

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property Reference	4907-0015-3990-018			Issued on Date	12/02/2020
Assessment Reference	018	Prop Type Ref	GFF Det		
Property	Plot 018, 2 Bed, K, Ba, ES, Welwyn Garden City				
SAP Rating	83 B	DER	19.10	TER	21.06
Environmental	87 B	% DER<TER	9.31		
CO₂ Emissions (t/year)	0.92	DFEE	48.75	TFEE	56.58
General Requirements Compliance	Pass	% DFEE<TFEE	13.84		
Assessor Details	Mr. Fraser Browning, Fraser Browning, Tel: 01884 242050, Fraser.browning@aessc.co.uk			Assessor ID	4907-0015
Client	TW North Thames, Taylor Wimpey				

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

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DWELLING AS DESIGNED

Ground-floor flat, total floor area 56 m²

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

1a TER and DER

Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 21.06 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 19.10 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)56.6 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)48.7 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.24 (max. 0.30)	0.25 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.15 (max. 0.25)	0.15 (max. 0.70)	OK
Roof (no roof)			
Openings	1.33 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals: 4.00 (design value)
Maximum 10.0 OK

4 Heating efficiency

Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Ideal LOGIC COMBI ESP1 35
Combi boiler
Efficiency: 89.6% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system:

None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Time and temperature zone control OK

Hot water controls:

No cylinder

Boiler interlock

Yes OK

7 Low energy lights

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

8 Mechanical ventilation

Continuous extract system (decentralised)
Specific fan power: 0.1900 0.1800
Maximum 0.7 OK

9 Summertime temperature

Overheating risk (East Anglia): Slight OK
Based on:
Overshading: Average
Windows facing North East: 3.99 m², No overhang
Windows facing South West: 3.97 m², No overhang
Air change rate: 3.00 ach
Blinds/curtains: None

10 Key features

Party wall U-value 0.00 W/m²K
Door U-value 1.08 W/m²K

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	56.4000 (1b)	2.3900 (2b)	134.7960 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	56.4000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	134.7960 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour	
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)	
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)	
Number of intermittent fans				0 * 10 =	0.0000 (7a)	
Number of passive vents				0 * 10 =	0.0000 (7b)	
Number of flueless gas fires				0 * 40 =	0.0000 (7c)	
Air changes per hour						
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					0.0000 / (5) =	0.0000 (8)
Pressure test					Yes	
Measured/design AP50					4.0000	
Infiltration rate					0.2000	(18)
Number of sides sheltered					1	(19)
Shelter factor					(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor					(21) = (18) x (20) =	0.1850 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.2359	0.2313	0.2266	0.2035	0.1989	0.1758	0.1758	0.1711	0.1850	0.1989	0.2081	0.2174 (22b)
Mechanical extract ventilation - decentralised												0.5000 (23a)
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
DTC			2.1200	1.0800	2.2896		(26)
Windows (Uw = 1.40)			5.4400	1.3258	7.2121		(27)
French Door (Uw = 1.40)			2.5200	1.3258	3.3409		(27)
Jetfloor Grey			56.4000	0.1500	8.4600	75.0000	4230.0000 (28a)
External Wall	59.1100	7.9600	51.1500	0.2500	12.7875	52.8000	2700.7200 (29a)
External Wall to Stairwell	20.2500	2.1200	18.1300	0.2000	3.6260	52.8000	957.2640 (29a)
Total net area of external elements Aum(A, m2)			135.7600				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	37.7161			(33)
E-FC-4			56.4000			70.0000	3948.0000 (32b)
Metal			114.3900			14.0000	1601.4600 (32c)
Heat capacity Cm = Sum(A x k)			(28)...(30) + (32) + (32a)...(32e) =				13437.4440 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							238.2526 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.6283 (36)
Total fabric heat loss			(33) + (36) =				43.3445 (37)

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

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	65.5858	65.5858	65.5858	65.5858	65.5858	65.5858	65.5858	65.5858	65.5858	65.5858	65.5858	65.5858 (39)
Average = Sum(39)m / 12 =												65.5858 (39)
HLP	1.1629	1.1629	1.1629	1.1629	1.1629	1.1629	1.1629	1.1629	1.1629	1.1629	1.1629	1.1629 (40)
HLP (average)												1.1629 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Assumed occupancy												1.8782 (42)
Average daily hot water use (litres/day)												78.8083 (43)
Daily hot water use	86.6892	83.5368	80.3845	77.2322	74.0798	70.9275	70.9275	74.0798	77.2322	80.3845	83.5368	86.6892 (44)
Energy conte	128.5575	112.4372	116.0252	101.1535	97.0592	83.7547	77.6111	89.0598	90.1235	105.0303	114.6487	124.5011 (45)
Energy content (annual)												Total = Sum(45)m = 1239.9620 (45)

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Distribution loss (46)m = 0.15 x (45)m	19.2836	16.8656	17.4038	15.1730	14.5589	12.5632	11.6417	13.3590	13.5185	15.7545	17.1973	18.6752 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.0240	12.6507	13.9804	13.5003	13.9291	13.4554	13.8887	13.9149	13.4799	13.9592	13.5427	14.0156 (61)
Total heat required for water heating calculated for each month	142.5816	125.0879	130.0056	114.6538	110.9884	97.2101	91.4998	102.9747	103.6034	118.9894	128.1914	138.5167 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	142.5816	125.0879	130.0056	114.6538	110.9884	97.2101	91.4998	102.9747	103.6034	118.9894	128.1914	138.5167 (64)
Heat gains from water heating, kWh/month	46.2514	40.5481	42.0735	37.0086	35.7545	31.2123	29.2779	33.0911	33.3360	38.4124	41.5064	44.9005 (65)
												Solar input (sum of months) = Sum(63)m = 0.0000 (63)
												Total per year (kWh/year) = Sum(64)m = 1404.3028 (64)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	93.9123	93.9123	93.9123	93.9123	93.9123	93.9123	93.9123	93.9123	93.9123	93.9123	93.9123	93.9123 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	15.6374	13.8890	11.2953	8.5513	6.3922	5.3965	5.8311	7.5795	10.1732	12.9173	15.0764	16.0720 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	163.7855	165.4850	161.2021	152.0844	140.5748	129.7575	122.5309	120.8313	125.1142	134.2319	145.7415	156.5588 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	32.3912	32.3912	32.3912	32.3912	32.3912	32.3912	32.3912	32.3912	32.3912	32.3912	32.3912	32.3912 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-75.1298	-75.1298	-75.1298	-75.1298	-75.1298	-75.1298	-75.1298	-75.1298	-75.1298	-75.1298	-75.1298	-75.1298 (71)
Water heating gains (Table 5)	62.1658	60.3394	56.5504	51.4009	48.0571	43.3504	39.3520	44.4773	46.3000	51.6295	57.6477	60.3502 (72)
Total internal gains	295.7624	293.8871	283.2215	266.2102	249.1978	232.6781	221.8876	227.0618	235.7611	252.9524	272.6392	287.1546 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	g	Specific data or Table 6c	FF	Access factor Table 6d	Gains W				
Northeast	3.9900	11.2829	0.4300	0.4300	0.0000	0.7700	14.9058 (75)					
Southwest	1.4500	36.7938	0.4300	0.4300	0.0000	0.7700	17.6645 (79)					
Southwest	2.5200	36.7938	0.4300	0.4300	0.0000	0.7700	30.6997 (79)					
Solar gains	63.2700	112.7234	167.3841	229.4400	277.1119	283.9580	270.0828	233.1645	188.6611	128.1292	76.6846	53.5625 (83)
Total gains	359.0324	406.6105	450.6055	495.6502	526.3096	516.6361	491.9705	460.2263	424.4222	381.0816	349.3238	340.7172 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation factor for gains for living area, nil,m (see Table 9a)	56.9121	56.9121	56.9121	56.9121	56.9121	56.9121	56.9121	56.9121	56.9121	56.9121	56.9121	56.9121 (85)
tau	4.7941	4.7941	4.7941	4.7941	4.7941	4.7941	4.7941	4.7941	4.7941	4.7941	4.7941	4.7941
alpha	0.9968	0.9936	0.9851	0.9579	0.8823	0.7320	0.5669	0.6229	0.8528	0.9720	0.9938	0.9975 (86)
MIT	19.7278	19.8753	20.1252	20.4500	20.7488	20.9283	20.9833	20.9741	20.8437	20.4623	20.0261	19.6854 (87)
Th 2	19.9498	19.9498	19.9498	19.9498	19.9498	19.9498	19.9498	19.9498	19.9498	19.9498	19.9498	19.9498 (88)
util rest of house	0.9958	0.9916	0.9801	0.9425	0.8387	0.6410	0.4413	0.4962	0.7832	0.9587	0.9914	0.9967 (89)
MIT 2	18.2596	18.4745	18.8368	19.2990	19.6979	19.9000	19.9433	19.9385	19.8203	19.3235	18.6953	18.1978 (90)
Living area fraction	18.8206	19.0097	19.3290	19.7388	20.0995	20.2929	20.3407	20.3342	20.2113	19.7586	19.2038	18.7662 (92)
MIT	18.8206	19.0097	19.3290	19.7388	20.0995	20.2929	20.3407	20.3342	20.2113	19.7586	19.2038	18.7662 (93)
Temperature adjustment												0.0000
adjusted MIT	18.8206	19.0097	19.3290	19.7388	20.0995	20.2929	20.3407	20.3342	20.2113	19.7586	19.2038	18.7662 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9942	0.9890	0.9761	0.9387	0.8457	0.6729	0.4896	0.5447	0.8029	0.9556	0.9890	0.9954 (94)
Ext temp.	356.9428	402.1505	439.8323	465.2550	445.1177	347.6292	240.8794	250.6969	340.7743	364.1443	345.4690	339.1493 (95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Month fracti	952.3461	925.3977	841.4033	710.8709	550.8869	373.3745	245.3356	258.0277	400.8161	600.6733	793.8390	955.3361 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating	442.9800	351.6221	298.7689	176.8434	78.6923	0.0000	0.0000	0.0000	0.0000	175.9776	322.8264	458.4430 (98)
Space heating per m2												2306.1537 (98)
												(98) / (4) = 40.8893 (99)

