

This design submission has been carried out using Approved SAP software. It has been prepared from plans and specifications and may not reflect the property as constructed.

Assessor name	Mr Stuart Searle	Assessor number	3519
Client	Avis Appleton & Associates	Last modified	14/09/2016
Address	PF1 Liffords Place, London, SW13		

1. Overall dwelling dimensions

	Area (m ²)	Average storey height (m)	Volume (m ³)
Lowest occupied	<input type="text" value="68.90"/> (1a)	<input type="text" value="2.50"/> (2a)	<input type="text" value="172.25"/> (3a)
Total floor area	(1a) + (1b) + (1c) + (1d)...(1n) =		<input type="text" value="68.90"/> (4)
Dwelling volume	(3a) + (3b) + (3c) + (3d)...(3n) =		<input type="text" value="172.25"/> (5)

2. Ventilation rate

		m ³ per hour
Number of chimneys	<input type="text" value="0"/> x 40 =	<input type="text" value="0"/> (6a)
Number of open flues	<input type="text" value="0"/> x 20 =	<input type="text" value="0"/> (6b)
Number of intermittent fans	<input type="text" value="2"/> x 10 =	<input type="text" value="20"/> (7a)
Number of passive vents	<input type="text" value="0"/> x 10 =	<input type="text" value="0"/> (7b)
Number of flueless gas fires	<input type="text" value="0"/> x 40 =	<input type="text" value="0"/> (7c)

	Air changes per hour
Infiltration due to chimneys, flues, fans, PSVs	(6a) + (6b) + (7a) + (7b) + (7c) = <input type="text" value="20"/> ÷ (5) = <input type="text" value="0.12"/> (8)

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

Air permeability value, q ₅₀ , expressed in cubic metres per hour per square metre of envelope area	<input type="text" value="5.00"/> (17)
--	--

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)	<input type="text" value="0.37"/> (18)
--	--

Number of sides on which the dwelling is sheltered	<input type="text" value="2"/> (19)
--	-------------------------------------

Shelter factor	1 - [0.075 x (19)] = <input type="text" value="0.85"/> (20)
----------------	---

Infiltration rate incorporating shelter factor	(18) x (20) = <input type="text" value="0.31"/> (21)
--	--

Infiltration rate modified for monthly wind speed:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table U2	<input type="text" value="5.10"/>	<input type="text" value="5.00"/>	<input type="text" value="4.90"/>	<input type="text" value="4.40"/>	<input type="text" value="4.30"/>	<input type="text" value="3.80"/>	<input type="text" value="3.80"/>	<input type="text" value="3.70"/>	<input type="text" value="4.00"/>	<input type="text" value="4.30"/>	<input type="text" value="4.50"/>	<input type="text" value="4.70"/> (22)

Wind factor (22)m ÷ 4	<input type="text" value="1.28"/>	<input type="text" value="1.25"/>	<input type="text" value="1.23"/>	<input type="text" value="1.10"/>	<input type="text" value="1.08"/>	<input type="text" value="0.95"/>	<input type="text" value="0.95"/>	<input type="text" value="0.93"/>	<input type="text" value="1.00"/>	<input type="text" value="1.08"/>	<input type="text" value="1.13"/>	<input type="text" value="1.18"/> (22a)
-----------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	---

Adjusted infiltration rate (allowing for shelter and wind factor) (21) x (22a)m	<input type="text" value="0.40"/>	<input type="text" value="0.39"/>	<input type="text" value="0.38"/>	<input type="text" value="0.34"/>	<input type="text" value="0.33"/>	<input type="text" value="0.30"/>	<input type="text" value="0.30"/>	<input type="text" value="0.29"/>	<input type="text" value="0.31"/>	<input type="text" value="0.33"/>	<input type="text" value="0.35"/>	<input type="text" value="0.37"/> (22b)
---	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	---

Calculate effective air change rate for the applicable case:

If mechanical ventilation: air change rate through system	<input type="text" value="N/A"/> (23a)
---	--

If balanced with heat recovery: efficiency in % allowing for in-use factor from Table 4h	<input type="text" value="N/A"/> (23c)
--	--

d) natural ventilation or whole house positive input ventilation from loft	<input type="text" value="0.58"/>	<input type="text" value="0.58"/>	<input type="text" value="0.57"/>	<input type="text" value="0.56"/>	<input type="text" value="0.56"/>	<input type="text" value="0.54"/>	<input type="text" value="0.54"/>	<input type="text" value="0.54"/>	<input type="text" value="0.55"/>	<input type="text" value="0.56"/>	<input type="text" value="0.56"/>	<input type="text" value="0.57"/> (24d)
--	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	---

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in (25)	<input type="text" value="0.58"/>	<input type="text" value="0.58"/>	<input type="text" value="0.57"/>	<input type="text" value="0.56"/>	<input type="text" value="0.56"/>	<input type="text" value="0.54"/>	<input type="text" value="0.54"/>	<input type="text" value="0.54"/>	<input type="text" value="0.55"/>	<input type="text" value="0.56"/>	<input type="text" value="0.56"/>	<input type="text" value="0.57"/> (25)
--	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	--

3. Heat losses and heat loss parameter

Element	Gross area, m ²	Openings m ²	Net area A, m ²	U-value W/m ² K	A x U W/K	κ-value, kJ/m ² .K	A x κ, kJ/K					
Door			2.10	1.00	2.10		(26)					
Window			15.12	1.33	20.05		(27)					
Exposed floor			68.90	0.13	8.96		(28b)					
External wall			77.72	0.18	13.99		(29a)					
Total area of external elements ΣA, m ²			163.84				(31)					
Fabric heat loss, W/K = Σ(A x U)					(26)...(30) + (32) =	45.09	(33)					
Heat capacity Cm = Σ(A x κ)					(28)...(30) + (32) + (32a)...(32e) =	N/A	(34)					
Thermal mass parameter (TMP) in kJ/m ² K						250.00	(35)					
Thermal bridges: Σ(L x Ψ) calculated using Appendix K						15.31	(36)					
Total fabric heat loss						(33) + (36) =	60.40 (37)					
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ventilation heat loss calculated monthly 0.33 x (25)m x (5)	32.90	32.72	32.55	31.75	31.60	30.91	30.91	30.78	31.17	31.60	31.90	32.22
Heat transfer coefficient, W/K (37)m + (38)m	93.30	93.12	92.95	92.15	92.00	91.31	91.31	91.18	91.58	92.00	92.31	92.62
	Average = Σ(39)1...12/12 =											92.15 (39)
Heat loss parameter (HLP), W/m ² K (39)m ÷ (4)	1.35	1.35	1.35	1.34	1.34	1.33	1.33	1.32	1.33	1.34	1.34	1.34
	Average = Σ(40)1...12/12 =											1.34 (40)
Number of days in month (Table 1a)	31.00	28.00	31.00	30.00	31.00	30.00	31.00	31.00	30.00	31.00	30.00	31.00

4. Water heating energy requirement

Assumed occupancy, N												2.22	(42)
Annual average hot water usage in litres per day Vd,average = (25 x N) + 36												86.90	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)	95.59	92.12	88.64	85.17	81.69	78.21	78.21	81.69	85.17	88.64	92.12	95.59	
	Σ(44)1...12 =											1042.85	(44)
Energy content of hot water used = 4.18 x Vd,m x nm x Tm/3600 kWh/month (see Tables 1b, 1c 1d)	141.76	123.99	127.94	111.54	107.03	92.36	85.58	98.21	99.38	115.82	126.43	137.29	
	Σ(45)1...12 =											1367.34	(45)
Distribution loss 0.15 x (45)m	21.26	18.60	19.19	16.73	16.05	13.85	12.84	14.73	14.91	17.37	18.96	20.59	
Water storage loss calculated for each month (55) x (41)m	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
If the vessel contains dedicated solar storage or dedicated WWHRS (56)m x [(47) - Vs] ÷ (47), else (56)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Primary circuit loss for each month from Table 3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Combi loss for each month from Table 3a, 3b or 3c	48.71	42.40	45.17	42.00	41.63	38.57	39.86	41.63	42.00	45.17	45.43	48.71	
Total heat required for water heating calculated for each month 0.85 x (45)m + (46)m + (57)m + (59)m + (61)m	190.48	166.39	173.12	153.54	148.66	130.93	125.44	139.84	141.38	160.99	171.85	186.00	
Solar DHW input calculated using Appendix G or Appendix H													

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(63)
------	------	------	------	------	------	------	------	------	------	------	------	------	------

Output from water heater for each month (kWh/month) (62)m + (63)m

190.48	166.39	173.12	153.54	148.66	130.93	125.44	139.84	141.38	160.99	171.85	186.00	$\Sigma(64)1...12 =$	1888.62	(64)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	----------------------	---------	------

Heat gains from water heating (kWh/month) $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

59.32	51.83	53.83	47.59	45.99	40.35	38.42	43.06	43.54	49.80	53.39	57.83	(65)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

5. Internal gains

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

Metabolic gains (Table 5)

110.96	110.96	110.96	110.96	110.96	110.96	110.96	110.96	110.96	110.96	110.96	110.96	(66)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

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

17.37	15.42	12.54	9.50	7.10	5.99	6.48	8.42	11.30	14.35	16.74	17.85	(67)
-------	-------	-------	------	------	------	------	------	-------	-------	-------	-------	------

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

194.72	196.74	191.65	180.81	167.12	154.26	145.67	143.65	148.74	159.58	173.26	186.12	(68)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

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

34.10	34.10	34.10	34.10	34.10	34.10	34.10	34.10	34.10	34.10	34.10	34.10	(69)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Pump and fan gains (Table 5a)

3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	(70)
------	------	------	------	------	------	------	------	------	------	------	------	------

Losses e.g. evaporation (Table 5)

-88.77	-88.77	-88.77	-88.77	-88.77	-88.77	-88.77	-88.77	-88.77	-88.77	-88.77	-88.77	(71)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Water heating gains (Table 5)

79.72	77.12	72.36	66.10	61.82	56.04	51.64	57.88	60.48	66.94	74.16	77.73	(72)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

351.09	348.57	335.83	315.68	295.33	275.59	263.07	269.23	279.81	300.15	323.45	340.99	(73)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

6. Solar gains

	Access factor Table 6d	Area m ²	Solar flux W/m ²	g specific data or Table 6b	FF specific data or Table 6c	Gains W		
SouthWest	0.77	4.62	36.79	0.9	0.63	0.70	51.95	(79)
SouthEast	0.77	2.31	36.79	0.9	0.63	0.70	25.98	(77)
NorthEast	0.77	8.19	11.28	0.9	0.63	0.70	28.24	(75)

Solar gains in watts $\Sigma(74)m...(82)m$

106.17	190.22	285.19	395.12	480.69	493.98	469.27	402.87	322.85	216.95	128.87	89.75	(83)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	------

Total gains - internal and solar (73)m + (83)m

457.26	538.79	621.02	710.81	776.02	769.57	732.35	672.10	602.66	517.11	452.32	430.74	(84)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

7. Mean internal temperature (heating season)

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

21.00	(85)
-------	------

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

Utilisation factor for gains for living area n1,m (see Table 9a)

1.00	0.99	0.98	0.95	0.85	0.69	0.53	0.59	0.84	0.97	0.99	1.00	(86)
------	------	------	------	------	------	------	------	------	------	------	------	------

Mean internal temp of living area T1 (steps 3 to 7 in Table 9c)

19.55	19.73	20.03	20.42	20.75	20.93	20.98	20.97	20.83	20.40	19.90	19.52	(87)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

19.80	19.80	19.80	19.81	19.81	19.82	19.82	19.82	19.82	19.81	19.81	19.81	(88)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Utilisation factor for gains for rest of dwelling n2,m

