth 0.25	5 ′ [0.85	$\times (45)$ m	+ (61)m	1 + 0.8 x	r[(46)m	⊥ (57)m	+ (59)m	1	
	· · · · ·			[	• ()	. (01)	11 1 0.0 7	(+0)111	+ (37)111	. (00)111	1	
(65)m= 85.98 76.21	81.04	74.04	73.57	67.18	65.9	70.41	69.7	76.71	79.36	84.38	ı	(65)
(65)m= 85.98 76.21 include (57)m in cal	81.04	74.04	73.57	67.18	65.9	70.41	69.7	76.71	79.36	84.38		(65)
` '	81.04 culation of	74.04 f (65)m	73.57 only if c	67.18	65.9	70.41	69.7	76.71	79.36	84.38		(65)
include (57)m in cal	81.04 culation of	74.04 f (65)m and 5a)	73.57 only if c	67.18	65.9	70.41	69.7	76.71	79.36	84.38		(65)
include (57)m in cal 5. Internal gains (see	81.04 culation of	74.04 f (65)m and 5a)	73.57 only if c	67.18	65.9	70.41	69.7	76.71	79.36	84.38		(65)
include (57)m in cal 5. Internal gains (see Metabolic gains (Table	81.04 culation of a Table 5 :	74.04 f (65)m and 5a)	73.57 only if c	67.18 ylinder i	65.9 s in the o	70.41 dwelling	69.7 or hot w	76.71 ater is fr	79.36 om com	84.38 munity h		(65)
include (57)m in cal  5. Internal gains (see  Metabolic gains (Table  Jan Feb	81.04 culation of e Table 5 are 5), Watts Mar 124.67	74.04 f (65)m and 5a) s Apr 124.67	73.57 only if controls:  May 124.67	67.18 ylinder is Jun 124.67	65.9 s in the o	70.41 dwelling Aug 124.67	69.7 or hot w Sep	76.71 ater is fr	79.36 om com	84.38 munity h		
include (57)m in cal  5. Internal gains (see  Metabolic gains (Table  Jan Feb  (66)m= 124.67 124.67	81.04 culation of e Table 5 are 5), Watts Mar 124.67	74.04 f (65)m and 5a) s Apr 124.67	73.57 only if controls:  May 124.67	67.18 ylinder is Jun 124.67	65.9 s in the o	70.41 dwelling Aug 124.67	69.7 or hot w Sep	76.71 ater is fr	79.36 om com	84.38 munity h		
include (57)m in cal  5. Internal gains (see  Metabolic gains (Table  Jan Feb  (66)m= 124.67 124.67  Lighting gains (calcula	81.04 culation of a Table 5 at the End of th	74.04  f (65)m  and 5a)  S  Apr  124.67  Dendix I  13.59	73.57 only if controls:  May 124.67 L, equation 10.16	67.18  ylinder is  Jun  124.67  on L9 of  8.58	Jul 124.67 r L9a), a	Aug 124.67 lso see	69.7 or hot w Sep 124.67 Table 5	76.71 ater is fr Oct 124.67	79.36 om com Nov 124.67	84.38 munity h		(66)
include (57)m in cal  5. Internal gains (see  Metabolic gains (Table  Jan Feb  (66)m= 124.67 124.67  Lighting gains (calculate)  (67)m= 24.85 22.07	81.04 culation of e Table 5 at e 5), Watts Mar 124.67 ated in App	74.04  f (65)m  and 5a)  S  Apr  124.67  Dendix I  13.59	73.57 only if controls:  May 124.67 L, equation 10.16	67.18  ylinder is  Jun  124.67  on L9 of  8.58	Jul 124.67 r L9a), a	Aug 124.67 lso see	69.7 or hot w Sep 124.67 Table 5	76.71 ater is fr Oct 124.67	79.36 om com Nov 124.67	84.38 munity h		(66)