8c. Space cooling requirement

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													2466.4746 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	442.9800	351.6221	298.7689	176.8434	78.6923	0.0000	0.0000	0.0000	0.0000	175.9776	322.8264	458.4430	(98)
Space heating efficiency (main heating system 1)	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)
Space heating fuel (main heating system)	473.7755	376.0665	319.5389	189.1374	84.1629	0.0000	0.0000	0.0000	0.0000	188.2113	345.2688	490.3134	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	142.5816	125.0879	130.0056	114.6538	110.9884	97.2101	91.4998	102.9747	103.6034	118.9894	128.1914	138.5167	(64)
Efficiency of water heater (217)m	89.6994	89.6378	89.5052	89.2138	88.5997	87.3000	87.3000	87.3000	87.3000	89.1813	89.5669	87.3000	(216)
Fuel for water heating, kWh/month	158.9549	139.5481	145.2491	128.5159	125.2695	111.3518	104.8107	117.9550	118.6751	133.4242	143.1237	154.3589	(219)
Water heating fuel used													1581.2369 (219)
Annual totals kWh/year													
Space heating fuel - main system													2466.4746 (211)
Space heating fuel - secondary													0.0000 (215)
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 6.9550, total flow = 29.0000, SFP = 0.2398)													
mechanical ventilation fans (SFP = 0.2398)													39.4399 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													114.4399 (231)
Electricity for lighting (calculated in Appendix L)													276.1610 (232)
Total delivered energy for all uses													4438.3124 (238)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	2466.4746	0.2160	532.7585 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1581.2369	0.2160	341.5472 (264)
Space and water heating			874.3057 (265)
Pumps and fans	114.4399	0.5190	59.3943 (267)
Energy for lighting	276.1610	0.5190	143.3275 (268)
Total CO2, kg/year			1077.0275 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			19.1000 (273)

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

	TFA	N	EF	
DER				19.1000 ZC1
Total Floor Area		56.4000		
Assumed number of occupants		1.8782		
CO2 emission factor in Table 12 for electricity displaced from grid		0.5190		
CO2 emissions from appliances, equation (L14)				17.2085 ZC2
CO2 emissions from cooking, equation (L16)				2.9092 ZC3
Total CO2 emissions				39.2177 ZC4
Residual CO2 emissions offset from biofuel CHP				0.0000 ZC5
Additional allowable electricity generation, kWh/m²/year				0.0000 ZC6
Resulting CO2 emissions offset from additional allowable electricity generation				0.0000 ZC7
Net CO2 emissions				39.2177 ZC8

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	56.4000 (1b)	x 2.3900 (2b)	= 134.7960 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	56.4000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 134.7960 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)
Number of intermittent fans				2 * 10 =	20.0000 (7a)
Number of passive vents				0 * 10 =	0.0000 (7b)
Number of flueless gas fires				0 * 40 =	0.0000 (7c)
Air changes per hour					
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				20.0000 / (5) =	0.1484 (8)
Pressure test				Yes	
Measured/design AP50				5.0000	
Infiltration rate				0.3984	(18)
Number of sides sheltered				1	(19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.9250 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3685 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4698	0.4606	0.4514	0.4053	0.3961	0.3501	0.3501	0.3409	0.3685	0.3961	0.4146	0.4330 (22b)
Effective ac	0.6104	0.6061	0.6019	0.5822	0.5785	0.5613	0.5613	0.5581	0.5679	0.5785	0.5859	0.5937 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K					
TER Opaque door			2.1200	1.0000	2.1200		(26)					
TER Opening Type (Uw = 1.40)			7.9600	1.3258	10.5530		(27)					
Jetfloor Grey			56.4000	0.1300	7.3320		(28a)					
External Wall	59.1100	7.9600	51.1500	0.1800	9.2070		(29a)					
External Wall to Stairwell	20.2500	2.1200	18.1300	0.1800	3.2634		(29a)					
Total net area of external elements Aum(A, m ²)			135.7600				(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	32.4754	(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.2059 (36)					
Total fabric heat loss						(33) + (36) =	41.6813 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	27.1509	26.9603	26.7734	25.8957	25.7315	24.9670	24.9670	24.8254	25.2615	25.7315	26.0637	26.4110 (38)
Average = Sum(39)m / 12 =	68.8322	68.6416	68.4547	67.5770	67.4128	66.6483	66.6483	66.5068	66.9428	67.4128	67.7450	68.0923 (39)
	19.2836	16.8656	17.4038	15.1730	14.5589	12.5632	11.6417	13.3590	13.5185	15.7545	17.1973	18.6752 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.2204	1.2170	1.2137	1.1982	1.1953	1.1817	1.1817	1.1792	1.1869	1.1953	1.2012	1.2073 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Assumed occupancy												1.8782 (42)
Average daily hot water use (litres/day)												78.8083 (43)
Daily hot water use	86.6892	83.5368	80.3845	77.2322	74.0798	70.9275	70.9275	74.0798	77.2322	80.3845	83.5368	86.6892 (44)
Energy conte	128.5575	112.4372	116.0252	101.1535	97.0592	83.7547	77.6111	89.0598	90.1235	105.0303	114.6487	124.5011 (45)
Energy content (annual)												Total = Sum(45)m =
Distribution loss (46)m = 0.15 x (45)m	19.2836	16.8656	17.4038	15.1730	14.5589	12.5632	11.6417	13.3590	13.5185	15.7545	17.1973	18.6752 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)