1.00	0.99	0.98	0.93	0.80	0.59	0.40	0.46	0.76	0.95	0.99	1.00	(89)
------	------	------	------	------	------	------	------	------	------	------	------	------

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

17.89	18.16	18.59	19.14	19.57	19.78	19.82	19.81	19.69	19.13	18.41	17.85	(90)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Living area fraction

Living area ÷ (4) = (91)

Mean internal temperature for the whole dwelling fLA x T1 +(1 - fLA) x T2

18.71	18.93	19.30	19.77	20.15	20.34	20.39	20.38	20.25	19.75	19.14	18.67	(92)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

18.71	18.93	19.30	19.77	20.15	20.34	20.39	20.38	20.25	19.75	19.14	18.67	(93)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

8. Space heating requirement

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

Utilisation factor for gains, ηm

0.99	0.99	0.97	0.93	0.82	0.64	0.46	0.52	0.79	0.95	0.99	1.00	(94)
------	------	------	------	------	------	------	------	------	------	------	------	------

Useful gains, ηmGm, W (94)m x (84)m

454.68	532.46	603.86	658.02	634.64	490.57	339.67	352.35	475.43	492.83	447.41	428.85	(95)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Monthly average external temperature from Table U1

4.30	4.90	6.50	8.90	11.70	14.60	16.60	16.40	14.10	10.60	7.10	4.20	(96)
------	------	------	------	-------	-------	-------	-------	-------	-------	------	------	------

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

1344.26	1306.69	1189.55	1001.66	777.41	524.54	346.06	363.19	563.17	842.21	1111.79	1340.14	(97)
---------	---------	---------	---------	--------	--------	--------	--------	--------	--------	---------	---------	------

Space heating requirement, kWh/month 0.024 x [(97)m - (95)m] x (41)m

661.85	520.28	435.75	247.42	106.22	0.00	0.00	0.00	0.00	259.94	478.35	678.00	(98)
--------	--------	--------	--------	--------	------	------	------	------	--------	--------	--------	------

Σ(98)1...5, 10...12 = (98)

Space heating requirement kWh/m²/year

(98) ÷ (4) = (99)

9a. Energy requirements - individual heating systems including micro-CHP

Space heating

Fraction of space heat from secondary/supplementary system (table 11)

(201)

Fraction of space heat from main system(s)

1 - (201) = (202)

Fraction of space heat from main system 2

(202)

Fraction of total space heat from main system 1

(202) x [1- (203)] = (204)

Fraction of total space heat from main system 2

(202) x (203) = (205)

Efficiency of main system 1 (%)

(206)

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

Space heating fuel (main system 1), kWh/month

708.62	557.05	466.54	264.90	113.73	0.00	0.00	0.00	0.00	278.31	512.15	725.91	(211)
--------	--------	--------	--------	--------	------	------	------	------	--------	--------	--------	-------

Σ(211)1...5, 10...12 = (211)

Water heating

Efficiency of water heater

87.93	87.73	87.28	86.25	84.22	80.30	80.30	80.30	80.30	86.25	87.49	88.02	(217)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

Water heating fuel, kWh/month

216.63	189.67	198.35	178.03	176.51	163.05	156.22	174.14	176.07	186.65	196.42	211.33	(219)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------

Σ(219a)1...12 = (219)

Annual totals

Space heating fuel - main system 1

Water heating fuel

Electricity for pumps, fans and electric keep-hot (Table 4f)

central heating pump or water pump within warm air heating unit

(230c)

boiler flue fan

(230e)

Total electricity for the above, kWh/year

(231)

Electricity for lighting (Appendix L)					306.70	(232)
Total delivered energy for all uses				(211)...(221) + (231) + (232)...(237b) =	6231.97	(238)

10a. Fuel costs - individual heating systems including micro-CHP

	Fuel kWh/year		Fuel price		Fuel cost £/year	
Space heating - main system 1	3627.21	x	3.48	x 0.01 =	126.23	(240)
Water heating	2223.07	x	3.48	x 0.01 =	77.36	(247)
Pumps and fans	75.00	x	13.19	x 0.01 =	9.89	(249)
Electricity for lighting	306.70	x	13.19	x 0.01 =	40.45	(250)
Additional standing charges					120.00	(251)
Total energy cost				(240)...(242) + (245)...(254) =	373.94	(255)

11a. SAP rating - individual heating systems including micro-CHP

Energy cost deflator (Table 12)	0.42	(256)
Energy cost factor (ECF)	1.38	(257)
SAP value	80.76	
SAP rating (section 13)	81	(258)
SAP band	B	

12a. CO₂ emissions - individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO ₂ /kWh		Emissions kg CO ₂ /year	
Space heating - main system 1	3627.21	x	0.216	=	783.48	(261)
Water heating	2223.07	x	0.216	=	480.18	(264)
Space and water heating				(261) + (262) + (263) + (264) =	1263.66	(265)
Pumps and fans	75.00	x	0.519	=	38.93	(267)
Electricity for lighting	306.70	x	0.519	=	159.18	(268)
Total CO ₂ , kg/year				(265)...(271) =	1461.76	(272)
Dwelling CO ₂ emission rate				(272) ÷ (4) =	21.22	(273)
EI value					82.80	
EI rating (section 14)					83	(274)
EI band					B	

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

	Energy kWh/year		Primary factor		Primary Energy kWh/year	
Space heating - main system 1	3627.21	x	1.22	=	4425.19	(261)
Water heating	2223.07	x	1.22	=	2712.14	(264)
Space and water heating				(261) + (262) + (263) + (264) =	7137.33	(265)
Pumps and fans	75.00	x	3.07	=	230.25	(267)
Electricity for lighting	306.70	x	3.07	=	941.56	(268)
Primary energy kWh/year					8309.15	(272)
Dwelling primary energy rate kWh/m ² /year					120.60	(273)

This design submission has been carried out using Approved SAP software. It has been prepared from plans and specifications and may not reflect the property as constructed.

Assessor name	Mr Stuart Searle	Assessor number	3519
Client	Avis Appleton & Associates	Last modified	14/09/2016
Address	PF2 Liffords Place, London, SW13		

1. Overall dwelling dimensions

	Area (m ²)	Average storey height (m)	Volume (m ³)
Lowest occupied	<input type="text" value="68.90"/> (1a) x	<input type="text" value="2.50"/> (2a) =	<input type="text" value="172.25"/> (3a)
Total floor area	(1a) + (1b) + (1c) + (1d)...(1n) = <input type="text" value="68.90"/> (4)		
Dwelling volume	(3a) + (3b) + (3c) + (3d)...(3n) = <input type="text" value="172.25"/> (5)		

2. Ventilation rate

		m ³ per hour
Number of chimneys	<input type="text" value="0"/> x 40 =	<input type="text" value="0"/> (6a)
Number of open flues	<input type="text" value="0"/> x 20 =	<input type="text" value="0"/> (6b)
Number of intermittent fans	<input type="text" value="2"/> x 10 =	<input type="text" value="20"/> (7a)
Number of passive vents	<input type="text" value="0"/> x 10 =	<input type="text" value="0"/> (7b)
Number of flueless gas fires	<input type="text" value="0"/> x 40 =	<input type="text" value="0"/> (7c)

	Air changes per hour
Infiltration due to chimneys, flues, fans, PSVs	(6a) + (6b) + (7a) + (7b) + (7c) = <input type="text" value="20"/> ÷ (5) = <input type="text" value="0.12"/> (8)

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

Air permeability value, q ₅₀ , expressed in cubic metres per hour per square metre of envelope area	<input type="text" value="5.00"/> (17)
--	--

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)	<input type="text" value="0.37"/> (18)
--	--

Number of sides on which the dwelling is sheltered	<input type="text" value="2"/> (19)
--	-------------------------------------

Shelter factor	1 - [0.075 x (19)] = <input type="text" value="0.85"/> (20)
----------------	---

Infiltration rate incorporating shelter factor	(18) x (20) = <input type="text" value="0.31"/> (21)
--	--

Infiltration rate modified for monthly wind speed:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table U2	<input type="text" value="5.10"/>	<input type="text" value="5.00"/>	<input type="text" value="4.90"/>	<input type="text" value="4.40"/>	<input type="text" value="4.30"/>	<input type="text" value="3.80"/>	<input type="text" value="3.80"/>	<input type="text" value="3.70"/>	<input type="text" value="4.00"/>	<input type="text" value="4.30"/>	<input type="text" value="4.50"/>	<input type="text" value="4.70"/>

Wind factor (22)m ÷ 4	<input type="text" value="1.28"/>	<input type="text" value="1.25"/>	<input type="text" value="1.23"/>	<input type="text" value="1.10"/>	<input type="text" value="1.08"/>	<input type="text" value="0.95"/>	<input type="text" value="0.95"/>	<input type="text" value="0.93"/>	<input type="text" value="1.00"/>	<input type="text" value="1.08"/>	<input type="text" value="1.13"/>	<input type="text" value="1.18"/>
-----------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------

Adjusted infiltration rate (allowing for shelter and wind factor) (21) x (22a)m	<input type="text" value="0.40"/>	<input type="text" value="0.39"/>	<input type="text" value="0.38"/>	<input type="text" value="0.34"/>	<input type="text" value="0.33"/>	<input type="text" value="0.30"/>	<input type="text" value="0.30"/>	<input type="text" value="0.29"/>	<input type="text" value="0.31"/>	<input type="text" value="0.33"/>	<input type="text" value="0.35"/>	<input type="text" value="0.37"/>
---	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------

Calculate effective air change rate for the applicable case:

If mechanical ventilation: air change rate through system	<input type="text" value="N/A"/> (23a)
---	--

If balanced with heat recovery: efficiency in % allowing for in-use factor from Table 4h	<input type="text" value="N/A"/> (23c)
--	--

d) natural ventilation or whole house positive input ventilation from loft	<input type="text" value="0.58"/>	<input type="text" value="0.58"/>	<input type="text" value="0.57"/>	<input type="text" value="0.56"/>	<input type="text" value="0.56"/>	<input type="text" value="0.54"/>	<input type="text" value="0.54"/>	<input type="text" value="0.54"/>	<input type="text" value="0.55"/>	<input type="text" value="0.56"/>	<input type="text" value="0.56"/>	<input type="text" value="0.57"/>
--	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in (25)	<input type="text" value="0.58"/>	<input type="text" value="0.58"/>	<input type="text" value="0.57"/>	<input type="text" value="0.56"/>	<input type="text" value="0.56"/>	<input type="text" value="0.54"/>	<input type="text" value="0.54"/>	<input type="text" value="0.54"/>	<input type="text" value="0.55"/>	<input type="text" value="0.56"/>	<input type="text" value="0.56"/>	<input type="text" value="0.57"/>
--	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------