include (57)m in cal  5. Internal gains (see  Metabolic gains (Table  Jan Feb  (66)m= 124.67 124.67  Lighting gains (calculate)  (67)m= 24.85 22.07  Appliances gains (calculate)	81.04 culation of a Table 5 at a 5), Watts Mar 124.67 ated in App 17.95 culated in 4 at a 219.34	74.04  f (65)m  and 5a)  S  Apr  124.67  Dendix I  13.59  Append  206.93	73.57 only if controls:  May 124.67 L, equati 10.16 dix L, equ 191.27	Jun 124.67 on L9 on 8.58 uation L	Jul 124.67 r L9a), a 9.27 13 or L1 166.72	70.41 dwelling  Aug 124.67 lso see 12.05 3a), also 164.41	69.7 or hot w Sep 124.67 Table 5 16.17 o see Tal 170.24	76.71  ater is fr  Oct 124.67  20.53  ble 5 182.64	79.36 om com Nov 124.67	84.38 munity h  Dec 124.67		(66) (67)
include (57)m in cal  5. Internal gains (see  Metabolic gains (Table  Jan Feb  (66)m= 124.67 124.67  Lighting gains (calculate)  (67)m= 24.85 22.07  Appliances gains (calculate)  (68)m= 222.85 225.17	81.04 culation of a Table 5 at a 5), Watts Mar 124.67 ated in App 17.95 culated in 4 at a 219.34	74.04  f (65)m  and 5a)  S  Apr  124.67  Dendix I  13.59  Append  206.93	73.57 only if controls:  May 124.67 L, equati 10.16 dix L, equ 191.27	Jun 124.67 on L9 on 8.58 uation L	Jul 124.67 r L9a), a 9.27 13 or L1 166.72	70.41 dwelling  Aug 124.67 lso see 12.05 3a), also 164.41	69.7 or hot w Sep 124.67 Table 5 16.17 o see Tal 170.24	76.71  ater is fr  Oct 124.67  20.53  ble 5 182.64	79.36 om com Nov 124.67	84.38 munity h  Dec 124.67		(66) (67)
include (57)m in cal  5. Internal gains (see  Metabolic gains (Table  Jan Feb  (66)m= 124.67 124.67  Lighting gains (calculate)  (67)m= 24.85 22.07  Appliances gains (calculate)  (68)m= 222.85 225.17  Cooking gains (calculate)	81.04 culation of e Table 5 at e 5), Watts Mar 124.67 ated in App 17.95 culated in App 219.34 ated in App 35.47	74.04 f (65)m and 5a) s Apr 124.67 pendix I 13.59 Append 206.93 pendix 35.47	73.57 only if controls:  May 124.67 L, equati 10.16 dix L, equati 191.27 L, equat	Jun 124.67 on L9 o 8.58 uation L 176.55 ion L15	Jul 124.67 r L9a), a 9.27 13 or L1 166.72 or L15a)	70.41 dwelling  Aug 124.67 lso see 12.05 3a), also 164.41 , also se	Sep 124.67 Table 5 16.17 See Tall 170.24	76.71  ater is fr  Oct 124.67  20.53  ole 5 182.64 5	79.36 om com Nov 124.67 23.96	84.38 munity h  Dec 124.67 25.54 213.02		(66) (67) (68)
include (57)m in cal  5. Internal gains (see  Metabolic gains (Table  Jan Feb  (66)m= 124.67 124.67  Lighting gains (calculate)  (67)m= 24.85 22.07  Appliances gains (calculate)  (68)m= 222.85 225.17  Cooking gains (calculate)  (69)m= 35.47 35.47	81.04 culation of e Table 5 at e 5), Watts Mar 124.67 ated in App 17.95 culated in App 219.34 ated in App 35.47	74.04 f (65)m and 5a) s Apr 124.67 pendix I 13.59 Append 206.93 pendix 