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Combi loss	44.1759	38.4498	40.9631	38.0871	37.7503	34.9779	36.1439	37.7503	38.0871	40.9631	41.1962	44.1759 (61)
Total heat required for water heating calculated for each month	172.7334	150.8871	156.9882	139.2406	134.8095	118.7327	113.7550	126.8101	128.2106	145.9933	155.8450	168.6770 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	172.7334	150.8871	156.9882	139.2406	134.8095	118.7327	113.7550	126.8101	128.2106	145.9933	155.8450	168.6770 (64)
Heat gains from water heating, kWh/month	53.7893	46.9978	48.8191	43.1553	41.7098	36.5929	34.8417	39.0500	39.4878	45.1633	48.4198	52.4406 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	93.9123	93.9123	93.9123	93.9123	93.9123	93.9123	93.9123	93.9123	93.9123	93.9123	93.9123	93.9123 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	15.6374	13.8890	11.2953	8.5513	6.3922	5.3965	5.8311	7.5795	10.1732	12.9173	15.0764	16.0720 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	163.7855	165.4850	161.2021	152.0844	140.5748	129.7575	122.5309	120.8313	125.1142	134.2319	145.7415	156.5588 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	32.3912	32.3912	32.3912	32.3912	32.3912	32.3912	32.3912	32.3912	32.3912	32.3912	32.3912	32.3912 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-75.1298	-75.1298	-75.1298	-75.1298	-75.1298	-75.1298	-75.1298	-75.1298	-75.1298	-75.1298	-75.1298	-75.1298 (71)
Water heating gains (Table 5)	72.2975	69.9373	65.6171	59.9380	56.0615	50.8235	46.8302	52.4865	54.8442	60.7034	67.2497	70.4847 (72)
Total internal gains	305.8940	303.4850	292.2882	274.7473	257.2022	240.1512	229.3659	235.0710	244.3053	262.0263	282.2412	297.2891 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b g	Specific data or Table 6c FF	Access factor Table 6d	Gains W						
Northeast	3.9900	11.2829	0.6300	0.7000	0.7700	13.7584 (75)						
Southwest	3.9700	36.7938	0.6300	0.7000	0.7700	44.6414 (79)						
Solar gains	58.3997	104.0463	154.4994	211.7785	255.7807	262.0998	249.2927	215.2162	174.1386	118.2662	70.7816	49.4395 (83)
Total gains	364.2937	407.5313	446.7876	486.5258	512.9829	502.2511	478.6586	450.2873	418.4439	380.2925	353.0228	346.7286 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil _m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.9016	57.0597	57.2154	57.9586	58.0998	58.7662	58.7662	58.8913	58.5077	58.0998	57.8148	57.5200	
alpha	4.7934	4.8040	4.8144	4.8639	4.8733	4.9177	4.9177	4.9261	4.9005	4.8733	4.8543	4.8347	
util living area	0.9972	0.9947	0.9881	0.9660	0.9012	0.7568	0.5901	0.6433	0.8688	0.9761	0.9946	0.9978 (86)	
MIT	19.7074	19.8489	20.0928	20.4260	20.7281	20.9231	20.9821	20.9731	20.8373	20.4552	20.0257	19.6850 (87)	
Th 2	19.9037	19.9064	19.9090	19.9215	19.9238	19.9347	19.9347	19.9367	19.9305	19.9238	19.9191	19.9142 (88)	
util rest of house	0.9963	0.9929	0.9837	0.9524	0.8603	0.6645	0.4585	0.5120	0.8004	0.9640	0.9924	0.9971 (89)	
MIT 2	18.1914	18.3995	18.7557	19.2410	19.6502	19.8818	19.9280	19.9253	19.7963	19.2902	18.6672	18.1659 (90)	
Living area fraction	fLA = Living area / (4) =												
MIT	18.7706	18.9533	19.2666	19.6938	20.0621	20.2796	20.3307	20.3257	20.1940	19.7353	19.1863	18.7463 (92)	
Temperature adjustment	0.0000												
adjusted MIT	18.7706	18.9533	19.2666	19.6938	20.0621	20.2796	20.3307	20.3257	20.1940	19.7353	19.1863	18.7463 (93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9949	0.9907	0.9803	0.9488	0.8664	0.6968	0.5093	0.5625	0.8198	0.9612	0.9903	0.9959 (94)
Useful gains	362.4270	403.7555	437.9715	461.6056	444.4255	349.9702	243.7768	253.2899	343.0431	365.5391	349.6160	345.3165 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	996.0457	964.6397	873.9325	729.4128	563.7107	378.5382	248.6476	261.0826	407.9516	615.8364	818.7866	990.4935 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	471.4124	376.9142	324.3550	192.8212	88.7482	0.0000	0.0000	0.0000	0.0000	186.2212	337.8028	480.0117 (98)
Space heating	2458.2866 (98)											
Space heating per m2	(98) / (4) = 43.5866 (99)											

8c. Space cooling requirement

Not applicable

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

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Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.4000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													2631.9985 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	471.4124	376.9142	324.3550	192.8212	88.7482	0.0000	0.0000	0.0000	0.0000	186.2212	337.8028	480.0117	(98)
Space heating efficiency (main heating system 1)	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)	504.7241	403.5483	347.2751	206.4467	95.0195	0.0000	0.0000	0.0000	0.0000	199.3803	361.6733	513.9312	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	172.7334	150.8871	156.9882	139.2406	134.8095	118.7327	113.7550	126.8101	128.2106	145.9933	155.8450	168.6770	(64)
Efficiency of water heater	87.4504	87.2623	86.8377	85.8710	84.0268	80.3000	80.3000	80.3000	80.3000	85.6650	86.9475	87.5370	(216)
Fuel for water heating, kWh/month	197.5215	172.9121	180.7834	162.1509	160.4362	147.8614	141.6625	157.9205	159.6645	170.4236	179.2404	192.6921	(219)
Water heating fuel used													2023.2691 (219)
Annual totals kWh/year													
Space heating fuel - main system													2631.9985 (211)
Space heating fuel - secondary													0.0000 (215)
Electricity for pumps and fans:													
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													75.0000 (231)
Electricity for lighting (calculated in Appendix L)													276.1610 (232)
Total delivered energy for all uses													5006.4286 (238)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	2631.9985	0.2160	568.5117 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2023.2691	0.2160	437.0261 (264)
Space and water heating			1005.5378 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	276.1610	0.5190	143.3275 (268)
Total CO2, kg/m2/year			1187.7904 (272)
Emissions per m2 for space and water heating			17.8287 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.5413 (272b)
Emissions per m2 for pumps and fans			0.6902 (272c)
Target Carbon Dioxide Emission Rate (TER) = (17.8287 * 1.00) + 2.5413 + 0.6902, rounded to 2 d.p.			21.0600 (273)

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CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
 CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	56.4000 (1b)	x 2.3900 (2b)	= 134.7960 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	56.4000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 134.7960 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)
Number of intermittent fans				2 * 10 =	20.0000 (7a)
Number of passive vents				0 * 10 =	0.0000 (7b)
Number of flueless gas fires				0 * 40 =	0.0000 (7c)
Air changes per hour					
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				20.0000 / (5) =	0.1484 (8)
Pressure test				Yes	
Measured/design AP50				4.0000	
Infiltration rate				0.3484	(18)
Number of sides sheltered				1	(19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.9250 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3222 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
Effective ac	0.4109	0.4028	0.3947	0.3545	0.3464	0.3061	0.3061	0.2981	0.3222	0.3464	0.3625	0.3786 (22b)
	0.5844	0.5811	0.5779	0.5628	0.5600	0.5469	0.5469	0.5444	0.5519	0.5600	0.5657	0.5717 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
DTC			2.1200	1.0800	2.2896		(26)
Windows (Uw = 1.40)			5.4400	1.3258	7.2121		(27)
French Door (Uw = 1.40)			2.5200	1.3258	3.3409		(27)
Jetfloor Grey			56.4000	0.1500	8.4600	75.0000	4230.0000 (28a)
External Wall	59.1100	7.9600	51.1500	0.2500	12.7875	52.8000	2700.7200 (29a)
External Wall to Stairwell	20.2500	2.1200	18.1300	0.2000	3.6260	52.8000	957.2640 (29a)
Total net area of external elements Aum(A, m2)			135.7600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	37.7161		(33)
E-FC-4			56.4000			30.0000	1692.0000 (32b)
Metal			114.3900			14.0000	1601.4600 (32c)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	11181.4440 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							198.2526 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.6283 (36)
Total fabric heat loss						(33) + (36) =	43.3445 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	25.9958	25.8500	25.7071	25.0359	24.9103	24.3257	24.3257	24.2175	24.5509	24.9103	25.1644	25.4300 (38)
Heat transfer coeff	69.3403	69.1945	69.0516	68.3804	68.2548	67.6702	67.6702	67.5619	67.8954	68.2548	68.5089	68.7745 (39)
Average = Sum(39)m / 12 =												68.3798 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2294	1.2269	1.2243	1.2124	1.2102	1.1998	1.1998	1.1979	1.2038	1.2102	1.2147	1.2194 (40)
HLP (average)												1.2124 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Assumed occupancy												1.8782 (42)
Average daily hot water use (litres/day)												78.8083 (43)
Daily hot water use	86.6892	83.5368	80.3845	77.2322	74.0798	70.9275	70.9275	74.0798	77.2322	80.3845	83.5368	86.6892 (44)
Energy conte	128.5575	112.4372	116.0252	101.1535	97.0592	83.7547	77.6111	89.0598	90.1235	105.0303	114.6487	124.5011 (45)
Energy content (annual)												Total = Sum(45)m = 1239.9620 (45)
Distribution loss (46)m = 0.15 x (45)m												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												

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Calculation Type: New Build (As Designed)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month	27.3185	23.8929	24.6553	21.4951	20.6251	17.7979	16.4924	18.9252	19.1512	22.3189	24.3629	26.4565	26.4565	(65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	93.9123	93.9123	93.9123	93.9123	93.9123	93.9123	93.9123	93.9123	93.9123	93.9123	93.9123	93.9123	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	15.6374	13.8890	11.2953	8.5513	6.3922	5.3965	5.8311	7.5795	10.1732	12.9173	15.0764	16.0720	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	163.7855	165.4850	161.2021	152.0844	140.5748	129.7575	122.5309	120.8313	125.1142	134.2319	145.7415	156.5588	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	32.3912	32.3912	32.3912	32.3912	32.3912	32.3912	32.3912	32.3912	32.3912	32.3912	32.3912	32.3912	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-75.1298	-75.1298	-75.1298	-75.1298	-75.1298	-75.1298	-75.1298	-75.1298	-75.1298	-75.1298	-75.1298	-75.1298	(71)
Water heating gains (Table 5)	36.7184	35.5549	33.1389	29.8543	27.7219	24.7193	22.1671	25.4371	26.5990	29.9986	33.8373	35.5598	(72)
Total internal gains	267.3149	266.1026	256.8100	241.6637	225.8626	211.0470	201.7028	205.0216	213.0600	228.3214	245.8288	259.3643	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
Northeast	3.9900	11.2829	0.4300	0.0000	0.7700	14.9058 (75)
Southwest	1.4500	36.7938	0.4300	0.0000	0.7700	17.6645 (79)
Southwest	2.5200	36.7938	0.4300	0.0000	0.7700	30.6997 (79)