3. Heat losses and heat loss parameter

Element	Gross area, m ²	Openings m ²	Net area A, m ²	U-value W/m ² K	A x U W/K	κ-value, kJ/m ² .K	A x κ, kJ/K						
Door			2.10	1.00	2.10		(26)						
Window			15.12	1.33	20.05		(27)						
Exposed floor			68.90	0.13	8.96		(28b)						
External wall			57.97	0.18	10.43		(29a)						
Party wall			19.75	0.00	0.00		(32)						
Total area of external elements $\sum A$, m ²			144.09				(31)						
Fabric heat loss, W/K = $\sum(A \times U)$					(26)...(30) + (32) =	41.54	(33)						
Heat capacity Cm = $\sum(A \times \kappa)$					(28)...(30) + (32) + (32a)...(32e) =	N/A	(34)						
Thermal mass parameter (TMP) in kJ/m ² K						250.00	(35)						
Thermal bridges: $\sum(L \times \Psi)$ calculated using Appendix K						13.34	(36)						
Total fabric heat loss						(33) + (36) =	54.88 (37)						
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ventilation heat loss calculated monthly $0.33 \times (25)m \times (5)$	32.90	32.72	32.55	31.75	31.60	30.91	30.91	30.78	31.17	31.60	31.90	32.22	(38)
Heat transfer coefficient, W/K (37)m + (38)m	87.78	87.60	87.43	86.63	86.48	85.79	85.79	85.66	86.05	86.48	86.78	87.10	
	Average = $\sum(39)1...12/12 =$											86.63 (39)	
Heat loss parameter (HLP), W/m ² K (39)m ÷ (4)	1.27	1.27	1.27	1.26	1.26	1.25	1.25	1.24	1.25	1.26	1.26	1.26	
	Average = $\sum(40)1...12/12 =$											1.26 (40)	
Number of days in month (Table 1a)	31.00	28.00	31.00	30.00	31.00	30.00	31.00	31.00	30.00	31.00	30.00	31.00	(40)

4. Water heating energy requirement

Assumed occupancy, N													2.22	(42)	
Annual average hot water usage in litres per day Vd,average = $(25 \times N) + 36$														86.90	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec			
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)	95.59	92.12	88.64	85.17	81.69	78.21	78.21	81.69	85.17	88.64	92.12	95.59			
	$\sum(44)1...12 =$											1042.85	(44)		
Energy content of hot water used = $4.18 \times Vd,m \times nm \times Tm/3600$ kWh/month (see Tables 1b, 1c 1d)	141.76	123.99	127.94	111.54	107.03	92.36	85.58	98.21	99.38	115.82	126.43	137.29			
	$\sum(45)1...12 =$											1367.34	(45)		
Distribution loss $0.15 \times (45)m$	21.26	18.60	19.19	16.73	16.05	13.85	12.84	14.73	14.91	17.37	18.96	20.59	(46)		
Water storage loss calculated for each month (55) x (41)m	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(56)		
If the vessel contains dedicated solar storage or dedicated WWHRS (56)m x [(47) - Vs] ÷ (47), else (56)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(57)		
Primary circuit loss for each month from Table 3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(59)		
Combi loss for each month from Table 3a, 3b or 3c	48.71	42.40	45.17	42.00	41.63	38.57	39.86	41.63	42.00	45.17	45.43	48.71	(61)		
Total heat required for water heating calculated for each month $0.85 \times (45)m + (46)m + (57)m + (59)m + (61)m$	190.48	166.39	173.12	153.54	148.66	130.93	125.44	139.84	141.38	160.99	171.85	186.00	(62)		

Solar DHW input calculated using Appendix G or Appendix H

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
------	------	------	------	------	------	------	------	------	------	------	------	------

 (63)

Output from water heater for each month (kWh/month) (62)m + (63)m

190.48	166.39	173.12	153.54	148.66	130.93	125.44	139.84	141.38	160.99	171.85	186.00
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

$\Sigma(64)1...12 = 1888.62$ (64)

Heat gains from water heating (kWh/month) $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

59.32	51.83	53.83	47.59	45.99	40.35	38.42	43.06	43.54	49.80	53.39	57.83
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (65)

5. Internal gains

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

Metabolic gains (Table 5)

110.96	110.96	110.96	110.96	110.96	110.96	110.96	110.96	110.96	110.96	110.96	110.96
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (66)

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

17.37	15.42	12.54	9.50	7.10	5.99	6.48	8.42	11.30	14.35	16.74	17.85
-------	-------	-------	------	------	------	------	------	-------	-------	-------	-------

 (67)

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

194.72	196.74	191.65	180.81	167.12	154.26	145.67	143.65	148.74	159.58	173.26	186.12
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (68)

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

34.10	34.10	34.10	34.10	34.10	34.10	34.10	34.10	34.10	34.10	34.10	34.10
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (69)

Pump and fan gains (Table 5a)

3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
------	------	------	------	------	------	------	------	------	------	------	------

 (70)

Losses e.g. evaporation (Table 5)

-88.77	-88.77	-88.77	-88.77	-88.77	-88.77	-88.77	-88.77	-88.77	-88.77	-88.77	-88.77
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (71)

Water heating gains (Table 5)

79.72	77.12	72.36	66.10	61.82	56.04	51.64	57.88	60.48	66.94	74.16	77.73
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (72)

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

351.09	348.57	335.83	315.68	295.33	275.59	263.07	269.23	279.81	300.15	323.45	340.99
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (73)

6. Solar gains

	Access factor Table 6d	Area m ²	Solar flux W/m ²	g specific data or Table 6b	FF specific data or Table 6c	Gains W
--	---------------------------	------------------------	--------------------------------	-----------------------------------	------------------------------------	------------

SouthWest $0.77 \times 4.62 \times 36.79 \times 0.9 \times 0.63 \times 0.70 = 51.95$ (79)

NorthWest $0.77 \times 2.31 \times 11.28 \times 0.9 \times 0.63 \times 0.70 = 7.97$ (81)

NorthEast $0.77 \times 8.19 \times 11.28 \times 0.9 \times 0.63 \times 0.70 = 28.24$ (75)

Solar gains in watts $\Sigma(74)m...(82)m$

88.16	162.19	253.86	368.09	461.16	479.32	453.17	380.45	292.90	187.87	107.78	74.03
-------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------

 (83)

Total gains - internal and solar (73)m + (83)m

439.25	510.76	589.69	683.77	756.49	754.91	716.24	649.68	572.70	488.02	431.23	415.01
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (84)

7. Mean internal temperature (heating season)

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

21.00 (85)

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

Utilisation factor for gains for living area n1,m (see Table 9a)

1.00	0.99	0.98	0.95	0.85	0.67	0.51	0.58	0.84	0.97	0.99	1.00
------	------	------	------	------	------	------	------	------	------	------	------

 (86)

Mean internal temp of living area T1 (steps 3 to 7 in Table 9c)

19.63	19.80	20.08	20.47	20.78	20.95	20.99	20.98	20.85	20.43	19.96	19.60
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (87)

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

19.86	19.86	19.87	19.87	19.88	19.88	19.88	19.89	19.88	19.88	19.87	19.87
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (88)

Utilisation factor for gains for rest of dwelling n2,m

1.00	0.99	0.98	0.93	0.80	0.58	0.39	0.45	0.76	0.96	0.99	1.00	(99)
------	------	------	------	------	------	------	------	------	------	------	------	------

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

18.05	18.29	18.71	19.26	19.67	19.85	19.88	19.88	19.76	19.22	18.54	18.01	(90)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Living area fraction

Living area ÷ (4) = (91)

Mean internal temperature for the whole dwelling fLA x T1 +(1 - fLA) x T2

18.83	19.03	19.39	19.85	20.22	20.39	20.43	20.42	20.30	19.82	19.24	18.79	(92)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

18.83	19.03	19.39	19.85	20.22	20.39	20.43	20.42	20.30	19.82	19.24	18.79	(93)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

8. Space heating requirement

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

Utilisation factor for gains, ηm

1.00	0.99	0.98	0.93	0.81	0.62	0.45	0.52	0.79	0.96	0.99	1.00	(94)
------	------	------	------	------	------	------	------	------	------	------	------	------

Useful gains, ηmGm, W (94)m x (84)m

437.18	505.80	575.46	634.97	615.06	470.74	323.62	336.02	454.77	467.82	427.30	413.50	(95)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Monthly average external temperature from Table U1

4.30	4.90	6.50	8.90	11.70	14.60	16.60	16.40	14.10	10.60	7.10	4.20	(96)
------	------	------	------	-------	-------	-------	-------	-------	-------	------	------	------

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

1275.11	1238.04	1126.60	948.75	736.59	496.67	328.14	344.30	533.22	797.14	1053.53	1270.94	(97)
---------	---------	---------	--------	--------	--------	--------	--------	--------	--------	---------	---------	------

Space heating requirement, kWh/month 0.024 x [(97)m - (95)m] x (41)m

623.42	492.07	410.05	225.92	90.42	0.00	0.00	0.00	0.00	245.02	450.89	637.94	(98)
--------	--------	--------	--------	-------	------	------	------	------	--------	--------	--------	------

Σ(98)1...5, 10...12 = (98)

Space heating requirement kWh/m²/year

(98) ÷ (4) = (99)

9a. Energy requirements - individual heating systems including micro-CHP

Space heating

Fraction of space heat from secondary/supplementary system (table 11)

(201)

Fraction of space heat from main system(s)

1 - (201) = (202)

Fraction of space heat from main system 2

(202)

Fraction of total space heat from main system 1

(202) x [1 - (203)] = (204)

Fraction of total space heat from main system 2

(202) x (203) = (205)

Efficiency of main system 1 (%)

(206)

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

Space heating fuel (main system 1), kWh/month

667.47	526.84	439.03	241.88	96.81	0.00	0.00	0.00	0.00	262.33	482.75	683.02	(211)
--------	--------	--------	--------	-------	------	------	------	------	--------	--------	--------	-------

Σ(211)1...5, 10...12 = (211)

Water heating

Efficiency of water heater

87.82	87.62	87.15	86.02	83.84	80.30	80.30	80.30	80.30	86.11	87.37	87.90	(217)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

Water heating fuel, kWh/month

216.91	189.91	198.65	178.49	177.31	163.05	156.22	174.14	176.07	186.97	196.70	211.60	(219)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------

Σ(219a)1...12 = (219)

Annual totals

Space heating fuel - main system 1

Water heating fuel

Electricity for pumps, fans and electric keep-hot (Table 4f)

central heating pump or water pump within warm air heating unit

(230c)

boiler flue fan

(230e)

Total electricity for the above, kWh/year					75.00	(231)
Electricity for lighting (Appendix L)					306.70	(232)
Total delivered energy for all uses				(211)...(221) + (231) + (232)...(237b) =	6007.84	(238)

10a. Fuel costs - individual heating systems including micro-CHP

	Fuel kWh/year		Fuel price		Fuel cost £/year	
Space heating - main system 1	3400.13	x	3.48	x 0.01 =	118.32	(240)
Water heating	2226.01	x	3.48	x 0.01 =	77.47	(247)
Pumps and fans	75.00	x	13.19	x 0.01 =	9.89	(249)
Electricity for lighting	306.70	x	13.19	x 0.01 =	40.45	(250)
Additional standing charges					120.00	(251)
Total energy cost				(240)...(242) + (245)...(254) =	366.14	(255)

11a. SAP rating - individual heating systems including micro-CHP

Energy cost deflator (Table 12)					0.42	(256)
Energy cost factor (ECF)					1.35	(257)
SAP value					81.17	
SAP rating (section 13)					81	(258)
SAP band					B	

12a. CO₂ emissions - individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO ₂ /kWh		Emissions kg CO ₂ /year	
Space heating - main system 1	3400.13	x	0.216	=	734.43	(261)
Water heating	2226.01	x	0.216	=	480.82	(264)
Space and water heating				(261) + (262) + (263) + (264) =	1215.25	(265)
Pumps and fans	75.00	x	0.519	=	38.93	(267)
Electricity for lighting	306.70	x	0.519	=	159.18	(268)
Total CO ₂ , kg/year				(265)...(271) =	1413.35	(272)
Dwelling CO ₂ emission rate				(272) ÷ (4) =	20.51	(273)
EI value					83.37	
EI rating (section 14)					83	(274)
EI band					B	

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

	Energy kWh/year		Primary factor		Primary Energy kWh/year	
Space heating - main system 1	3400.13	x	1.22	=	4148.15	(261)
Water heating	2226.01	x	1.22	=	2715.74	(264)
Space and water heating				(261) + (262) + (263) + (264) =	6863.89	(265)
Pumps and fans	75.00	x	3.07	=	230.25	(267)
Electricity for lighting	306.70	x	3.07	=	941.56	(268)
Primary energy kWh/year					8035.71	(272)
Dwelling primary energy rate kWh/m ² /year					116.63	(273)

This design submission has been carried out using Approved SAP software. It has been prepared from plans and specifications and may not reflect the property as constructed.