35.47	73.57 only if controls:  May 124.67 L, equati 10.16 dix L, equati 191.27 L, equat	Jun 124.67 on L9 o 8.58 uation L 176.55 ion L15	Jul 124.67 r L9a), a 9.27 13 or L1 166.72 or L15a)	70.41 dwelling  Aug 124.67 lso see 12.05 3a), also 164.41 , also se	Sep 124.67 Table 5 16.17 See Tall 170.24	76.71  ater is fr  Oct 124.67  20.53  ole 5 182.64 5	79.36 om com Nov 124.67 23.96	84.38 munity h  Dec 124.67 25.54 213.02		(66) (67) (68)
include (57)m in cal  5. Internal gains (see  Metabolic gains (Table  Jan Feb  (66)m= 124.67 124.67  Lighting gains (calculate)  (67)m= 24.85 22.07  Appliances gains (calculate)  (68)m= 222.85 225.17  Cooking gains (calculate)  (69)m= 35.47 35.47  Pumps and fans gains	81.04 culation of e Table 5 at e 5), Watts Mar 124.67 ated in App 17.95 culated in App 219.34 ated in App 35.47 at ed in App 35.47	74.04  f (65)m  and 5a)  S  Apr  124.67  Dendix I  13.59  Appendix  206.93  pendix  35.47  a)  3	73.57 only if controls:  May 124.67 L, equati 10.16 dix L, equati 191.27 L, equati 35.47	Jun 124.67 5 on L9 o 8.58 uation L 176.55 ion L15 35.47	Jul 124.67 r L9a), a 9.27 13 or L1 166.72 or L15a) 35.47	70.41 dwelling  Aug 124.67 lso see 12.05 3a), also 164.41 ), also se 35.47	Sep 124.67 Table 5 16.17 See Tal 170.24 ee Table 35.47	76.71  ater is fr  Oct 124.67  20.53 ble 5 182.64 5 35.47	79.36 om com Nov 124.67 23.96	84.38 munity h Dec 124.67 25.54 213.02		(66) (67) (68) (69)
include (57)m in cal  5. Internal gains (see  Metabolic gains (Table  Jan Feb  (66)m= 124.67 124.67  Lighting gains (calcula (67)m= 24.85 22.07  Appliances gains (calcula (68)m= 222.85 225.17  Cooking gains (calcula (69)m= 35.47 35.47  Pumps and fans gains (70)m= 3 3	81.04 culation of e Table 5 at e 5), Watts Mar 124.67 ated in App 17.95 culated in App 219.34 ated in App 35.47 at ed in App 35.47	74.04  f (65)m  and 5a)  S  Apr  124.67  Dendix I  13.59  Appendix  206.93  pendix  35.47  a)  3	73.57 only if controls:  May 124.67 L, equati 10.16 dix L, equati 191.27 L, equati 35.47	Jun 124.67 5 on L9 o 8.58 uation L 176.55 ion L15 35.47	Jul 124.67 r L9a), a 9.27 13 or L1 166.72 or L15a) 35.47	70.41 dwelling  Aug 124.67 lso see 12.05 3a), also 164.41 ), also se 35.47	Sep 124.67 Table 5 16.17 See Tal 170.24 ee Table 35.47	76.71  ater is fr  Oct 124.67  20.53 ble 5 182.64 5 35.47	79.36 om com Nov 124.67 23.96	84.38 munity h Dec 124.67 25.54 213.02		(66) (67) (68) (69)