Solar gains	63.2700	112.7234	167.3841	229.4400	277.1119	283.9580	270.0828	233.1645	188.6611	128.1292	76.6846	53.5625	(83)
Total gains	330.5849	378.8260	424.1941	471.1037	502.9744	495.0050	471.7856	438.1861	401.7211	356.4507	322.5134	312.9268	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains for living area, nil,m (see Table 9a)	0.9952	0.9911	0.9812	0.9527	0.8823	0.7455	0.5913	0.6474	0.8584	0.9681	0.9915	0.9961	(86)
MIT	19.3776	19.5537	19.8537	20.2563	20.6247	20.8738	20.9630	20.9466	20.7567	20.2831	19.7582	19.3452	(87)
Th 2	19.8965	19.8986	19.9006	19.9101	19.9119	19.9201	19.9201	19.9217	19.9169	19.9119	19.9083	19.9045	(88)
util rest of house	0.9938	0.9886	0.9756	0.9375	0.8422	0.6593	0.4637	0.5213	0.7951	0.9549	0.9886	0.9951	(89)
MIT 2	18.4230	18.5997	18.8984	19.2987	19.6428	19.8538	19.9085	19.9029	19.7683	19.3317	18.8115	18.3969	(90)
Living area fraction	18.7877	18.9642	19.2634	19.6646	20.0180	20.2435	20.3114	20.3017	20.1459	19.6953	19.1732	18.7592	(92)
MIT	18.7877	18.9642	19.2634	19.6646	20.0180	20.2435	20.3114	20.3017	20.1459	19.6953	19.1732	18.7592	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7877	18.9642	19.2634	19.6646	20.0180	20.2435	20.3114	20.3017	20.1459	19.6953	19.1732	18.7592	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	327.9333	373.4271	412.0613	439.6706	425.8625	340.2520	241.6781	249.1971	325.6087	339.2018	318.0206	310.8942	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1004.5821	973.1647	881.3362	736.0888	567.7424	381.8994	251.1510	263.6055	410.4917	620.7955	827.1227	1001.3029	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	503.4267	403.0237	349.1406	213.4211	105.5587	0.0000	0.0000	0.0000	0.0000	209.5057	366.5535	513.6641	(98)
Space heating												2664.2940	(98)
Space heating per m2												47.2393	(99)

8c. Space cooling requirement

Ext. temp.	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	636.0998	500.7594	513.4707	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8106	0.8782	0.8500	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	515.6448	439.7612	436.4271	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	649.4901	621.0207	582.9737	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	96.3687	134.8571	109.0307	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												340.2564	(104)
Cooled fraction												1.0000	(105)
Intermittency factor (Table 10b)													
0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	24.0922	33.7143	27.2577	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												85.0641	(107)
Space cooling per m2												1.5082	(108)
Energy for space heating												47.2393	(99)
Energy for space cooling												1.5082	(108)
Total												48.7475	(109)
Dwelling Fabric Energy Efficiency (DFEE)												48.7	(109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	56.4000 (1b)	x 2.3900 (2b)	= 134.7960 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	56.4000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 134.7960 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)
Number of intermittent fans				2 * 10 =	20.0000 (7a)
Number of passive vents				0 * 10 =	0.0000 (7b)
Number of flueless gas fires				0 * 40 =	0.0000 (7c)
Air changes per hour					
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				20.0000 / (5) =	0.1484 (8)
Pressure test				Yes	
Measured/design AP50					5.0000
Infiltration rate					0.3984 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3685 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4698	0.4606	0.4514	0.4053	0.3961	0.3501	0.3501	0.3409	0.3685	0.3961	0.4146	0.4330 (22b)
Effective ac	0.6104	0.6061	0.6019	0.5822	0.5785	0.5613	0.5613	0.5581	0.5679	0.5785	0.5859	0.5937 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			2.1200	1.0000	2.1200		(26)					
TER Opening Type (Uw = 1.40)			7.9600	1.3258	10.5530		(27)					
Jetfloor Grey			56.4000	0.1300	7.3320		(28a)					
External Wall	59.1100	7.9600	51.1500	0.1800	9.2070		(29a)					
External Wall to Stairwell	20.2500	2.1200	18.1300	0.1800	3.2634		(29a)					
Total net area of external elements Aum(A, m2)			135.7600				(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	32.4754	(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.2059 (36)					
Total fabric heat loss							(33) + (36) =	41.6813 (37)				
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	27.1509	26.9603	26.7734	25.8957	25.7315	24.9670	24.9670	24.8254	25.2615	25.7315	26.0637	26.4110 (38)
Average = Sum(39)m / 12 =	68.8322	68.6416	68.4547	67.5770	67.4128	66.6483	66.6483	66.5068	66.9428	67.4128	67.7450	68.0923 (39)
												67.5762 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.2204	1.2170	1.2137	1.1982	1.1953	1.1817	1.1817	1.1792	1.1869	1.1953	1.2012	1.2073 (40)
Days in month												1.1982 (40)
	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Assumed occupancy												1.8782 (42)
Average daily hot water use (litres/day)												78.8083 (43)
Daily hot water use	86.6892	83.5368	80.3845	77.2322	74.0798	70.9275	70.9275	74.0798	77.2322	80.3845	83.5368	86.6892 (44)
Energy conte	128.5575	112.4372	116.0252	101.1535	97.0592	83.7547	77.6111	89.0598	90.1235	105.0303	114.6487	124.5011 (45)
Energy content (annual)												Total = Sum(45)m =
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month	27.3185	23.8929	24.6553	21.4951	20.6251	17.7979	16.4924	18.9252	19.1512	22.3189	24.3629	26.4565	26.4565	(65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	93.9123	93.9123	93.9123	93.9123	93.9123	93.9123	93.9123	93.9123	93.9123	93.9123	93.9123	93.9123	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	15.6374	13.8890	11.2953	8.5513	6.3922	5.3965	5.8311	7.5795	10.1732	12.9173	15.0764	16.0720	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	163.7855	165.4850	161.2021	152.0844	140.5748	129.7575	122.5309	120.8313	125.1142	134.2319	145.7415	156.5588	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	32.3912	32.3912	32.3912	32.3912	32.3912	32.3912	32.3912	32.3912	32.3912	32.3912	32.3912	32.3912	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-75.1298	-75.1298	-75.1298	-75.1298	-75.1298	-75.1298	-75.1298	-75.1298	-75.1298	-75.1298	-75.1298	-75.1298	(71)
Water heating gains (Table 5)	36.7184	35.5549	33.1389	29.8543	27.7219	24.7193	22.1671	25.4371	26.5990	29.9986	33.8373	35.5598	(72)
Total internal gains	267.3149	266.1026	256.8100	241.6637	225.8626	211.0470	201.7028	205.0216	213.0600	228.3214	245.8288	259.3643	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	g Specific data or Table 6c	FF Specific data or Table 6c	Access factor Table 6d	Gains W						
Northeast	3.9900	11.2829	0.6300	0.7000	0.7000	0.7700	13.7584 (75)						
Southwest	3.9700	36.7938	0.6300	0.7000	0.7000	0.7700	44.6414 (79)						
Solar gains	58.3997	104.0463	154.4994	211.7785	255.7807	262.0998	249.2927	215.2162	174.1386	118.2662	70.7816	49.4395	(83)
Total gains	325.7146	370.1489	411.3094	453.4422	481.6433	473.1468	450.9956	420.2379	387.1986	346.5877	316.6105	308.8037	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains for living area, nil,m (see Table 9a)													21.0000 (85)
tau	56.9016	57.0597	57.2154	57.9586	58.0998	58.7662	58.7662	58.8913	58.5077	58.0998	57.8148	57.5200	
alpha	4.7934	4.8040	4.8144	4.8639	4.8733	4.9177	4.9177	4.9261	4.9005	4.8733	4.8543	4.8347	
util living area	0.9983	0.9965	0.9915	0.9739	0.9186	0.7852	0.6205	0.6791	0.8947	0.9834	0.9967	0.9987	(86)
MIT	19.6447	19.7888	20.0374	20.3792	20.6953	20.9089	20.9778	20.9660	20.8090	20.4050	19.9670	19.6230	(87)
Th 2	19.9037	19.9064	19.9090	19.9215	19.9238	19.9347	19.9347	19.9367	19.9305	19.9238	19.9191	19.9142	(88)
util rest of house	0.9977	0.9953	0.9883	0.9630	0.8824	0.6953	0.4850	0.5451	0.8338	0.9746	0.9952	0.9982	(89)
MIT 2	18.6722	18.8179	19.0672	19.4128	19.7101	19.8907	19.9288	19.9265	19.8189	19.4436	19.0062	18.6588	(90)
Living area fraction										fLA = Living area / (4) =			0.3821 (91)
MIT	19.0438	19.1889	19.4379	19.7821	20.0865	20.2797	20.3296	20.3237	20.1972	19.8109	19.3733	19.0272	(92)
Temperature adjustment													0.0000
adjusted MIT	19.0438	19.1889	19.4379	19.7821	20.0865	20.2797	20.3296	20.3237	20.1972	19.8109	19.3733	19.0272	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9971	0.9942	0.9865	0.9612	0.8888	0.7272	0.5376	0.5970	0.8516	0.9734	0.9943	0.9977	(94)
Useful gains	324.7608	368.0059	405.7581	435.8600	428.0880	344.0649	242.4332	250.8946	329.7564	337.3543	314.7974	308.1051	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1014.8464	980.8106	885.6622	735.3768	565.3594	378.5442	248.5738	260.9512	408.1638	620.9345	831.4570	1009.6206	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	513.4237	411.8047	357.0486	215.6521	102.1299	0.0000	0.0000	0.0000	0.0000	210.9837	371.9949	521.9275	(98)
Space heating												2704.9651	(98)
Space heating per m2												47.9604	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	626.4942	493.1976	505.4513	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8293	0.8995	0.8721	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	519.5615	443.6204	440.8024	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	623.9416	596.7206	561.9952	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	75.1537	113.9066	90.1675	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling													279.2277
Cooled fraction													1.0000
Intermittency factor (Table 10b)													fC = cooled area / (4) =