Assessor name	Mr Stuart Searle	Assessor number	3519
Client	Avis Appleton & Associates	Last modified	14/09/2016
Address	PF3 Liffords Place, London, SW13		

1. Overall dwelling dimensions

	Area (m ²)	Average storey height (m)	Volume (m ³)
Lowest occupied	<input type="text" value="42.60"/> (1a) x	<input type="text" value="2.50"/> (2a) =	<input type="text" value="106.50"/> (3a)
+1	<input type="text" value="42.60"/> (1b) x	<input type="text" value="3.00"/> (2b) =	<input type="text" value="127.80"/> (3b)
Total floor area	(1a) + (1b) + (1c) + (1d)...(1n) = <input type="text" value="85.20"/> (4)		
Dwelling volume		(3a) + (3b) + (3c) + (3d)...(3n) =	<input type="text" value="234.30"/> (5)

2. Ventilation rate

			m ³ per hour
Number of chimneys	<input type="text" value="0"/>	x 40 =	<input type="text" value="0"/> (6a)
Number of open flues	<input type="text" value="0"/>	x 20 =	<input type="text" value="0"/> (6b)
Number of intermittent fans	<input type="text" value="3"/>	x 10 =	<input type="text" value="30"/> (7a)
Number of passive vents	<input type="text" value="0"/>	x 10 =	<input type="text" value="0"/> (7b)
Number of flueless gas fires	<input type="text" value="0"/>	x 40 =	<input type="text" value="0"/> (7c)
			Air changes per hour
Infiltration due to chimneys, flues, fans, PSVs	(6a) + (6b) + (7a) + (7b) + (7c) = <input type="text" value="30"/>	÷ (5) =	<input type="text" value="0.13"/> (8)
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>			
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			<input type="text" value="5.00"/> (17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)			<input type="text" value="0.38"/> (18)
Number of sides on which the dwelling is sheltered			<input type="text" value="2"/> (19)
Shelter factor		1 - [0.075 x (19)] =	<input type="text" value="0.85"/> (20)
Infiltration rate incorporating shelter factor		(18) x (20) =	<input type="text" value="0.32"/> (21)

Monthly average wind speed from Table U2	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	<input type="text" value="5.10"/>	<input type="text" value="5.00"/>	<input type="text" value="4.90"/>	<input type="text" value="4.40"/>	<input type="text" value="4.30"/>	<input type="text" value="3.80"/>	<input type="text" value="3.80"/>	<input type="text" value="3.70"/>	<input type="text" value="4.00"/>	<input type="text" value="4.30"/>	<input type="text" value="4.50"/>	<input type="text" value="4.70"/> (22)
Wind factor (22)m ÷ 4	<input type="text" value="1.28"/>	<input type="text" value="1.25"/>	<input type="text" value="1.23"/>	<input type="text" value="1.10"/>	<input type="text" value="1.08"/>	<input type="text" value="0.95"/>	<input type="text" value="0.95"/>	<input type="text" value="0.93"/>	<input type="text" value="1.00"/>	<input type="text" value="1.08"/>	<input type="text" value="1.13"/>	<input type="text" value="1.18"/> (22a)
Adjusted infiltration rate (allowing for shelter and wind factor) (21) x (22a)m	<input type="text" value="0.41"/>	<input type="text" value="0.40"/>	<input type="text" value="0.39"/>	<input type="text" value="0.35"/>	<input type="text" value="0.35"/>	<input type="text" value="0.31"/>	<input type="text" value="0.31"/>	<input type="text" value="0.30"/>	<input type="text" value="0.32"/>	<input type="text" value="0.35"/>	<input type="text" value="0.36"/>	<input type="text" value="0.38"/> (22b)

Calculate effective air change rate for the applicable case:

If mechanical ventilation: air change rate through system	<input type="text" value="N/A"/> (23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor from Table 4h	<input type="text" value="N/A"/> (23c)
d) natural ventilation or whole house positive input ventilation from loft	
	<input type="text" value="0.58"/> <input type="text" value="0.58"/> <input type="text" value="0.58"/> <input type="text" value="0.56"/> <input type="text" value="0.56"/> <input type="text" value="0.55"/> <input type="text" value="0.55"/> <input type="text" value="0.54"/> <input type="text" value="0.55"/> <input type="text" value="0.56"/> <input type="text" value="0.57"/> <input type="text" value="0.57"/> (24d)

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

0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.57	0.57	(25)
------	------	------	------	------	------	------	------	------	------	------	------	------

3. Heat losses and heat loss parameter

Element	Gross area, m ²	Openings m ²	Net area A, m ²	U-value W/m ² K	A x U W/K	κ-value, kJ/m ² .K	A x κ, kJ/K	
Door			2.10	1.00	2.10			(26)
Window			14.86	1.33	19.70			(27)
Exposed floor			42.60	0.13	5.54			(28b)
External wall			104.59	0.18	18.83			(29a)
Party wall			43.45	0.00	0.00			(32)
Roof			7.92	0.13	1.03			(30)
Total area of external elements ΣA, m ²			172.07					(31)
Fabric heat loss, W/K = Σ(A × U)						(26)...(30) + (32) =	47.19	(33)
Heat capacity Cm = Σ(A × κ)						(28)...(30) + (32) + (32a)...(32e) =	N/A	(34)
Thermal mass parameter (TMP) in kJ/m ² K							250.00	(35)
Thermal bridges: Σ(L × Ψ) calculated using Appendix K							13.60	(36)
Total fabric heat loss						(33) + (36) =	60.80	(37)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ventilation heat loss calculated monthly 0.33 x (25)m x (5)	45.15	44.90	44.65	43.49	43.27	42.26	42.26	42.08	42.65	43.27	43.71	44.17	(38)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Heat transfer coefficient, W/K (37)m + (38)m	105.94	105.69	105.45	104.29	104.07	103.06	103.06	102.87	103.45	104.07	104.51	104.97		
Average = Σ(39)1...12/12 =													104.28	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Heat loss parameter (HLP), W/m ² K (39)m ÷ (4)	1.24	1.24	1.24	1.22	1.22	1.21	1.21	1.21	1.21	1.22	1.23	1.23		
Average = Σ(40)1...12/12 =													1.22	(40)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Number of days in month (Table 1a)	31.00	28.00	31.00	30.00	31.00	30.00	31.00	31.00	30.00	31.00	30.00	31.00	(40)

4. Water heating energy requirement

Assumed occupancy, N													2.55	(42)
Annual average hot water usage in litres per day Vd,average = (25 × N) + 36													94.86	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)	104.35	100.55	96.76	92.96	89.17	85.38	85.38	89.17	92.96	96.76	100.55	104.35		
Σ(44)1...12 =													1138.34	(44)

Energy content of hot water used = 4.18 × Vd,m × nm × Tm/3600 kWh/month (see Tables 1b, 1c 1d)	154.74	135.34	139.66	121.76	116.83	100.82	93.42	107.20	108.48	126.42	138.00	149.86		
Σ(45)1...12 =													1492.54	(45)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Distribution loss 0.15 x (45)m	23.21	20.30	20.95	18.26	17.52	15.12	14.01	16.08	16.27	18.96	20.70	22.48	(46)

Water storage loss calculated for each month (55) x (41)m	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(56)
---	------	------	------	------	------	------	------	------	------	------	------	------	------

If the vessel contains dedicated solar storage or dedicated WWHRS (56)m x [(47) - Vs] ÷ (47), else (56)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(57)
---	------	------	------	------	------	------	------	------	------	------	------	------	------

Primary circuit loss for each month from Table 3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(59)
--	------	------	------	------	------	------	------	------	------	------	------	------	------

Combi loss for each month from Table 3a, 3b or 3c	50.96	46.03	49.31	45.85	45.44	42.10	43.51	45.44	45.85	49.31	49.32	50.96	(61)
---	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Total heat required for water heating calculated for each month $0.85 \times (45)m + (46)m + (57)m + (59)m + (61)m$

205.70	181.37	188.97	167.60	162.27	142.92	136.93	152.64	154.33	175.73	187.32	200.82	(62)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Solar DHW input calculated using Appendix G or Appendix H

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(63)
------	------	------	------	------	------	------	------	------	------	------	------	------

Output from water heater for each month (kWh/month) (62)m + (63)m

205.70	181.37	188.97	167.60	162.27	142.92	136.93	152.64	154.33	175.73	187.32	200.82	(64)
$\Sigma(64)1...12 =$											2056.59	

Heat gains from water heating (kWh/month) $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

64.19	56.51	58.76	51.95	50.21	44.05	41.94	47.00	47.53	54.36	58.21	62.57	(65)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

5. Internal gains

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

Metabolic gains (Table 5)

127.71	127.71	127.71	127.71	127.71	127.71	127.71	127.71	127.71	127.71	127.71	127.71	127.71	(66)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

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

21.05	18.70	15.20	11.51	8.60	7.26	7.85	10.20	13.69	17.39	20.29	21.63	(67)
-------	-------	-------	-------	------	------	------	-------	-------	-------	-------	-------	------

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

229.96	232.35	226.34	213.54	197.38	182.19	172.04	169.65	175.67	188.47	204.63	219.82	(68)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

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

35.77	35.77	35.77	35.77	35.77	35.77	35.77	35.77	35.77	35.77	35.77	35.77	(69)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Pump and fan gains (Table 5a)

3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	(70)
------	------	------	------	------	------	------	------	------	------	------	------	------

Losses e.g. evaporation (Table 5)

-102.17	-102.17	-102.17	-102.17	-102.17	-102.17	-102.17	-102.17	-102.17	-102.17	-102.17	-102.17	(71)
---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	------

Water heating gains (Table 5)

86.28	84.09	78.98	72.15	67.48	61.18	56.37	63.18	66.02	73.07	80.85	84.10	(72)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

401.61	399.45	384.84	361.51	337.77	314.94	300.57	307.35	319.69	343.24	370.09	389.86	(73)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

6. Solar gains

	Access factor Table 6d	Area m ²	Solar flux W/m ²	g specific data or Table 6b	FF specific data or Table 6c	Gains W
--	---------------------------	------------------------	--------------------------------	-----------------------------------	------------------------------------	------------

SouthEast $0.77 \times 10.02 \times 36.79 \times 0.9 \times 0.63 \times 0.70 = 112.67$ (77)

SouthWest $0.77 \times 4.84 \times 36.79 \times 0.9 \times 0.63 \times 0.70 = 54.42$ (79)

Solar gains in watts $\Sigma(74)m...(82)m$

167.10	284.63	389.44	482.53	540.48	536.57	517.31	474.08	421.68	314.57	200.14	143.00	(83)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Total gains - internal and solar (73)m + (83)m

568.70	684.07	774.28	844.04	878.25	851.51	817.88	781.43	741.37	657.81	570.23	532.86	(84)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

7. Mean internal temperature (heating season)

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

21.00 (85)

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

Utilisation factor for gains for living area n1,m (see Table 9a)

1.00	0.99	0.98	0.95	0.86	0.71	0.54	0.58	0.81	0.96	0.99	1.00	(86)
------	------	------	------	------	------	------	------	------	------	------	------	------