include (57)m in cal  5. Internal gains (see  Metabolic gains (Table  Jan Feb  (66)m= 124.67 124.67  Lighting gains (calculate) (67)m= 24.85 22.07  Appliances gains (calculate) (68)m= 222.85 225.17  Cooking gains (calculate) (69)m= 35.47 35.47  Pumps and fans gains (70)m= 3 3  Losses e.g. evaporation	81.04  culation of a Table 5 at 5), Watts  Mar 124.67  ated in App 17.95  culated in App 219.34  ated in App 35.47	74.04  f (65)m  and 5a)  S  Apr  124.67  Dendix I  13.59  Append  206.93  pendix  35.47  a)  3  ve value	73.57 only if control of the control	Jun 124.67 on L9 on 8.58 uation L 176.55 ion L15 35.47	Jul 124.67 r L9a), a 9.27 13 or L1 166.72 or L15a) 35.47	70.41 dwelling  Aug 124.67 lso see 12.05 3a), also 164.41 ), also se 35.47	Sep 124.67 Table 5 16.17 See Tal 170.24 9e Table 35.47	76.71 ater is fr  Oct 124.67  20.53 ble 5 182.64 5 35.47	79.36 om com  Nov 124.67 23.96 198.3 35.47	84.38 munity h  Dec 124.67  25.54  213.02  35.47		(66) (67) (68) (69)
include (57)m in cal  5. Internal gains (see  Metabolic gains (Table  Jan Feb  (66)m= 124.67 124.67  Lighting gains (calculate) (67)m= 24.85 22.07  Appliances gains (calculate) (68)m= 222.85 225.17  Cooking gains (calculate) (69)m= 35.47 35.47  Pumps and fans gains (70)m= 3 3  Losses e.g. evaporation (71)m= -99.74 -99.74	81.04  culation of a Table 5 at 5), Watts  Mar	74.04  f (65)m  and 5a)  S  Apr  124.67  Dendix I  13.59  Append  206.93  pendix  35.47  a)  3  ve value	73.57 only if control of the control	Jun 124.67 on L9 on 8.58 uation L 176.55 ion L15 35.47	Jul 124.67 r L9a), a 9.27 13 or L1 166.72 or L15a) 35.47	70.41 dwelling  Aug 124.67 lso see 12.05 3a), also 164.41 ), also se 35.47	Sep 124.67 Table 5 16.17 See Tal 170.24 9e Table 35.47	76.71 ater is fr  Oct 124.67  20.53 ble 5 182.64 5 35.47	79.36 om com  Nov 124.67 23.96 198.3 35.47	84.38 munity h  Dec 124.67  25.54  213.02  35.47		(66) (67) (68) (69)
include (57)m in cal  5. Internal gains (see  Metabolic gains (Table  Jan Feb  (66)m= 124.67 124.67  Lighting gains (calcula (67)m= 24.85 22.07  Appliances gains (calcula (68)m= 222.85 225.17  Cooking gains (calcula (69)m= 35.47 35.47  Pumps and fans gains (70)m= 3 3  Losses e.g. evaporatic (71)m= -99.74 -99.74  Water heating gains (**)	81.04  culation of a Table 5 at a ted in App a	74.04 f (65)m and 5a) s Apr 124.67 Dendix I 13.59 Appendix 206.93 pendix 35.47 a) 3 ve value -99.74	73.57 only if controls:  May 124.67  L, equati 10.16 dix L, equati 191.27  L, equati 35.47  3 es) (Tab -99.74	Jun 124.67 fon L9 of 8.58 uation L 176.55 ion L15 35.47  3 le 5) -99.74	Jul 124.67 r L9a), a 9.27 13 or L1 166.72 or L15a) 35.47	70.41 dwelling  Aug 124.67 lso see 12.05 3a), also 164.41 ), also se 35.47  3  -99.74	Sep 124.67 Table 5 16.17 See Talle 170.24 ee Table 35.47	76.71 ater is fr  Oct 124.67  20.53 ble 5 182.64 5 35.47  3 -99.74	79.36  om com  Nov 124.67  23.96  198.3  35.47  3  -99.74	84.38 munity h  Dec 124.67  25.54  213.02  35.47  3  -99.74		(66) (67) (68) (69) (70)