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	18.7884	28.4766	22.5419	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling per m2												69.8069 (107)
Energy for space heating												1.2377 (108)
Energy for space cooling												47.9604 (99)
Total												1.2377 (108)
Target Fabric Energy Efficiency (TFEE)												49.1981 (109)
												56.6 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF HEAT DEMAND 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	56.4000 (1b)	2.3900 (2b)	134.7960 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	56.4000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	134.7960 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)
Number of intermittent fans				0 * 10 =	0.0000 (7a)
Number of passive vents				0 * 10 =	0.0000 (7b)
Number of flueless gas fires				0 * 40 =	0.0000 (7c)
Air changes per hour					
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				0.0000 / (5) =	0.0000 (8)
Pressure test				Yes	
Measured/design AP50				4.0000	
Infiltration rate				0.2000	0.2000 (18)
Number of sides sheltered				1	1 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.9250 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.1850 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.9000	4.8000	4.7000	4.2000	4.2000	3.7000	3.8000	3.8000	4.0000	4.2000	4.3000	4.5000 (22)
Wind factor	1.2250	1.2000	1.1750	1.0500	1.0500	0.9250	0.9500	0.9500	1.0000	1.0500	1.0750	1.1250 (22a)
Adj infilt rate	0.2266	0.2220	0.2174	0.1943	0.1943	0.1711	0.1758	0.1758	0.1850	0.1943	0.1989	0.2081 (22b)
Mechanical extract ventilation - decentralised												0.5000 (23a)
If mechanical ventilation:												
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
DTC			2.1200	1.0800	2.2896		(26)
Windows (Uw = 1.40)			5.4400	1.3258	7.2121		(27)
French Door (Uw = 1.40)			2.5200	1.3258	3.3409		(27)
Jetfloor Grey			56.4000	0.1500	8.4600	75.0000	4230.0000 (28a)
External Wall	59.1100	7.9600	51.1500	0.2500	12.7875	52.8000	2700.7200 (29a)
External Wall to Stairwell	20.2500	2.1200	18.1300	0.2000	3.6260	52.8000	957.2640 (29a)
Total net area of external elements Aum(A, m2)			135.7600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	37.7161		(33)
E-FC-4			56.4000			70.0000	3948.0000 (32b)
Metal			114.3900			14.0000	1601.4600 (32c)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	13437.4440 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							238.2526 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.6283 (36)
Total fabric heat loss						(33) + (36) =	43.3445 (37)

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

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	65.5858	65.5858	65.5858	65.5858	65.5858	65.5858	65.5858	65.5858	65.5858	65.5858	65.5858	65.5858 (39)
Average = Sum(39)m / 12 =												65.5858 (39)
HLP	1.1629	1.1629	1.1629	1.1629	1.1629	1.1629	1.1629	1.1629	1.1629	1.1629	1.1629	1.1629 (40)
HLP (average)												1.1629 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Assumed occupancy												1.8782 (42)
Average daily hot water use (litres/day)												78.8083 (43)
Daily hot water use	86.6892	83.5368	80.3845	77.2322	74.0798	70.9275	70.9275	74.0798	77.2322	80.3845	83.5368	86.6892 (44)
Energy conte	128.5575	112.4372	116.0252	101.1535	97.0592	83.7547	77.6111	89.0598	90.1235	105.0303	114.6487	124.5011 (45)
Energy content (annual)										Total = Sum(45)m =		1239.9620 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF HEAT DEMAND 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	19.2836	16.8656	17.4038	15.1730	14.5589	12.5632	11.6417	13.3590	13.5185	15.7545	17.1973	18.6752 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.0240	12.6507	13.9804	13.5003	13.9291	13.4554	13.8887	13.9149	13.4799	13.9592	13.5427	14.0156 (61)
Total heat required for water heating calculated for each month	142.5816	125.0879	130.0056	114.6538	110.9884	97.2101	91.4998	102.9747	103.6034	118.9894	128.1914	138.5167 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	142.5816	125.0879	130.0056	114.6538	110.9884	97.2101	91.4998	102.9747	103.6034	118.9894	128.1914	138.5167 (64)
RHI water heating demand												1404.3028 (64)
Heat gains from water heating, kWh/month	46.2514	40.5481	42.0735	37.0086	35.7545	31.2123	29.2779	33.0911	33.3360	38.4124	41.5064	44.9005 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	112.6947	112.6947	112.6947	112.6947	112.6947	112.6947	112.6947	112.6947	112.6947	112.6947	112.6947	112.6947 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	39.0934	34.7225	28.2382	21.3781	15.9804	13.4913	14.5779	18.9489	25.4331	32.2932	37.6909	40.1800 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	244.4559	246.9926	240.6002	226.9916	209.8132	193.6679	182.8819	180.3452	186.7376	200.3462	217.5246	233.6699 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	48.1477	48.1477	48.1477	48.1477	48.1477	48.1477	48.1477	48.1477	48.1477	48.1477	48.1477	48.1477 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-75.1298	-75.1298	-75.1298	-75.1298	-75.1298	-75.1298	-75.1298	-75.1298	-75.1298	-75.1298	-75.1298	-75.1298 (71)
Water heating gains (Table 5)	62.1658	60.3394	56.5504	51.4009	48.0571	43.3504	39.3520	44.4773	46.3000	51.6295	57.6477	60.3502 (72)
Total internal gains	434.4278	430.7670	414.1014	388.4833	362.5633	339.2223	325.5243	332.4840	347.1833	372.9815	401.5758	422.9126 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data g or Table 6b	Specific data FF or Table 6c	Access factor Table 6d	Gains W						
Northeast	3.9900	12.9465	0.4300	0.0000	0.7700	17.1035 (75)						
Southwest	1.4500	40.9830	0.4300	0.0000	0.7700	19.6757 (79)						
Southwest	2.5200	40.9830	0.4300	0.0000	0.7700	34.1951 (79)						
Solar gains	70.9744	118.0344	172.7456	249.5228	291.2205	311.0919	292.9423	254.6442	206.6368	140.3387	88.1648	59.4819 (83)
Total gains	505.4022	548.8014	586.8470	638.0061	653.7838	650.3142	618.4666	587.1282	553.8202	513.3202	489.7406	482.3945 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	56.9121	56.9121	56.9121	56.9121	56.9121	56.9121	56.9121	56.9121	56.9121	56.9121	56.9121	56.9121
alpha	4.7941	4.7941	4.7941	4.7941	4.7941	4.7941	4.7941	4.7941	4.7941	4.7941	4.7941	4.7941
util living area	0.9853	0.9771	0.9544	0.8887	0.7556	0.5483	0.3588	0.3775	0.6642	0.9000	0.9714	0.9878 (86)
MIT	20.0148	20.1373	20.3822	20.6770	20.8905	20.9815	20.9981	20.9977	20.9557	20.7108	20.3159	19.9777 (87)
Th 2	19.9498	19.9498	19.9498	19.9498	19.9498	19.9498	19.9498	19.9498	19.9498	19.9498	19.9498	19.9498 (88)
util rest of house	0.9809	0.9703	0.9405	0.8556	0.6900	0.4529	0.2489	0.2622	0.5666	0.8618	0.9614	0.9841 (89)
MIT 2	18.6752	18.8510	19.1983	19.5974	19.8551	19.9400	19.9494	19.9493	19.9224	19.6508	19.1095	18.6221 (90)
Living area fraction	19.1870	19.3425	19.6507	20.0099	20.2507	20.3379	20.3501	20.3499	20.3172	20.0558	19.5704	0.3821 (91)
Temperature adjustment	19.1870	19.3425	19.6507	20.0099	20.2507	20.3379	20.3501	20.3499	20.3172	20.0558	19.5704	19.1400 (92)
adjusted MIT	19.1870	19.3425	19.6507	20.0099	20.2507	20.3379	20.3501	20.3499	20.3172	20.0558	19.5704	0.0000 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9767	0.9654	0.9357	0.8578	0.7101	0.4890	0.2911	0.3064	0.6024	0.8663	0.9569	0.9803 (94)
Ext temp.	493.6266	529.7900	549.1218	547.2631	464.2261	318.0067	180.0228	179.9189	333.6353	444.6729	468.6142	472.8796 (95)
Heat loss rate W	4.7000	5.2000	7.0000	9.5000	12.5000	15.4000	17.6000	17.6000	15.0000	11.4000	7.7000	4.7000 (96)
Month fracti	950.1434	927.5463	829.7043	689.3016	508.3366	323.8580	180.3705	180.3551	348.7319	567.6963	778.5321	947.0622 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000 (97a)
Space heating	339.6485	267.2922	208.7534	102.2677	32.8182	0.0000	0.0000	0.0000	0.0000	91.5294	223.1409	352.7918 (98)
RHI space heating demand												1618.2422 (98)