Mean internal temp of living area T1 (steps 3 to 7 in Table 9c)

19.70	19.89	20.16	20.50	20.77	20.94	20.99	20.98	20.88	20.51	20.04	19.66	(87)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

19.89	19.89	19.89	19.90	19.90	19.91	19.91	19.91	19.91	19.90	19.90	19.89	(88)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Utilisation factor for gains for rest of dwelling n2,m

1.00	0.99	0.97	0.93	0.82	0.61	0.41	0.46	0.73	0.94	0.99	1.00	(89)
------	------	------	------	------	------	------	------	------	------	------	------	------

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

18.16	18.45	18.84	19.32	19.68	19.87	19.91	19.91	19.81	19.35	18.67	18.12	(90)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Living area fraction

Living area ÷ (4) = (91)

Mean internal temperature for the whole dwelling fLA x T1 +(1 - fLA) x T2

18.81	19.06	19.40	19.82	20.14	20.32	20.36	20.36	20.26	19.84	19.25	18.77	(92)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

18.81	19.06	19.40	19.82	20.14	20.32	20.36	20.36	20.26	19.84	19.25	18.77	(93)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

8. Space heating requirement

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

Utilisation factor for gains, ηm

0.99	0.99	0.97	0.92	0.83	0.65	0.47	0.51	0.76	0.94	0.99	1.00	(94)
------	------	------	------	------	------	------	------	------	------	------	------	------

Useful gains, ηmGm, W (94)m x (84)m

565.42	674.82	750.27	780.61	726.78	554.90	382.23	398.86	563.65	619.89	563.28	530.56	(95)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Monthly average external temperature from Table U1

4.30	4.90	6.50	8.90	11.70	14.60	16.60	16.40	14.10	10.60	7.10	4.20	(96)
------	------	------	------	-------	-------	-------	-------	-------	-------	------	------	------

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

1537.37	1496.25	1360.41	1138.44	878.76	589.80	387.87	407.42	637.66	961.59	1269.36	1529.46	(97)
---------	---------	---------	---------	--------	--------	--------	--------	--------	--------	---------	---------	------

Space heating requirement, kWh/month 0.024 x [(97)m - (95)m] x (41)m

723.13	552.00	453.94	257.64	113.07	0.00	0.00	0.00	0.00	254.23	508.38	743.19	(98)
--------	--------	--------	--------	--------	------	------	------	------	--------	--------	--------	------

Σ(98)1...5, 10...12 = (98)

Space heating requirement kWh/m²/year

(98) ÷ (4) = (99)

9a. Energy requirements - individual heating systems including micro-CHP

Space heating

Fraction of space heat from secondary/supplementary system (table 11)

(201)

Fraction of space heat from main system(s)

1 - (201) = (202)

Fraction of space heat from main system 2

(202)

Fraction of total space heat from main system 1

(202) x [1 - (203)] = (204)

Fraction of total space heat from main system 2

(202) x (203) = (205)

Efficiency of main system 1 (%)

(206)

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

Space heating fuel (main system 1), kWh/month

774.23	591.01	486.02	275.84	121.06	0.00	0.00	0.00	0.00	272.19	544.30	795.70	(211)
--------	--------	--------	--------	--------	------	------	------	------	--------	--------	--------	-------

Σ(211)1...5, 10...12 = (211)

Water heating

Efficiency of water heater

87.95	87.67	87.18	86.13	84.16	80.30	80.30	80.30	80.30	85.98	87.44	88.04	(217)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

Water heating fuel, kWh/month

233.89	206.87	216.76	194.59	192.81	177.98	170.52	190.09	192.19	204.39	214.23	228.09	(219)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------

Σ(219a)1...12 = (219)

Annual totals

Space heating fuel - main system 1

Water heating fuel

Electricity for pumps, fans and electric keep-hot (Table 4f)

central heating pump or water pump within warm air heating unit

(230c)

boiler flue fan			45.00		(230e)
Total electricity for the above, kWh/year				75.00	(231)
Electricity for lighting (Appendix L)				371.74	(232)
Total delivered energy for all uses			(211)...(221) + (231) + (232)...(237b) =	6729.49	(238)

10a. Fuel costs - individual heating systems including micro-CHP

	Fuel kWh/year		Fuel price		Fuel cost £/year	
Space heating - main system 1	3860.36	x	3.48	x 0.01 =	134.34	(240)
Water heating	2422.40	x	3.48	x 0.01 =	84.30	(247)
Pumps and fans	75.00	x	13.19	x 0.01 =	9.89	(249)
Electricity for lighting	371.74	x	13.19	x 0.01 =	49.03	(250)
Additional standing charges					120.00	(251)
Total energy cost			(240)...(242) + (245)...(254) =		397.56	(255)

11a. SAP rating - individual heating systems including micro-CHP

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)		1.28	(257)
SAP value		82.11	
SAP rating (section 13)		82	(258)
SAP band		B	

12a. CO₂ emissions - individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO ₂ /kWh		Emissions kg CO ₂ /year	
Space heating - main system 1	3860.36	x	0.216	=	833.84	(261)
Water heating	2422.40	x	0.216	=	523.24	(264)
Space and water heating			(261) + (262) + (263) + (264) =		1357.07	(265)
Pumps and fans	75.00	x	0.519	=	38.93	(267)
Electricity for lighting	371.74	x	0.519	=	192.93	(268)
Total CO ₂ , kg/year			(265)...(271) =		1588.93	(272)
Dwelling CO ₂ emission rate			(272) ÷ (4) =		18.65	(273)
EI value					83.65	
EI rating (section 14)					84	(274)
EI band					B	

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

	Energy kWh/year		Primary factor		Primary Energy kWh/year	
Space heating - main system 1	3860.36	x	1.22	=	4709.64	(261)
Water heating	2422.40	x	1.22	=	2955.32	(264)
Space and water heating			(261) + (262) + (263) + (264) =		7664.96	(265)
Pumps and fans	75.00	x	3.07	=	230.25	(267)
Electricity for lighting	371.74	x	3.07	=	1141.23	(268)
Primary energy kWh/year					9036.44	(272)
Dwelling primary energy rate kWh/m ² /year					106.06	(273)

This design submission has been carried out using Approved SAP software. It has been prepared from plans and specifications and may not reflect the property as constructed.

Assessor name	Mr Stuart Searle	Assessor number	3519
Client	Avis Appleton & Associates	Last modified	14/09/2016
Address	PF4 Liffords Place, London, SW13		

1. Overall dwelling dimensions

	Area (m ²)	Average storey height (m)	Volume (m ³)
Lowest occupied	<input type="text" value="102.40"/> (1a)	<input type="text" value="2.50"/> (2a)	<input type="text" value="256.00"/> (3a)
Total floor area	(1a) + (1b) + (1c) + (1d)...(1n) =		<input type="text" value="102.40"/> (4)
Dwelling volume	(3a) + (3b) + (3c) + (3d)...(3n) =		<input type="text" value="256.00"/> (5)

2. Ventilation rate

		m ³ per hour
Number of chimneys	<input type="text" value="0"/> x 40 =	<input type="text" value="0"/> (6a)
Number of open flues	<input type="text" value="0"/> x 20 =	<input type="text" value="0"/> (6b)
Number of intermittent fans	<input type="text" value="4"/> x 10 =	<input type="text" value="40"/> (7a)
Number of passive vents	<input type="text" value="0"/> x 10 =	<input type="text" value="0"/> (7b)
Number of flueless gas fires	<input type="text" value="0"/> x 40 =	<input type="text" value="0"/> (7c)

	Air changes per hour
Infiltration due to chimneys, flues, fans, PSVs	(6a) + (6b) + (7a) + (7b) + (7c) = <input type="text" value="40"/> ÷ (5) = <input type="text" value="0.16"/> (8)

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

Air permeability value, q ₅₀ , expressed in cubic metres per hour per square metre of envelope area	<input type="text" value="5.00"/> (17)
--	--

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)	<input type="text" value="0.41"/> (18)
--	--

Number of sides on which the dwelling is sheltered	<input type="text" value="2"/> (19)
--	-------------------------------------

Shelter factor	1 - [0.075 x (19)] = <input type="text" value="0.85"/> (20)
----------------	---

Infiltration rate incorporating shelter factor	(18) x (20) = <input type="text" value="0.35"/> (21)
--	--

Infiltration rate modified for monthly wind speed:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table U2	<input type="text" value="5.10"/>	<input type="text" value="5.00"/>	<input type="text" value="4.90"/>	<input type="text" value="4.40"/>	<input type="text" value="4.30"/>	<input type="text" value="3.80"/>	<input type="text" value="3.80"/>	<input type="text" value="3.70"/>	<input type="text" value="4.00"/>	<input type="text" value="4.30"/>	<input type="text" value="4.50"/>	<input type="text" value="4.70"/>
Wind factor (22)m ÷ 4	<input type="text" value="1.28"/>	<input type="text" value="1.25"/>	<input type="text" value="1.23"/>	<input type="text" value="1.10"/>	<input type="text" value="1.08"/>	<input type="text" value="0.95"/>	<input type="text" value="0.95"/>	<input type="text" value="0.93"/>	<input type="text" value="1.00"/>	<input type="text" value="1.08"/>	<input type="text" value="1.13"/>	<input type="text" value="1.18"/>

Adjusted infiltration rate (allowing for shelter and wind factor) (21) x (22a)m	<input type="text" value="0.44"/>	<input type="text" value="0.43"/>	<input type="text" value="0.42"/>	<input type="text" value="0.38"/>	<input type="text" value="0.37"/>	<input type="text" value="0.33"/>	<input type="text" value="0.33"/>	<input type="text" value="0.32"/>	<input type="text" value="0.35"/>	<input type="text" value="0.37"/>	<input type="text" value="0.39"/>	<input type="text" value="0.41"/>
---	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------

Calculate effective air change rate for the applicable case:	
--	--

If mechanical ventilation: air change rate through system	<input type="text" value="N/A"/> (23a)
---	--

If balanced with heat recovery: efficiency in % allowing for in-use factor from Table 4h	<input type="text" value="N/A"/> (23c)
--	--

d) natural ventilation or whole house positive input ventilation from loft	<input type="text" value="0.60"/>	<input type="text" value="0.59"/>	<input type="text" value="0.59"/>	<input type="text" value="0.57"/>	<input type="text" value="0.57"/>	<input type="text" value="0.55"/>	<input type="text" value="0.55"/>	<input type="text" value="0.55"/>	<input type="text" value="0.56"/>	<input type="text" value="0.57"/>	<input type="text" value="0.58"/>	<input type="text" value="0.58"/>
--	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in (25)	<input type="text" value="0.60"/>	<input type="text" value="0.59"/>	<input type="text" value="0.59"/>	<input type="text" value="0.57"/>	<input type="text" value="0.57"/>	<input type="text" value="0.55"/>	<input type="text" value="0.55"/>	<input type="text" value="0.55"/>	<input type="text" value="0.56"/>	<input type="text" value="0.57"/>	<input type="text" value="0.58"/>	<input type="text" value="0.58"/>
--	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------