include (57)m in cal  5. Internal gains (see  Metabolic gains (Table	81.04  culation of a Table 5 a 5), Watts  Mar  124.67  ated in App  17.95  culated in App  219.34  ated in App  35.47  s (Table 5a 3  on (negative 199.74  Table 5)  108.93	74.04 f (65)m and 5a) s Apr 124.67 Dendix I 13.59 Appendix 206.93 pendix 35.47 a) 3 ve value -99.74	73.57 only if controls:  May 124.67  L, equati 10.16 dix L, equati 191.27  L, equati 35.47  3 es) (Tab -99.74	Jun 124.67 fon L9 of 8.58 uation L 176.55 ion L15 35.47  3 le 5) -99.74	Jul 124.67 r L9a), a 9.27 13 or L1 166.72 or L15a) 35.47	70.41 dwelling  Aug 124.67 lso see 12.05 3a), also 164.41 ), also se 35.47  3  -99.74	Sep 124.67 Table 5 16.17 See Tal 170.24 9e Table 35.47  96.8	76.71 ater is fr  Oct 124.67  20.53 ble 5 182.64 5 35.47  3 -99.74	79.36  om com  Nov 124.67  23.96  198.3  35.47  3  -99.74	84.38 munity h  Dec 124.67  25.54  213.02  35.47  3  -99.74		(66) (67) (68) (69) (70)
include (57)m in cal  5. Internal gains (see  Metabolic gains (Table  Jan Feb  (66)m= 124.67 124.67  Lighting gains (calcula (67)m= 24.85 22.07  Appliances gains (calcula (68)m= 222.85 225.17  Cooking gains (calcula (69)m= 35.47 35.47  Pumps and fans gains (70)m= 3 3  Losses e.g. evaporatio (71)m= -99.74 -99.74  Water heating gains (** (72)m= 115.57 113.41  Total internal gains =	81.04  culation of a Table 5 a 5), Watts  Mar  124.67  ated in App  17.95  culated in App  219.34  ated in App  35.47  s (Table 5a 3  on (negative 199.74  Table 5)  108.93	74.04 f (65)m and 5a) s Apr 124.67 cendix I 13.59 Appendix 206.93 pendix 35.47 a) 3 ve value -99.74	73.57 only if controls:  May 124.67 L, equati 10.16 dix L, equati 191.27 L, equati 35.47  3 es) (Tab -99.74	Jun 124.67 fon L9 of 8.58 uation L 176.55 ion L15 35.47  3 le 5) -99.74	Jul 124.67 r L9a), a 9.27 13 or L1 166.72 or L15a) 35.47 3	70.41 dwelling  Aug 124.67 lso see 12.05 3a), also 164.41 ), also se 35.47  3  -99.74	Sep 124.67 Table 5 16.17 See Tal 170.24 ee Table 35.47  3  -99.74	76.71  ater is fr  Oct 124.67  20.53  ole 5 182.64  5 35.47  3  -99.74  103.1  70)m + (7	79.36 om com Nov 124.67 23.96 198.3 35.47 3 -99.74 110.22 1)m + (72)	84.38 munity h  Dec 124.67  25.54  213.02  35.47  3  -99.74		(66) (67) (68) (69) (70) (71)

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

Orientation: A	ccess Facto able 6d	r	Area m²		Flux Table 6a	l		g_ Table 6b		FF Table 6c			Gains (W)	
Northeast <sub>0.9x</sub>	0.77	x	5.92	X	11.28	×	· [	0.63	x	0.7		<u> </u>	20.41	(75)
Northeast <sub>0.9x</sub>	0.77	x	5.92	x	22.97	x	, <u> </u>	0.63	×	0.7	<u> </u>	<u> </u>	41.55	(75)
Northeast 0.9x	0.77	x	5.92	X	41.38	<u> </u>	, <u> </u>	0.63	×	0.7	╡ -	<u> </u>	74.86	(75)