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CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	56.4000 (1b)	2.3900 (2b)	134.7960 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	56.4000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	134.7960 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)
Number of intermittent fans				0 * 10 =	0.0000 (7a)
Number of passive vents				0 * 10 =	0.0000 (7b)
Number of flueless gas fires				0 * 40 =	0.0000 (7c)
Air changes per hour					
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				0.0000 / (5) =	0.0000 (8)
Pressure test				Yes	
Measured/design AP50				4.0000	
Infiltration rate					0.2000 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.1850 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.2359	0.2313	0.2266	0.2035	0.1989	0.1758	0.1758	0.1711	0.1850	0.1989	0.2081	0.2174 (22b)
Mechanical extract ventilation - decentralised												0.5000 (23a)
If mechanical ventilation:												0.5000 (25)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
DTC			2.1200	1.0800	2.2896		(26)
Windows (Uw = 1.40)			5.4400	1.3258	7.2121		(27)
French Door (Uw = 1.40)			2.5200	1.3258	3.3409		(27)
Jetfloor Grey			56.4000	0.1500	8.4600	75.0000	4230.0000 (28a)
External Wall	59.1100	7.9600	51.1500	0.2500	12.7875	52.8000	2700.7200 (29a)
External Wall to Stairwell	20.2500	2.1200	18.1300	0.2000	3.6260	52.8000	957.2640 (29a)
Total net area of external elements Aum(A, m2)			135.7600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	37.7161		(33)
E-FC-4			56.4000			70.0000	3948.0000 (32b)
Metal			114.3900			14.0000	1601.4600 (32c)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	13437.4440 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							238.2526 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.6283 (36)
Total fabric heat loss						(33) + (36) =	43.3445 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	22.2413	22.2413	22.2413	22.2413	22.2413	22.2413	22.2413	22.2413	22.2413	22.2413	22.2413	22.2413 (38)
Heat transfer coeff	65.5858	65.5858	65.5858	65.5858	65.5858	65.5858	65.5858	65.5858	65.5858	65.5858	65.5858	65.5858 (39)
Average = Sum(39)m / 12 =												65.5858 (39)
HLP	1.1629	1.1629	1.1629	1.1629	1.1629	1.1629	1.1629	1.1629	1.1629	1.1629	1.1629	1.1629 (40)
HLP (average)												1.1629 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Assumed occupancy												1.8782 (42)
Average daily hot water use (litres/day)												78.8083 (43)
Daily hot water use	86.6892	83.5368	80.3845	77.2322	74.0798	70.9275	70.9275	74.0798	77.2322	80.3845	83.5368	86.6892 (44)
Energy conte	128.5575	112.4372	116.0252	101.1535	97.0592	83.7547	77.6111	89.0598	90.1235	105.0303	114.6487	124.5011 (45)
Energy content (annual)										Total = Sum(45)m =		1239.9620 (45)

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Distribution loss (46)m = 0.15 x (45)m	19.2836	16.8656	17.4038	15.1730	14.5589	12.5632	11.6417	13.3590	13.5185	15.7545	17.1973	18.6752 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.0240	12.6507	13.9804	13.5003	13.9291	13.4554	13.8887	13.9149	13.4799	13.9592	13.5427	14.0156 (61)
Total heat required for water heating calculated for each month	142.5816	125.0879	130.0056	114.6538	110.9884	97.2101	91.4998	102.9747	103.6034	118.9894	128.1914	138.5167 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	142.5816	125.0879	130.0056	114.6538	110.9884	97.2101	91.4998	102.9747	103.6034	118.9894	128.1914	138.5167 (64)
Heat gains from water heating, kWh/month	46.2514	40.5481	42.0735	37.0086	35.7545	31.2123	29.2779	33.0911	33.3360	38.4124	41.5064	44.9005 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	112.6947	112.6947	112.6947	112.6947	112.6947	112.6947	112.6947	112.6947	112.6947	112.6947	112.6947	112.6947 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	39.0934	34.7225	28.2382	21.3781	15.9804	13.4913	14.5779	18.9489	25.4331	32.2932	37.6909	40.1800 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	244.4559	246.9926	240.6002	226.9916	209.8132	193.6679	182.8819	180.3452	186.7376	200.3462	217.5246	233.6699 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	48.1477	48.1477	48.1477	48.1477	48.1477	48.1477	48.1477	48.1477	48.1477	48.1477	48.1477	48.1477 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-75.1298	-75.1298	-75.1298	-75.1298	-75.1298	-75.1298	-75.1298	-75.1298	-75.1298	-75.1298	-75.1298	-75.1298 (71)
Water heating gains (Table 5)	62.1658	60.3394	56.5504	51.4009	48.0571	43.3504	39.3520	44.4773	46.3000	51.6295	57.6477	60.3502 (72)
Total internal gains	434.4278	430.7670	414.1014	388.4833	362.5633	339.2223	325.5243	332.4840	347.1833	372.9815	401.5758	422.9126 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	g	Specific data or Table 6c	FF	Access factor Table 6d	Gains W				
Northeast	3.9900	11.2829	0.4300	0.4300	0.0000	0.7700	14.9058 (75)					
Southwest	1.4500	36.7938	0.4300	0.4300	0.0000	0.7700	17.6645 (79)					
Southwest	2.5200	36.7938	0.4300	0.4300	0.0000	0.7700	30.6997 (79)					
Solar gains	63.2700	112.7234	167.3841	229.4400	277.1119	283.9580	270.0828	233.1645	188.6611	128.1292	76.6846	53.5625 (83)
Total gains	497.6979	543.4904	581.4855	617.9233	639.6752	623.1803	595.6071	565.6485	535.8444	501.1107	478.2604	476.4752 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation factor for gains for living area, nil,m (see Table 9a)	56.9121	56.9121	56.9121	56.9121	56.9121	56.9121	56.9121	56.9121	56.9121	56.9121	56.9121	56.9121 (85)
tau	4.7941	4.7941	4.7941	4.7941	4.7941	4.7941	4.7941	4.7941	4.7941	4.7941	4.7941	4.7941
alpha	0.9874	0.9795	0.9610	0.9128	0.8072	0.6368	0.4767	0.5208	0.7510	0.9273	0.9779	0.9897 (86)
MIT	19.9582	20.0967	20.3234	20.6040	20.8385	20.9604	20.9919	20.9877	20.9135	20.6249	20.2341	19.9127 (87)
Th 2	19.9498	19.9498	19.9498	19.9498	19.9498	19.9498	19.9498	19.9498	19.9498	19.9498	19.9498	19.9498 (88)
util rest of house	0.9837	0.9734	0.9492	0.8862	0.7517	0.5468	0.3669	0.4081	0.6681	0.8993	0.9703	0.9867 (89)
MIT 2	18.5934	18.7925	19.1156	19.5023	19.7977	19.9242	19.9469	19.9449	19.8850	19.5390	18.9929	18.5276 (90)
Living area fraction	19.1149	19.2908	19.5771	19.9232	20.1954	20.3202	20.3462	20.3434	20.2780	19.9539	19.4671	19.0568 (92)
MIT	19.1149	19.2908	19.5771	19.9232	20.1954	20.3202	20.3462	20.3434	20.2780	19.9539	19.4671	19.0568 (92)
Temperature adjustment												0.0000
adjusted MIT	19.1149	19.2908	19.5771	19.9232	20.1954	20.3202	20.3462	20.3434	20.2780	19.9539	19.4671	19.0568 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	487.6659	526.4427	549.0116	547.1164	489.8654	361.3236	243.6148	255.2968	372.9275	450.7070	461.8987	468.4605 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	971.6467	943.8346	857.6709	722.9685	557.1756	375.1612	245.6961	258.6280	405.1867	613.4856	811.1075	974.3962 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	360.0817	280.4873	229.6425	126.6135	50.0787	0.0000	0.0000	0.0000	0.0000	121.1073	251.4304	376.4161 (98)
Space heating												1795.8575 (98)
Space heating per m2												(98) / (4) = 31.8414 (99)