3. Heat losses and heat loss parameter

Element	Gross area, m ²	Openings m ²	Net area A, m ²	U-value W/m ² K	A x U W/K	κ-value, kJ/m ² .K	A x κ, kJ/K					
Door			2.10	1.00	2.10		(26)					
Window			18.32	1.33	24.29		(27)					
Exposed floor			102.40	0.13	13.31		(28b)					
External wall			89.58	0.18	16.12		(29a)					
Total area of external elements ΣA, m ²			212.40				(31)					
Fabric heat loss, W/K = Σ(A x U)					(26)...(30) + (32) =	55.82	(33)					
Heat capacity Cm = Σ(A x κ)					(28)...(30) + (32) + (32a)...(32e) =	N/A	(34)					
Thermal mass parameter (TMP) in kJ/m ² K						250.00	(35)					
Thermal bridges: Σ(L x Ψ) calculated using Appendix K						15.62	(36)					
Total fabric heat loss						(33) + (36) =	71.44 (37)					
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ventilation heat loss calculated monthly 0.33 x (25)m x (5)	50.43	50.11	49.80	48.33	48.06	46.79	46.79	46.55	47.28	48.06	48.61	49.19
Heat transfer coefficient, W/K (37)m + (38)m	121.87	121.55	121.24	119.78	119.50	118.23	118.23	117.99	118.72	119.50	120.06	120.64
	Average = Σ(39)1...12/12 =											119.77 (39)
Heat loss parameter (HLP), W/m ² K (39)m ÷ (4)	1.19	1.19	1.18	1.17	1.17	1.15	1.15	1.15	1.16	1.17	1.17	1.18
	Average = Σ(40)1...12/12 =											1.17 (40)
Number of days in month (Table 1a)	31.00	28.00	31.00	30.00	31.00	30.00	31.00	31.00	30.00	31.00	30.00	31.00

4. Water heating energy requirement

Assumed occupancy, N												2.76	(42)
Annual average hot water usage in litres per day Vd,average = (25 x N) + 36												99.77	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)	109.74	105.75	101.76	97.77	93.78	89.79	89.79	93.78	97.77	101.76	105.75	109.74	
	Σ(44)1...12 =											1197.19	(44)
Energy content of hot water used = 4.18 x Vd,m x nm x Tm/3600 kWh/month (see Tables 1b, 1c 1d)	162.74	142.34	146.88	128.05	122.87	106.03	98.25	112.74	114.09	132.96	145.14	157.61	
	Σ(45)1...12 =											1569.70	(45)
Distribution loss 0.15 x (45)m	24.41	21.35	22.03	19.21	18.43	15.90	14.74	16.91	17.11	19.94	21.77	23.64	
Water storage loss calculated for each month (55) x (41)m	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
If the vessel contains dedicated solar storage or dedicated WWHRS (56)m x [(47) - Vs] ÷ (47), else (56)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Primary circuit loss for each month from Table 3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Combi loss for each month from Table 3a, 3b or 3c	50.96	46.03	50.96	48.22	47.79	44.28	45.76	47.79	48.22	50.96	49.32	50.96	
Total heat required for water heating calculated for each month 0.85 x (45)m + (46)m + (57)m + (59)m + (61)m	213.70	188.36	197.84	176.27	170.66	150.31	144.01	160.53	162.31	183.92	194.45	208.57	
Solar DHW input calculated using Appendix G or Appendix H													

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(63)
------	------	------	------	------	------	------	------	------	------	------	------	------	------

Output from water heater for each month (kWh/month) (62)m + (63)m

213.70	188.36	197.84	176.27	170.66	150.31	144.01	160.53	162.31	183.92	194.45	208.57	$\Sigma(64)1...12 =$	2150.93	(64)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	----------------------	---------	------

Heat gains from water heating (kWh/month) $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

66.85	58.83	61.58	54.63	52.80	46.32	44.11	49.43	49.99	56.95	60.59	65.14	(65)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

5. Internal gains

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

Metabolic gains (Table 5)

138.03	138.03	138.03	138.03	138.03	138.03	138.03	138.03	138.03	138.03	138.03	138.03	(66)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

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

23.71	21.06	17.13	12.97	9.69	8.18	8.84	11.49	15.43	19.59	22.86	24.37	(67)
-------	-------	-------	-------	------	------	------	-------	-------	-------	-------	-------	------

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

260.15	262.85	256.05	241.56	223.28	206.10	194.62	191.92	198.73	213.21	231.49	248.67	(68)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

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

36.80	36.80	36.80	36.80	36.80	36.80	36.80	36.80	36.80	36.80	36.80	36.80	(69)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Pump and fan gains (Table 5a)

3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	(70)
------	------	------	------	------	------	------	------	------	------	------	------	------

Losses e.g. evaporation (Table 5)

-110.43	-110.43	-110.43	-110.43	-110.43	-110.43	-110.43	-110.43	-110.43	-110.43	-110.43	-110.43	(71)
---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	------

Water heating gains (Table 5)

89.86	87.55	82.76	75.88	70.97	64.34	59.28	66.44	69.43	76.54	84.15	87.56	(72)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

441.13	438.87	423.35	397.82	371.36	346.03	330.16	337.27	350.99	376.75	405.91	428.01	(73)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

6. Solar gains

	Access factor Table 6d	Area m ²	Solar flux W/m ²	g specific data or Table 6b	FF specific data or Table 6c	Gains W
--	---------------------------	------------------------	--------------------------------	-----------------------------------	------------------------------------	------------

NorthWest $0.77 \times 8.64 \times 11.28 \times 0.9 \times 0.63 \times 0.70 = 29.79$ (81)

SouthEast $0.77 \times 9.68 \times 36.79 \times 0.9 \times 0.63 \times 0.70 = 108.85$ (77)

Solar gains in watts $\Sigma(74)m...(82)m$

138.64	246.05	362.95	493.77	593.27	606.67	577.53	500.59	407.82	279.03	167.86	117.48	(83)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Total gains - internal and solar (73)m + (83)m

579.77	684.92	786.29	891.58	964.63	952.70	907.69	837.86	758.81	655.78	573.77	545.49	(84)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

7. Mean internal temperature (heating season)

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

21.00 (85)

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

Utilisation factor for gains for living area n1,m (see Table 9a)

1.00	1.00	0.99	0.96	0.89	0.73	0.56	0.62	0.86	0.98	1.00	1.00	(86)
------	------	------	------	------	------	------	------	------	------	------	------	------

Mean internal temp of living area T1 (steps 3 to 7 in Table 9c)

19.67	19.84	20.11	20.46	20.76	20.94	20.99	20.98	20.85	20.45	20.00	19.65	(87)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

19.93	19.93	19.93	19.94	19.95	19.96	19.96	19.96	19.95	19.95	19.94	19.94	(88)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Utilisation factor for gains for rest of dwelling n2,m

1.00	0.99	0.99	0.95	0.84	0.63	0.43	0.49	0.79	0.97	1.00	1.00	(89)
------	------	------	------	------	------	------	------	------	------	------	------	------

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

18.16	18.40	18.79	19.31	19.71	19.92	19.95	19.95	19.83	19.30	18.64	18.13	(90)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Living area fraction

Living area ÷ (4) = (91)

Mean internal temperature for the whole dwelling $FLA \times T1 + (1 - fLA) \times T2$

18.77	18.99	19.33	19.78	20.14	20.33	20.37	20.37	20.24	19.77	19.19	18.75	(92)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

18.77	18.99	19.33	19.78	20.14	20.33	20.37	20.37	20.24	19.77	19.19	18.75	(93)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

8. Space heating requirement

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

Utilisation factor for gains, η_m

1.00	0.99	0.98	0.95	0.85	0.67	0.48	0.55	0.82	0.97	0.99	1.00	(94)
------	------	------	------	------	------	------	------	------	------	------	------	------

Useful gains, $\eta_m G_m$, W (94)m x (84)m

578.08	680.29	772.39	843.63	820.35	636.92	439.45	456.66	619.38	634.21	570.25	544.31	(95)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Monthly average external temperature from Table U1

4.30	4.90	6.50	8.90	11.70	14.60	16.60	16.40	14.10	10.60	7.10	4.20	(96)
------	------	------	------	-------	-------	-------	-------	-------	-------	------	------	------

Heat loss rate for mean internal temperature, L_m , W [(39)m x ((93)m - (96)m)]

1764.04	1712.12	1555.09	1302.58	1008.66	677.69	445.99	468.13	729.39	1095.70	1451.93	1754.71	(97)
---------	---------	---------	---------	---------	--------	--------	--------	--------	---------	---------	---------	------

Space heating requirement, kWh/month $0.024 \times ((97)m - (95)m) \times (41)m$

882.35	693.39	582.33	330.45	140.10	0.00	0.00	0.00	0.00	343.35	634.81	900.54	(98)
--------	--------	--------	--------	--------	------	------	------	------	--------	--------	--------	------

$\Sigma(98)_{1...5, 10...12} =$ (98)

Space heating requirement kWh/m²/year

$(98) \div (4) =$ (99)

9a. Energy requirements - individual heating systems including micro-CHP

Space heating

Fraction of space heat from secondary/supplementary system (table 11)

(201)

Fraction of space heat from main system(s)

$1 - (201) =$ (202)

Fraction of space heat from main system 2

(202)

Fraction of total space heat from main system 1

$(202) \times [1 - (203)] =$ (204)

Fraction of total space heat from main system 2

$(202) \times (203) =$ (205)

Efficiency of main system 1 (%)

(206)

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

Space heating fuel (main system 1), kWh/month

944.70	742.39	623.48	353.80	150.00	0.00	0.00	0.00	0.00	367.61	679.67	964.17	(211)
--------	--------	--------	--------	--------	------	------	------	------	--------	--------	--------	-------

$\Sigma(211)_{1...5, 10...12} =$ (211)

Water heating

Efficiency of water heater

88.24	88.03	87.61	86.61	84.56	80.30	80.30	80.30	80.30	86.60	87.81	88.31	(217)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

Water heating fuel, kWh/month

242.19	213.97	225.83	203.52	201.82	187.18	179.33	199.92	202.12	212.38	221.45	236.17	(219)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------

$\Sigma(219a)_{1...12} =$ (219)

Annual totals

Space heating fuel - main system 1

Water heating fuel

Electricity for pumps, fans and electric keep-hot (Table 4f)

central heating pump or water pump within warm air heating unit

(230c)

boiler flue fan

(230e)

Total electricity for the above, kWh/year

(231)

Electricity for lighting (Appendix L)

(232)

10a. Fuel costs - individual heating systems including micro-CHP

	Fuel kWh/year		Fuel price		Fuel cost £/year	
Space heating - main system 1	4825.83	x	3.48	x 0.01 =	167.94	(240)
Water heating	2525.88	x	3.48	x 0.01 =	87.90	(247)
Pumps and fans	75.00	x	13.19	x 0.01 =	9.89	(249)
Electricity for lighting	418.75	x	13.19	x 0.01 =	55.23	(250)
Additional standing charges					120.00	(251)
Total energy cost				(240)...(242) + (245)...(254) =	440.96	(255)

11a. SAP rating - individual heating systems including micro-CHP

Energy cost deflator (Table 12)	0.42	(256)
Energy cost factor (ECF)	1.26	(257)
SAP value	82.47	
SAP rating (section 13)	82	(258)
SAP band	B	

12a. CO₂ emissions - individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO ₂ /kWh		Emissions kg CO ₂ /year	
Space heating - main system 1	4825.83	x	0.216	=	1042.38	(261)
Water heating	2525.88	x	0.216	=	545.59	(264)
Space and water heating				(261) + (262) + (263) + (264) =	1587.97	(265)
Pumps and fans	75.00	x	0.519	=	38.93	(267)
Electricity for lighting	418.75	x	0.519	=	217.33	(268)
Total CO ₂ , kg/year				(265)...(271) =	1844.22	(272)
Dwelling CO ₂ emission rate				(272) ÷ (4) =	18.01	(273)
EI value					83.23	
EI rating (section 14)					83	(274)
EI band					B	

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

	Energy kWh/year		Primary factor		Primary Energy kWh/year	
Space heating - main system 1	4825.83	x	1.22	=	5887.51	(261)
Water heating	2525.88	x	1.22	=	3081.58	(264)
Space and water heating				(261) + (262) + (263) + (264) =	8969.09	(265)
Pumps and fans	75.00	x	3.07	=	230.25	(267)
Electricity for lighting	418.75	x	3.07	=	1285.55	(268)
Primary energy kWh/year					10484.89	(272)
Dwelling primary energy rate kWh/m ² /year					102.39	(273)

This design submission has been carried out using Approved SAP software. It has been prepared from plans and specifications and may not reflect the property as constructed.