Northeast <sub>0.9x</sub>	0.77	x	5.92	x	67.96	<u> </u>	, <u> </u>	0.63	x	0.7	<del>=</del>	<u> </u>	122.95	(75)
Northeast <sub>0.9x</sub>	0.77	x	5.92	X	91.35	<u> </u>	· [	0.63	×	0.7		• [	165.27	(75)
Northeast <sub>0.9x</sub>	0.77	x	5.92	X	97.38	x	· [	0.63	x	0.7		• [	176.19	(75)
Northeast <sub>0.9x</sub>	0.77	x	5.92	X	91.1	x	· [	0.63	x	0.7		• [	164.82	(75)
Northeast <sub>0.9x</sub>	0.77	x	5.92	X	72.63	x	· [	0.63	x	0.7		• [	131.4	(75)
Northeast <sub>0.9x</sub>	0.77	x	5.92	X	50.42	X	· [	0.63	x	0.7		<u> </u>	91.22	(75)
Northeast <sub>0.9x</sub>	0.77	x	5.92	X	28.07	X	· [	0.63	x	0.7		<u> </u>	50.78	(75)
Northeast <sub>0.9x</sub>	0.77	X	5.92	X	14.2	×	· [	0.63	x	0.7		<u> </u>	25.69	(75)
Northeast <sub>0.9x</sub>	0.77	x	5.92	X	9.21	x	· [	0.63	x	0.7		• [	16.67	(75)
Southwest <sub>0.9x</sub>	0.77	x	5.92	X	36.79			0.63	x	0.7		<u> </u>	66.57	(79)
Southwest <sub>0.9x</sub>	0.77	x	5.92	X	62.67			0.63	x	0.7		<u> </u>	113.39	(79)
Southwest <sub>0.9x</sub>	0.77	x	5.92	X	85.75			0.63	x	0.7		<u> </u>	155.15	(79)
Southwest <sub>0.9x</sub>	0.77	x	5.92	X	106.25		Ī	0.63	x	0.7		• [	192.23	(79)
Southwest <sub>0.9x</sub>	0.77	x	5.92	X	119.01		Ī	0.63	x	0.7		• [	215.32	(79)
Southwest <sub>0.9x</sub>	0.77	x	5.92	X	118.15		Ī	0.63	x	0.7		<u> </u>	213.76	(79)
Southwest <sub>0.9x</sub>	0.77	x	5.92	X	113.91		Ī	0.63	x	0.7		• [	206.09	(79)
Southwest <sub>0.9x</sub>	0.77	X	5.92	X	104.39			0.63	x	0.7		<u> </u>	188.87	(79)
Southwest <sub>0.9x</sub>	0.77	x	5.92	X	92.85			0.63	x	0.7		<u> </u>	167.99	(79)
Southwest <sub>0.9x</sub>	0.77	X	5.92	X	69.27			0.63	x	0.7		<u> </u>	125.32	(79)
Southwest <sub>0.9x</sub>	0.77	x	5.92	x	44.07			0.63	x	0.7	=	<u> </u>	79.73	(79)
Southwest <sub>0.9x</sub>	0.77	x	5.92	X	31.49			0.63	x	0.7	=	<u> </u>	56.97	(79)
Rooflights <sub>0.9x</sub>	1	x	4.3	X	26	Х		0.63	X	0.8		<u> </u>	50.71	(82)
Rooflights <sub>0.9x</sub>	1	x	4.3	X	54	Х	(	0.63	x	0.8		<u> </u>	105.33	(82)
Rooflights <sub>0.9x</sub>	1	x	4.3	X	96	Х	(	0.63	x	0.8		<u> </u>	187.25	(82)
Rooflights <sub>0.9x</sub>	1	x	4.3	X	150	Х		0.63	x	0.8	=	<u> </u>	292.57	(82)
Rooflights 0.9x	1	X	4.3	X	192	×	(	0.63	x	0.8	=	<u> </u>	374.49	(82)
Rooflights <sub>0.9x</sub>	1	X	4.3	X	200	Х	(	0.63	x	0.8		<u> </u>	390.1	(82)
Rooflights 0.9x	1	X	4.3	X	189	X		0.63	x	0.8	=	<u> </u>	368.64	(82)
Rooflights 0.9x	1	x	4.3	X	157	×		0.63	x	0.8	=	<u> </u>	306.23	(82)
Rooflights 0.9x	1	X	4.3	X	115	X	(	0.63	X	0.8	=	<u> </u>	224.31	(82)
Rooflights <sub>0.9x</sub>	1	x	4.3	X	66	×		0.63	x	0.8	=	<u> </u>	128.73	(82)
Rooflights <sub>0.9x</sub>	1	X	4.3	X	33	х	(	0.63	x	0.8	=	<u> </u>	64.37	(82)
Rooflights 0.9x	1	X	4.3	X	21	X	(	0.63	X	0.8	=	<u> </u>	40.96	(82)
Solar gains in v		$\overline{}$			,,, ,, l	_		= Sum(74)m		122 ==		$\neg$		(00)
(83)m= 137.69	260.27 417		607.75 755.0		780.05 739.5		26.4	19 483.52	304.83	169.78	114.6	╝		(83)