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													1920.7032 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	360.0817	280.4873	229.6425	126.6135	50.0787	0.0000	0.0000	0.0000	0.0000	121.1073	251.4304	376.4161	(98)
Space heating efficiency (main heating system 1)	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)
Space heating fuel (main heating system)	385.1141	299.9864	245.6070	135.4155	53.5602	0.0000	0.0000	0.0000	0.0000	129.5265	268.9095	402.5841	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	142.5816	125.0879	130.0056	114.6538	110.9884	97.2101	91.4998	102.9747	103.6034	118.9894	128.1914	138.5167	(64)
Efficiency of water heater (217)m	89.5687	89.4883	89.3165	88.9506	88.2704	87.3000	87.3000	87.3000	87.3000	88.8853	89.3935	87.3000	(216)
Fuel for water heating, kWh/month	159.1868	139.7813	145.5560	128.8961	125.7367	111.3518	104.8107	117.9550	118.6751	133.8685	143.4012	154.5663	(219)
Water heating fuel used													1583.7856 (219)
Annual totals kWh/year													
Space heating fuel - main system													1920.7032 (211)
Space heating fuel - secondary													0.0000 (215)
Electricity for pumps and fans: (MEVDecentralised, Database: total watage = 6.9550, total flow = 29.0000, SFP = 0.2398)													
mechanical ventilation fans (SFP = 0.2398)													39.4399 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													114.4399 (231)
Electricity for lighting (calculated in Appendix L)													276.1610 (232)
Total delivered energy for all uses													3895.0898 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1920.7032	3.4800	66.8405 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1583.7856	3.4800	55.1157 (247)
Mechanical ventilation fans	39.4399	13.1900	5.2021 (249)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	276.1610	13.1900	36.4256 (250)
Additional standing charges			120.0000 (251)
Total energy cost			293.4765 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	1.2156 (257)
SAP value		83.0426
SAP rating (Section 12)		B (258)
SAP band		B

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1920.7032	0.2160	414.8719 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1583.7856	0.2160	342.0977 (264)
Space and water heating			756.9696 (265)
Pumps and fans	114.4399	0.5190	59.3943 (267)
Energy for lighting	276.1610	0.5190	143.3275 (268)
Total kg/year			959.6915 (272)
CO2 emissions per m2			17.0200 (273)
EI value			87.3177
EI rating			B (274)
EI band			B

Calculation of stars for heating and DHW

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9050 = 3.845$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9050 = 0.2387$, stars = 4
Water heating energy efficiency	$3.48 / 0.8856 = 3.930$, stars = 4
Water heating environmental impact	$0.216 / 0.8856 = 0.2439$, stars = 4

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



CALCULATION OF ENERGY RATINGS 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
 CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	56.4000 (1b)	2.3900 (2b)	134.7960 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	56.4000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	134.7960 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)
Number of intermittent fans				0 * 10 =	0.0000 (7a)
Number of passive vents				0 * 10 =	0.0000 (7b)
Number of flueless gas fires				0 * 40 =	0.0000 (7c)
Air changes per hour					
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				0.0000 / (5) =	0.0000 (8)
Pressure test				Yes	
Measured/design AP50				4.0000	
Infiltration rate					0.2000 (18)
Number of sides sheltered					1 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.9250 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.1850 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.9000	4.8000	4.7000	4.2000	4.2000	3.7000	3.8000	3.8000	4.0000	4.2000	4.3000	4.5000 (22)
Wind factor	1.2250	1.2000	1.1750	1.0500	1.0500	0.9250	0.9500	0.9500	1.0000	1.0500	1.0750	1.1250 (22a)
Adj infilt rate	0.2266	0.2220	0.2174	0.1943	0.1943	0.1711	0.1758	0.1758	0.1850	0.1943	0.1989	0.2081 (22b)
Mechanical extract ventilation - decentralised												0.5000 (23a)
If mechanical ventilation:												
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
DTC			2.1200	1.0800	2.2896		(26)
Windows (Uw = 1.40)			5.4400	1.3258	7.2121		(27)
French Door (Uw = 1.40)			2.5200	1.3258	3.3409		(27)
Jetfloor Grey			56.4000	0.1500	8.4600	75.0000	4230.0000 (28a)
External Wall	59.1100	7.9600	51.1500	0.2500	12.7875	52.8000	2700.7200 (29a)
External Wall to Stairwell	20.2500	2.1200	18.1300	0.2000	3.6260	52.8000	957.2640 (29a)
Total net area of external elements Aum(A, m2)			135.7600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	37.7161		(33)
E-FC-4			56.4000			70.0000	3948.0000 (32b)
Metal			114.3900			14.0000	1601.4600 (32c)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	13437.4440 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							238.2526 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.6283 (36)
Total fabric heat loss						(33) + (36) =	43.3445 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	22.2413	22.2413	22.2413	22.2413	22.2413	22.2413	22.2413	22.2413	22.2413	22.2413	22.2413	22.2413 (38)
Heat transfer coeff	65.5858	65.5858	65.5858	65.5858	65.5858	65.5858	65.5858	65.5858	65.5858	65.5858	65.5858	65.5858 (39)
Average = Sum(39)m / 12 =												65.5858 (39)
HLP	1.1629	1.1629	1.1629	1.1629	1.1629	1.1629	1.1629	1.1629	1.1629	1.1629	1.1629	1.1629 (40)
HLP (average)												1.1629 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Assumed occupancy												1.8782 (42)
Average daily hot water use (litres/day)												78.8083 (43)
Daily hot water use	86.6892	83.5368	80.3845	77.2322	74.0798	70.9275	70.9275	74.0798	77.2322	80.3845	83.5368	86.6892 (44)
Energy conte	128.5575	112.4372	116.0252	101.1535	97.0592	83.7547	77.6111	89.0598	90.1235	105.0303	114.6487	124.5011 (45)
Energy content (annual)										Total = Sum(45)m =		1239.9620 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	19.2836	16.8656	17.4038	15.1730	14.5589	12.5632	11.6417	13.3590	13.5185	15.7545	17.1973	18.6752 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.0240	12.6507	13.9804	13.5003	13.9291	13.4554	13.8887	13.9149	13.4799	13.9592	13.5427	14.0156 (61)
Total heat required for water heating calculated for each month	142.5816	125.0879	130.0056	114.6538	110.9884	97.2101	91.4998	102.9747	103.6034	118.9894	128.1914	138.5167 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	142.5816	125.0879	130.0056	114.6538	110.9884	97.2101	91.4998	102.9747	103.6034	118.9894	128.1914	138.5167 (64)
Heat gains from water heating, kWh/month	46.2514	40.5481	42.0735	37.0086	35.7545	31.2123	29.2779	33.0911	33.3360	38.4124	41.5064	44.9005 (65)
												Solar input (sum of months) = Sum(63)m = 0.0000 (63)
												Total per year (kWh/year) = Sum(64)m = 1404.3028 (64)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	112.6947	112.6947	112.6947	112.6947	112.6947	112.6947	112.6947	112.6947	112.6947	112.6947	112.6947	112.6947 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	39.0934	34.7225	28.2382	21.3781	15.9804	13.4913	14.5779	18.9489	25.4331	32.2932	37.6909	40.1800 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	244.4559	246.9926	240.6002	226.9916	209.8132	193.6679	182.8819	180.3452	186.7376	200.3462	217.5246	233.6699 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	48.1477	48.1477	48.1477	48.1477	48.1477	48.1477	48.1477	48.1477	48.1477	48.1477	48.1477	48.1477 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-75.1298	-75.1298	-75.1298	-75.1298	-75.1298	-75.1298	-75.1298	-75.1298	-75.1298	-75.1298	-75.1298	-75.1298 (71)
Water heating gains (Table 5)	62.1658	60.3394	56.5504	51.4009	48.0571	43.3504	39.3520	44.4773	46.3000	51.6295	57.6477	60.3502 (72)
Total internal gains	434.4278	430.7670	414.1014	388.4833	362.5633	339.2223	325.5243	332.4840	347.1833	372.9815	401.5758	422.9126 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	g	Specific data or Table 6c	FF	Access factor Table 6d	Gains W				
Northeast	3.9900	12.9465	0.4300	0.4300	0.0000	0.7700	17.1035 (75)					
Southwest	1.4500	40.9830	0.4300	0.4300	0.0000	0.7700	19.6757 (79)					
Southwest	2.5200	40.9830	0.4300	0.4300	0.0000	0.7700	34.1951 (79)					
Solar gains	70.9744	118.0344	172.7456	249.5228	291.2205	311.0919	292.9423	254.6442	206.6368	140.3387	88.1648	59.4819 (83)
Total gains	505.4022	548.8014	586.8470	638.0061	653.7838	650.3142	618.4666	587.1282	553.8202	513.3202	489.7406	482.3945 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation factor for gains for living area, nil,m (see Table 9a)	56.9121	56.9121	56.9121	56.9121	56.9121	56.9121	56.9121	56.9121	56.9121	56.9121	56.9121	56.9121 (85)
tau	4.7941	4.7941	4.7941	4.7941	4.7941	4.7941	4.7941	4.7941	4.7941	4.7941	4.7941	4.7941
alpha	0.9853	0.9771	0.9544	0.8887	0.7556	0.5483	0.3588	0.3775	0.6642	0.9000	0.9714	0.9878 (86)
MIT	20.0148	20.1373	20.3822	20.6770	20.8905	20.9815	20.9981	20.9977	20.9557	20.7108	20.3159	19.9777 (87)
Th 2	19.9498	19.9498	19.9498	19.9498	19.9498	19.9498	19.9498	19.9498	19.9498	19.9498	19.9498	19.9498 (88)
util rest of house	0.9809	0.9703	0.9405	0.8556	0.6900	0.4529	0.2489	0.2622	0.5666	0.8618	0.9614	0.9841 (89)
MIT 2	18.6752	18.8510	19.1983	19.5974	19.8551	19.9400	19.9494	19.9493	19.9224	19.6508	19.1095	18.6221 (90)
Living area fraction	19.1870	19.3425	19.6507	20.0099	20.2507	20.3379	20.3501	20.3499	20.3172	20.0558	19.5704	0.3821 (91)
MIT	19.1870	19.3425	19.6507	20.0099	20.2507	20.3379	20.3501	20.3499	20.3172	20.0558	19.5704	19.1400 (92)
Temperature adjustment	19.1870	19.3425	19.6507	20.0099	20.2507	20.3379	20.3501	20.3499	20.3172	20.0558	19.5704	0.0000
adjusted MIT	19.1870	19.3425	19.6507	20.0099	20.2507	20.3379	20.3501	20.3499	20.3172	20.0558	19.5704	19.1400 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9767	0.9654	0.9357	0.8578	0.7101	0.4890	0.2911	0.3064	0.6024	0.8663	0.9569	0.9803 (94)
Useful gains	493.6266	529.7900	549.1218	547.2631	464.2261	318.0067	180.0228	179.9189	333.6353	444.6729	468.6142	472.8796 (95)
Ext temp.	4.7000	5.2000	7.0000	9.5000	12.5000	15.4000	17.6000	17.6000	15.0000	11.4000	7.7000	4.7000 (96)
Heat loss rate W	950.1434	927.5463	829.7043	689.3016	508.3366	323.8580	180.3705	180.3551	348.7319	567.6963	778.5321	947.0622 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	339.6485	267.2922	208.7534	102.2677	32.8182	0.0000	0.0000	0.0000	0.0000	91.5294	223.1409	352.7918 (98)
Space heating												1618.2422 (98)
Space heating per m2												(98) / (4) = 28.6922 (99)