Assessor name	Mr Stuart Searle	Assessor number	3519
Client	Avis Appleton & Associates	Last modified	14/09/2016
Address	PF5 Liffords Place, London, SW13		

1. Overall dwelling dimensions

	Area (m ²)	Average storey height (m)	Volume (m ³)
Lowest occupied	<input type="text" value="79.10"/> (1a)	<input type="text" value="2.50"/> (2a)	<input type="text" value="197.75"/> (3a)
Total floor area	(1a) + (1b) + (1c) + (1d)...(1n) =		<input type="text" value="79.10"/> (4)
Dwelling volume	(3a) + (3b) + (3c) + (3d)...(3n) =		<input type="text" value="197.75"/> (5)

2. Ventilation rate

		m ³ per hour
Number of chimneys	<input type="text" value="0"/> x 40 =	<input type="text" value="0"/> (6a)
Number of open flues	<input type="text" value="0"/> x 20 =	<input type="text" value="0"/> (6b)
Number of intermittent fans	<input type="text" value="3"/> x 10 =	<input type="text" value="30"/> (7a)
Number of passive vents	<input type="text" value="0"/> x 10 =	<input type="text" value="0"/> (7b)
Number of flueless gas fires	<input type="text" value="0"/> x 40 =	<input type="text" value="0"/> (7c)

	Air changes per hour
Infiltration due to chimneys, flues, fans, PSVs	(6a) + (6b) + (7a) + (7b) + (7c) = <input type="text" value="30"/> ÷ (5) = <input type="text" value="0.15"/> (8)

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

Air permeability value, q ₅₀ , expressed in cubic metres per hour per square metre of envelope area	<input type="text" value="5.00"/> (17)
--	--

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)	<input type="text" value="0.40"/> (18)
--	--

Number of sides on which the dwelling is sheltered	<input type="text" value="2"/> (19)
--	-------------------------------------

Shelter factor	1 - [0.075 x (19)] = <input type="text" value="0.85"/> (20)
----------------	---

Infiltration rate incorporating shelter factor	(18) x (20) = <input type="text" value="0.34"/> (21)
--	--

Infiltration rate modified for monthly wind speed:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table U2	<input type="text" value="5.10"/>	<input type="text" value="5.00"/>	<input type="text" value="4.90"/>	<input type="text" value="4.40"/>	<input type="text" value="4.30"/>	<input type="text" value="3.80"/>	<input type="text" value="3.80"/>	<input type="text" value="3.70"/>	<input type="text" value="4.00"/>	<input type="text" value="4.30"/>	<input type="text" value="4.50"/>	<input type="text" value="4.70"/> (22)

Wind factor (22)m ÷ 4	<input type="text" value="1.28"/>	<input type="text" value="1.25"/>	<input type="text" value="1.23"/>	<input type="text" value="1.10"/>	<input type="text" value="1.08"/>	<input type="text" value="0.95"/>	<input type="text" value="0.95"/>	<input type="text" value="0.93"/>	<input type="text" value="1.00"/>	<input type="text" value="1.08"/>	<input type="text" value="1.13"/>	<input type="text" value="1.18"/> (22a)
-----------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	---

Adjusted infiltration rate (allowing for shelter and wind factor) (21) x (22a)m	<input type="text" value="0.44"/>	<input type="text" value="0.43"/>	<input type="text" value="0.42"/>	<input type="text" value="0.38"/>	<input type="text" value="0.37"/>	<input type="text" value="0.32"/>	<input type="text" value="0.32"/>	<input type="text" value="0.32"/>	<input type="text" value="0.34"/>	<input type="text" value="0.37"/>	<input type="text" value="0.38"/>	<input type="text" value="0.40"/> (22b)
---	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	---

Calculate effective air change rate for the applicable case:

If mechanical ventilation: air change rate through system	<input type="text" value="N/A"/> (23a)
---	--

If balanced with heat recovery: efficiency in % allowing for in-use factor from Table 4h	<input type="text" value="N/A"/> (23c)
--	--

d) natural ventilation or whole house positive input ventilation from loft	<input type="text" value="0.59"/>	<input type="text" value="0.59"/>	<input type="text" value="0.59"/>	<input type="text" value="0.57"/>	<input type="text" value="0.57"/>	<input type="text" value="0.55"/>	<input type="text" value="0.55"/>	<input type="text" value="0.55"/>	<input type="text" value="0.56"/>	<input type="text" value="0.57"/>	<input type="text" value="0.57"/>	<input type="text" value="0.58"/> (24d)
--	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	---

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in (25)	<input type="text" value="0.59"/>	<input type="text" value="0.59"/>	<input type="text" value="0.59"/>	<input type="text" value="0.57"/>	<input type="text" value="0.57"/>	<input type="text" value="0.55"/>	<input type="text" value="0.55"/>	<input type="text" value="0.55"/>	<input type="text" value="0.56"/>	<input type="text" value="0.57"/>	<input type="text" value="0.57"/>	<input type="text" value="0.58"/> (25)
--	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	--

3. Heat losses and heat loss parameter

Element	Gross area, m ²	Openings m ²	Net area A, m ²	U-value W/m ² K	A x U W/K	κ-value, kJ/m ² .K	A x κ, kJ/K					
Door			2.10	1.00	2.10		(26)					
Window			12.10	1.33	16.04		(27)					
Exposed floor			79.10	0.13	10.28		(28b)					
External wall			88.80	0.18	15.98		(29a)					
Total area of external elements ΣA, m ²			182.10				(31)					
Fabric heat loss, W/K = Σ(A x U)					(26)...(30) + (32) =	44.41	(33)					
Heat capacity Cm = Σ(A x κ)					(28)...(30) + (32) + (32a)...(32e) =	N/A	(34)					
Thermal mass parameter (TMP) in kJ/m ² K						250.00	(35)					
Thermal bridges: Σ(L x Ψ) calculated using Appendix K						16.60	(36)					
Total fabric heat loss						(33) + (36) =	61.01 (37)					
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ventilation heat loss calculated monthly 0.33 x (25)m x (5)	38.81	38.57	38.34	37.23	37.02	36.06	36.06	35.88	36.43	37.02	37.44	37.88
Heat transfer coefficient, W/K (37)m + (38)m	99.82	99.58	99.34	98.24	98.03	97.07	97.07	96.89	97.44	98.03	98.45	98.89
										Average = Σ(39)1...12/12 =	98.24	(39)
Heat loss parameter (HLP), W/m ² K (39)m ÷ (4)	1.26	1.26	1.26	1.24	1.24	1.23	1.23	1.22	1.23	1.24	1.24	1.25
										Average = Σ(40)1...12/12 =	1.24	(40)
Number of days in month (Table 1a)	31.00	28.00	31.00	30.00	31.00	30.00	31.00	31.00	30.00	31.00	30.00	31.00

4. Water heating energy requirement

Assumed occupancy, N												2.45	(42)	
Annual average hot water usage in litres per day Vd,average = (25 x N) + 36													92.28	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)	101.51	97.82	94.13	90.44	86.75	83.05	83.05	86.75	90.44	94.13	97.82	101.51		
													Σ(44)1...12 =	1107.39 (44)
Energy content of hot water used = 4.18 x Vd,m x nm x Tm/3600 kWh/month (see Tables 1b, 1c 1d)	150.54	131.66	135.86	118.45	113.65	98.07	90.88	104.29	105.53	122.99	134.25	145.79		
													Σ(45)1...12 =	1451.96 (45)
Distribution loss 0.15 x (45)m	22.58	19.75	20.38	17.77	17.05	14.71	13.63	15.64	15.83	18.45	20.14	21.87		
Water storage loss calculated for each month (55) x (41)m	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
If the vessel contains dedicated solar storage or dedicated WWHRS (56)m x [(47) - Vs] ÷ (47), else (56)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
Primary circuit loss for each month from Table 3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
Combi loss for each month from Table 3a, 3b or 3c	50.96	45.02	47.97	44.60	44.20	40.96	42.32	44.20	44.60	47.97	48.24	50.96		
Total heat required for water heating calculated for each month 0.85 x (45)m + (46)m + (57)m + (59)m + (61)m	201.50	176.68	183.83	163.05	157.86	139.03	133.20	148.49	150.13	170.95	182.49	196.75		
Solar DHW input calculated using Appendix G or Appendix H														

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(63)
------	------	------	------	------	------	------	------	------	------	------	------	------	------

Output from water heater for each month (kWh/month) (62)m + (63)m

201.50	176.68	183.83	163.05	157.86	139.03	133.20	148.49	150.13	170.95	182.49	196.75	$\Sigma(64)1...12 =$	2003.96	(64)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	----------------------	---------	------

Heat gains from water heating (kWh/month) $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

62.79	55.03	57.17	50.53	48.84	42.85	40.80	45.73	46.24	52.88	56.70	61.21	(65)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

5. Internal gains

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

Metabolic gains (Table 5)

122.28	122.28	122.28	122.28	122.28	122.28	122.28	122.28	122.28	122.28	122.28	122.28	(66)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

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

20.42	18.14	14.75	11.17	8.35	7.05	7.61	9.90	13.28	16.87	19.69	20.99	(67)
-------	-------	-------	-------	------	------	------	------	-------	-------	-------	-------	------

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

217.55	219.81	214.12	202.01	186.72	172.35	162.75	160.50	166.18	178.29	193.58	207.95	(68)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

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

35.23	35.23	35.23	35.23	35.23	35.23	35.23	35.23	35.23	35.23	35.23	35.23	(69)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Pump and fan gains (Table 5a)

3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	(70)
------	------	------	------	------	------	------	------	------	------	------	------	------

Losses e.g. evaporation (Table 5)

-97.82	-97.82	-97.82	-97.82	-97.82	-97.82	-97.82	-97.82	-97.82	-97.82	-97.82	-97.82	(71)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Water heating gains (Table 5)

84.40	81.89	76.84	70.19	65.65	59.51	54.84	61.46	64.22	71.08	78.75	82.28	(72)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

385.05	382.52	368.39	346.04	323.40	301.59	287.89	294.54	306.37	328.93	354.70	373.90	(73)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

6. Solar gains

	Access factor Table 6d	Area m ²	Solar flux W/m ²	g specific data or Table 6b	FF specific data or Table 6c	Gains W	
SouthWest	0.77	4.84	36.79	0.9 x 0.63	0.70	54.42	(79)
NorthWest	0.77	4.84	11.28	0.9 x 0.63	0.70	16.69	(81)
SouthEast	0.77	2.42	36.79	0.9 x 0.63	0.70	27.21	(77)

Solar gains in watts $\Sigma(74)m...(82)m$

98.33	173.03	251.47	336.26	399.17	406.19	387.49	339.04	280.60	195.20	118.78	83.49	(83)
-------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	------

Total gains - internal and solar (73)m + (83)m

483.38	555.55	619.86	682.31	722.57	707.79	675.38	633.58	586.97	524.13	473.48	457.39	(84)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

7. Mean internal temperature (heating season)

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

21.00 (85)

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

Utilisation factor for gains for living area n1,m (see Table 9a)