Total gains – in (84)m= 564.37	684.32 826		$\frac{(84)\text{III} = (73)}{994.52  1118.}$		121.89 1067.		60.9	99 830.12	674.51	565.68	529.99	$\Box$		(84)
(04)111=   304.37	004.32   626	.00	394.02   1118.	1 81	121.08 1007.	JZ   90	00.8	030.12	074.5	303.08	529.98	"		(04)

7. Me	an inter	nal temr	perature	(heating	season	)								
			neating p			•	from Tal	ole 9. Th	1 (°C)				21	(85)
•		_	ains for l			•		, ···	( - )					`
•	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(86)m=	1	0.99	0.98	0.94	0.85	0.68	0.53	0.6	0.84	0.97	0.99	1		(86)
Mean	interna	l temper	ature in	living are	ea T1 (fo	ollow ste	ps 3 to 7	in Tabl	e 9c)					
(87)m=	18.98	19.21	19.61	20.17	20.61	20.89	20.97	20.95	20.73	20.15	19.5	19		(87)
Temp	erature	during h	neating p	eriods ir	rest of	dwelling	from Ta	able 9, T	h2 (°C)					
(88)m=	19.42	19.43	19.45	19.5	19.51	19.57	19.57	19.58	19.55	19.51	19.49	19.47		(88)
Utilisa	ation fac	tor for g	ains for	rest of d	welling,	h2,m (se	e Table	9a)						
(89)m=	0.99	0.99	0.97	0.91	0.78	0.56	0.37	0.43	0.75	0.95	0.99	1		(89)
Mean	interna	l temper	ature in	the rest	of dwelli	ng T2 (f	ollow ste	eps 3 to	7 in Tabl	e 9c)				
(90)m=	17.65	17.88	18.28	18.87	19.27	19.52	19.56	19.57	19.41	18.87	18.22	17.7		(90)
		-				-	-	-	f	fLA = Livin	g area ÷ (4	4) =	0.37	(91)
Mean	interna	l temper	ature (fo	r the wh	ole dwe	lling) = f	LA × T1	+ (1 – fL	.A) × T2					
(92)m=	18.14	18.38	18.77	19.35	19.77	20.03	20.08	20.08	19.9	19.34	18.69	18.18		(92)
Apply	adjustn	nent to t	he mean	interna	temper	ature fro	m Table	4e, whe	ere appro	opriate	-	-		
(93)m=	18.14	18.38	18.77	19.35	19.77	20.03	20.08	20.08	19.9	19.34	18.69	18.18		(93)
			uirement											
			ternal ter or gains	•		ned at sto	ep 11 of	Table 9	o, so tha	t Ti,m=(	76)m an	d re-calc	ulate	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisa	ation fac	tor for g	ains, hm	:										
(94)m=	0.99	0.99	0.97	0.91	0.79	0.6	0.43	0.49	0.77	0.95	0.99	0.99		(94)
		i	, W = (9 <sup>2</sup>	<u> </u>										(0.5)
(95)m=		674.27	798.89	905.88	888.93	677.43	460.38	475.18	643.02	639.43	558.24	526.87		(95)
(96)m=	4.3	age exte	rnal tem	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
			an intern			l	l			ļ	7.1	4.2		(00)
		2036.96			1144.87	736.91	472.69	495.22	801.03	1240.29	1676.03	2058.16		(97)
Space	e heatin	g require	ement fo	r each n	nonth, k\	Nh/mon	th = $0.02$	24 x [(97	ı )m – (95	)m] x (4 <sup>-</sup>	1)m			
-	1153.67		773.9	425.72	190.42	0	0	0	0	447.04	804.81	1139.28		
			•			•	•	Tota	l per year	(kWh/year	) = Sum(9	8) <sub>15,912</sub> =	5850.57	(98)
Space	e heatin	g require	ement in	kWh/m²	/year								71.65	(99)
9a. En	ergy red	quiremer	nts – Indi	vidual h	eating sy	ystems i	ncluding	micro-C	CHP)					