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													1730.7403 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	339.6485	267.2922	208.7534	102.2677	32.8182	0.0000	0.0000	0.0000	0.0000	91.5294	223.1409	352.7918	(98)
Space heating efficiency (main heating system 1)	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)
Space heating fuel (main heating system)	363.2604	285.8741	223.2656	109.3773	35.0997	0.0000	0.0000	0.0000	0.0000	97.8924	238.6534	377.3174	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	142.5816	125.0879	130.0056	114.6538	110.9884	97.2101	91.4998	102.9747	103.6034	118.9894	128.1914	138.5167	(64)
Efficiency of water heater (217)m	89.5297	89.4547	89.2446	88.7800	88.0102	87.3000	87.3000	87.3000	87.3000	88.6631	89.3056	87.3000	(216)
Fuel for water heating, kWh/month	159.2562	139.8339	145.6733	129.1438	126.1085	111.3518	104.8107	117.9550	118.6751	134.2041	143.5424	154.6389	(219)
Water heating fuel used													1585.1938 (219)
Annual totals kWh/year													
Space heating fuel - main system													1730.7403 (211)
Space heating fuel - secondary													0.0000 (215)
Electricity for pumps and fans: (MEVDecentralised, Database: total watage = 6.9550, total flow = 29.0000, SFP = 0.2398)													
mechanical ventilation fans (SFP = 0.2398)													39.4399 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													114.4399 (231)
Electricity for lighting (calculated in Appendix L)													276.1610 (232)
Total delivered energy for all uses													3706.5350 (238)

10a. Fuel costs - using BEDF prices (443)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1730.7403	3.9200	67.8450 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1585.1938	3.9200	62.1396 (247)
Mechanical ventilation fans	39.4399	16.9600	6.6890 (249)
Pumps and fans for heating	75.0000	16.9600	12.7200 (249)
Energy for lighting	276.1610	16.9600	46.8369 (250)
Additional standing charges			88.0000 (251)
Total energy cost			284.2305 (255)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1730.7403	0.2160	373.8399 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1585.1938	0.2160	342.4019 (264)
Space and water heating			716.2418 (265)
Pumps and fans	114.4399	0.5190	59.3943 (267)
Energy for lighting	276.1610	0.5190	143.3275 (268)
Total kg/year			918.9636 (272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	1730.7403	1.2200	2111.5032 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1585.1938	1.2200	1933.9364 (264)
Space and water heating			4045.4396 (265)
Pumps and fans	114.4399	3.0700	351.3305 (267)
Energy for lighting	276.1610	3.0700	847.8142 (268)
Primary energy kWh/year			5244.5843 (272)
Primary energy kWh/m2/year			92.9891 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating:

B 83

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Current environmental impact rating:

B 87

(For testing purposes):

A	Not considered
B	Not considered
C	Not considered
D	Not considered
E Low energy lighting	Already installed
F	Not considered
G	Not considered
H	Not considered
I	Not considered
J	Not considered
K	Not considered
M	Not considered
N Solar water heating	Not applicable
O	Not considered
P	Not considered
R	Not considered
S	Not considered
T	Not considered
U Solar photovoltaic panels	Not applicable
A2	Not considered
A3	Not considered
T2	Not considered
W	Not considered
X	Not considered
Y	Not considered
J2	Not considered
Q2	Not considered
Z1	Not considered
Z2	Not considered
Z3	Not considered
Z4	Not considered
Z5	Not considered
V2 Wind turbine	Not applicable
L2	Not considered
Q3	Not considered
O3	Not considered

Recommended measures:	SAP change	Cost change	CO2 change
(none)			

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
(none)	Total Savings £0	0.00 kg/m ²	

Potential energy efficiency rating:
Potential environmental impact rating:

B 83
B 87

Fuel prices for cost data on this page from database revision number 443 TEST (28 May 2019)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, East Anglia):

	Current	Potential	Saving
Electricity	£66	£66	£0
Mains gas	£218	£218	£0
Space heating	£175	£175	£0
Water heating	£62	£62	£0
Lighting	£47	£47	£0
Total cost of fuels	£284	£284	£0
Total cost of uses	£284	£284	£0
Delivered energy	66 kWh/m ²	66 kWh/m ²	0 kWh/m ²
Carbon dioxide emissions	0.9 tonnes	0.9 tonnes	0.0 tonnes
CO2 emissions per m ²	16 kg/m ²	16 kg/m ²	0 kg/m ²
Primary energy	93 kWh/m ²	93 kWh/m ²	0 kWh/m ²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

No improvements selected / applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
 CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

No improvements selected / applicable

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Designed) 9.92

Overheating Calculation Input Data

Dwelling type	Detached Flat
Number of storeys	1
Cross ventilation possible	Yes
SAP Region	East Anglia
Front of dwelling faces	North West
Overshading	Average or unknown
Thermal mass parameter	238.3 (calculated from construction elements)
Night ventilation	No
Ventilation rate during hot weather (ach)	3.00 (Windows half open)

Overheating Calculation

Summer ventilation heat loss coefficient	133.45 (P1)
Transmission heat loss coefficient	43.34 (37)
Summer heat loss coefficient	176.79 (P2)

Overhangs	Ratio	Z_overhangs	Overhang type
Orientation			
North East	0.000	1.000	None
South West	0.000	1.000	None

Solar shading	Z blinds	Solar access	Z overhangs	Z summer
Orientation				
North East	1.000	0.90	1.000	0.900 (P8)
South West	1.000	0.90	1.000	0.900 (P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North East	3.9900	100.0415	0.4300	0.0000	0.9000	154.4770
South West	1.4500	122.3147	0.4300	0.0000	0.9000	68.6369
South West	2.5200	122.3147	0.4300	0.0000	0.9000	119.2862

total: 342.4001

	Jun	Jul	Aug
Solar gains	364	342	298
Internal gains	336	323	329
Total summer gains	700	665	627

	3.96	3.76	3.55
Summer gain/loss ratio			
Summer external temperature	15.40	17.60	17.60
Thermal mass temperature increment (TMP = 238.3)	0.33	0.33	0.33
Threshold temperature	19.69	21.69	21.48
Likelihood of high internal temperature	Not significant	Slight	Slight

Assessment of likelihood of high internal temperature: Slight