-	e heatir	_			/ !-		1							¬(004)
			at from s			mentary	system		(204)				0	(201)
			at from m	-	` ,			(202) = 1	` '	(000)			1	(202)
			ng from	-				(204) = (2	02) × [1 –	(203)] =			1	(204)
	•	•	ace heat										86.9	(206)
Efficie	ency of s	seconda	ry/suppl	ementar	y heating	g systen	າ, %						0	(208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/yea	ar
Space heating	•	· `	r	ı i		ı		ı	ı	ı	ı	1	
1153.67		773.9	425.72	190.42	0	0	0	0	447.04	804.81	1139.28		
$(211)$ m = {[(98)]	•	<del></del>	<u> </u>						T 54.40	000.44	4044.00	I	(211)
1327.59	1053.77	890.57	489.89	219.13	0	0	0 Tota	0 (kWh/ve:	514.42 ar) =Sum(2	926.14	1311.02	6732.53	(211)
Space heating	a fuel (c	ocondor	v) k\/h/	month			rota	ii (ittviii) yot	ui) – <b>C</b> uii(2	- ' '/15,1012	2	6/32.53	
$= \{[(98) \text{m x } (20)\}$	•		• •	monun									
(215)m = 0	0	0	0	0	0	0	0	0	0	0	0		
			•			!	Tota	l (kWh/yea	ar) =Sum(2	215) <sub>15,1012</sub>	=	0	(215)
Water heating	l										'		_
Output from wa					4.40	400.44	4 40 74	140.55	1,00,04	470.00	404.70	1	
196.53 Efficiency of w	173.15	181.68	162.62	159.19	142	136.14	149.71	149.55	168.64	178.62	191.72	76.8	(216)
(217)m= 85.27	85.12	84.78	83.85	81.99	76.8	76.8	76.8	76.8	83.88	84.87	85.28	70.0	(217)
Fuel for water				01.00	70.0	7 0.0	10.0	7 0.0	00.00	0 1.01	00.20		(= ,
(219)m = (64)	0,								•	•		•	
(219)m= 230.49	203.42	214.29	193.94	194.16	184.89	177.27	194.94	194.72	201.06	210.46	224.8		7
							Tota	I = Sum(2				2424.44	(219)
Annual totals Space heating	fuel use	d main	system	1					k\	Wh/year	•	<b>kWh/year</b> 6732.53	7
			oyotom	•									] 7
Water heating			-1(-'									2424.44	_
Electricity for p	·		electric	keep-no	[							Ī	(222.)
central heatin											30		(230c)
boiler with a f											45		(230e)
Total electricity	for the	above, I	kWh/yea	r			sum	of (230a).	(230g) =			75	(231)
Electricity for li	ghting											438.92	(232)
12a. CO2 em	issions -	– Individ	ual heati	ing syste	ms inclu	uding mi	cro-CHP	)					
					En	ergy			Emiss	ion fac	tor	Emissions	
					kW	/h/year			kg CO	2/kWh		kg CO2/yea	ır
Space heating	(main s	ystem 1	)		(21	1) x			0.2	16	=	1454.23	(261)
Space heating	(second	dary)			(21	5) x			0.5	19	=	0	(263)
Water heating					(219	9) x			0.2	16	=	523.68	(264)
Space and wat	ter heati	ng			(26	1) + (262)	+ (263) + (	(264) =				1977.91	(265)
Electricity for p	umps, f	ans and	electric	keep-ho	(23	1) x			0.5	19	=	38.93	(267)
Electricity for li	ghting				(232	2) x			0.5	19	=	227.8	(268)
Total CO2, kg/	year							sum o	of (265)(2	271) =		2244.63	(272)
Dwelling CO2	Emissi	on Rate	<b>!</b>					(272)	÷ (4) =			27.49	(273)
El rating (secti	on 14)											76	(274)
• •													_