1.00	1.00	0.99	0.97	0.91	0.77	0.60	0.66	0.88	0.98	1.00	1.00	(86)
------	------	------	------	------	------	------	------	------	------	------	------	------

Mean internal temp of living area T1 (steps 3 to 7 in Table 9c)

19.62	19.78	20.04	20.38	20.70	20.91	20.98	20.97	20.82	20.41	19.95	19.60	(87)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

19.87	19.87	19.88	19.89	19.89	19.90	19.90	19.90	19.89	19.89	19.88	19.88	(88)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Utilisation factor for gains for rest of dwelling n2,m

1.00	0.99	0.98	0.95	0.87	0.68	0.47	0.52	0.81	0.97	0.99	1.00	(89)
------	------	------	------	------	------	------	------	------	------	------	------	------

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

18.04	18.27	18.65	19.15	19.59	19.84	19.89	19.89	19.74	19.20	18.54	18.01	(90)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Living area fraction

Living area ÷ (4) = (91)

Mean internal temperature for the whole dwelling fLA x T1 +(1 - fLA) x T2

18.73	18.93	19.25	19.69	20.07	20.30	20.36	20.36	20.21	19.73	19.15	18.70	(92)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

18.73	18.93	19.25	19.69	20.07	20.30	20.36	20.36	20.21	19.73	19.15	18.70	(93)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

8. Space heating requirement

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

Utilisation factor for gains, ηm

1.00	0.99	0.98	0.95	0.87	0.71	0.53	0.58	0.83	0.97	0.99	1.00	(94)
------	------	------	------	------	------	------	------	------	------	------	------	------

Useful gains, ηmGm, W (94)m x (84)m

481.41	551.04	608.56	649.38	631.36	504.41	356.20	368.91	488.45	506.03	469.74	455.94	(95)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Monthly average external temperature from Table U1

4.30	4.90	6.50	8.90	11.70	14.60	16.60	16.40	14.10	10.60	7.10	4.20	(96)
------	------	------	------	-------	-------	-------	-------	-------	-------	------	------	------

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

1440.56	1396.96	1267.09	1060.03	820.70	553.71	365.41	383.44	595.38	894.64	1186.79	1434.09	(97)
---------	---------	---------	---------	--------	--------	--------	--------	--------	--------	---------	---------	------

Space heating requirement, kWh/month 0.024 x [(97)m - (95)m] x (41)m

713.61	568.46	489.95	295.67	140.87	0.00	0.00	0.00	0.00	289.12	516.27	727.74	(98)
--------	--------	--------	--------	--------	------	------	------	------	--------	--------	--------	------

Σ(98)1...5, 10...12 = (98)

Space heating requirement kWh/m²/year

(98) ÷ (4) = (99)

9a. Energy requirements - individual heating systems including micro-CHP

Space heating

Fraction of space heat from secondary/supplementary system (table 11)

(201)

Fraction of space heat from main system(s)

1 - (201) = (202)

Fraction of space heat from main system 2

(202)

Fraction of total space heat from main system 1

(202) x [1 - (203)] = (204)

Fraction of total space heat from main system 2

(202) x (203) = (205)

Efficiency of main system 1 (%)

(206)

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

Space heating fuel (main system 1), kWh/month

764.03	608.63	524.57	316.56	150.82	0.00	0.00	0.00	0.00	309.55	552.76	779.16	(211)
--------	--------	--------	--------	--------	------	------	------	------	--------	--------	--------	-------

Σ(211)1...5, 10...12 = (211)

Water heating

Efficiency of water heater

87.96	87.78	87.40	86.53	84.77	80.30	80.30	80.30	80.30	86.36	87.52	88.04	(217)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

Water heating fuel, kWh/month

229.07	201.28	210.33	188.42	186.23	173.14	165.88	184.92	186.96	197.95	208.50	223.46	(219)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------

Σ(219a)1...12 = (219)

Annual totals

Space heating fuel - main system 1

Water heating fuel

Electricity for pumps, fans and electric keep-hot (Table 4f)

central heating pump or water pump within warm air heating unit

(230c)

boiler flue fan

(230e)

Total electricity for the above, kWh/year

(231)

Electricity for lighting (Appendix L)					360.60	(232)
Total delivered energy for all uses				(211)...(221) + (231) + (232)...(237b) =	6797.83	(238)

10a. Fuel costs - individual heating systems including micro-CHP

	Fuel kWh/year		Fuel price		Fuel cost £/year	
Space heating - main system 1	4006.09	x	3.48	x 0.01 =	139.41	(240)
Water heating	2356.14	x	3.48	x 0.01 =	81.99	(247)
Pumps and fans	75.00	x	13.19	x 0.01 =	9.89	(249)
Electricity for lighting	360.60	x	13.19	x 0.01 =	47.56	(250)
Additional standing charges					120.00	(251)
Total energy cost				(240)...(242) + (245)...(254) =	398.86	(255)

11a. SAP rating - individual heating systems including micro-CHP

Energy cost deflator (Table 12)	0.42	(256)
Energy cost factor (ECF)	1.35	(257)
SAP value	81.17	
SAP rating (section 13)	81	(258)
SAP band	B	

12a. CO₂ emissions - individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO ₂ /kWh		Emissions kg CO ₂ /year	
Space heating - main system 1	4006.09	x	0.216	=	865.31	(261)
Water heating	2356.14	x	0.216	=	508.93	(264)
Space and water heating				(261) + (262) + (263) + (264) =	1374.24	(265)
Pumps and fans	75.00	x	0.519	=	38.93	(267)
Electricity for lighting	360.60	x	0.519	=	187.15	(268)
Total CO ₂ , kg/year				(265)...(271) =	1600.32	(272)
Dwelling CO ₂ emission rate				(272) ÷ (4) =	20.23	(273)
EI value					82.72	
EI rating (section 14)					83	(274)
EI band					B	

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

	Energy kWh/year		Primary factor		Primary Energy kWh/year	
Space heating - main system 1	4006.09	x	1.22	=	4887.43	(261)
Water heating	2356.14	x	1.22	=	2874.49	(264)
Space and water heating				(261) + (262) + (263) + (264) =	7761.92	(265)
Pumps and fans	75.00	x	3.07	=	230.25	(267)
Electricity for lighting	360.60	x	3.07	=	1107.04	(268)
Primary energy kWh/year					9099.20	(272)
Dwelling primary energy rate kWh/m ² /year					115.03	(273)

This design submission has been carried out using Approved SAP software. It has been prepared from plans and specifications and may not reflect the property as constructed.

Assessor name	Mr Stuart Searle	Assessor number	3519
Client	Avis Appleton & Associates	Last modified	14/09/2016
Address	PS1 Liffords Place, London, SW13		

1. Overall dwelling dimensions

	Area (m ²)	Average storey height (m)	Volume (m ³)
Lowest occupied	<input type="text" value="68.90"/> (1a) x	<input type="text" value="2.50"/> (2a) =	<input type="text" value="172.25"/> (3a)
Total floor area	(1a) + (1b) + (1c) + (1d)...(1n) = <input type="text" value="68.90"/> (4)		
Dwelling volume	(3a) + (3b) + (3c) + (3d)...(3n) = <input type="text" value="172.25"/> (5)		

2. Ventilation rate

		m ³ per hour
Number of chimneys	<input type="text" value="0"/> x 40 =	<input type="text" value="0"/> (6a)
Number of open flues	<input type="text" value="0"/> x 20 =	<input type="text" value="0"/> (6b)
Number of intermittent fans	<input type="text" value="2"/> x 10 =	<input type="text" value="20"/> (7a)
Number of passive vents	<input type="text" value="0"/> x 10 =	<input type="text" value="0"/> (7b)
Number of flueless gas fires	<input type="text" value="0"/> x 40 =	<input type="text" value="0"/> (7c)

	Air changes per hour
Infiltration due to chimneys, flues, fans, PSVs	(6a) + (6b) + (7a) + (7b) + (7c) = <input type="text" value="20"/> ÷ (5) = <input type="text" value="0.12"/> (8)

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

Air permeability value, q ₅₀ , expressed in cubic metres per hour per square metre of envelope area	<input type="text" value="5.00"/> (17)
--	--

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)	<input type="text" value="0.37"/> (18)
--	--

Number of sides on which the dwelling is sheltered	<input type="text" value="2"/> (19)
--	-------------------------------------

Shelter factor	1 - [0.075 x (19)] = <input type="text" value="0.85"/> (20)
----------------	---

Infiltration rate incorporating shelter factor	(18) x (20) = <input type="text" value="0.31"/> (21)
--	--

Infiltration rate modified for monthly wind speed:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table U2	<input type="text" value="5.10"/>	<input type="text" value="5.00"/>	<input type="text" value="4.90"/>	<input type="text" value="4.40"/>	<input type="text" value="4.30"/>	<input type="text" value="3.80"/>	<input type="text" value="3.80"/>	<input type="text" value="3.70"/>	<input type="text" value="4.00"/>	<input type="text" value="4.30"/>	<input type="text" value="4.50"/>	<input type="text" value="4.70"/>
Wind factor (22)m ÷ 4	<input type="text" value="1.28"/>	<input type="text" value="1.25"/>	<input type="text" value="1.23"/>	<input type="text" value="1.10"/>	<input type="text" value="1.08"/>	<input type="text" value="0.95"/>	<input type="text" value="0.95"/>	<input type="text" value="0.93"/>	<input type="text" value="1.00"/>	<input type="text" value="1.08"/>	<input type="text" value="1.13"/>	<input type="text" value="1.18"/>

Adjusted infiltration rate (allowing for shelter and wind factor) (21) x (22a)m	<input type="text" value="0.40"/>	<input type="text" value="0.39"/>	<input type="text" value="0.38"/>	<input type="text" value="0.34"/>	<input type="text" value="0.33"/>	<input type="text" value="0.30"/>	<input type="text" value="0.30"/>	<input type="text" value="0.29"/>	<input type="text" value="0.31"/>	<input type="text" value="0.33"/>	<input type="text" value="0.35"/>	<input type="text" value="0.37"/>
---	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------

Calculate effective air change rate for the applicable case:	
--	--

If mechanical ventilation: air change rate through system	<input type="text" value="N/A"/> (23a)
---	--

If balanced with heat recovery: efficiency in % allowing for in-use factor from Table 4h	<input type="text" value="N/A"/> (23c)
--	--

d) natural ventilation or whole house positive input ventilation from loft	<input type="text" value="0.58"/>	<input type="text" value="0.58"/>	<input type="text" value="0.57"/>	<input type="text" value="0.56"/>	<input type="text" value="0.56"/>	<input type="text" value="0.54"/>	<input type="text" value="0.54"/>	<input type="text" value="0.54"/>	<input type="text" value="0.55"/>	<input type="text" value="0.56"/>	<input type="text" value="0.56"/>	<input type="text" value="0.57"/>
--	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in (25)	<input type="text" value="0.58"/>	<input type="text" value="0.58"/>	<input type="text" value="0.57"/>	<input type="text" value="0.56"/>	<input type="text" value="0.56"/>	<input type="text" value="0.54"/>	<input type="text" value="0.54"/>	<input type="text" value="0.54"/>	<input type="text" value="0.55"/>	<input type="text" value="0.56"/>	<input type="text" value="0.56"/>	<input type="text" value="0.57"/>
--	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------

3. Heat losses and heat loss parameter

Element	Gross area, m ²	Openings m ²	Net area A, m ²	U-value W/m ² K	A x U W/K	κ-value, kJ/m ² .K	A x κ, kJ/K					
Door			2.10	1.00	2.10		(26)					
Window			15.12	1.33	20.05		(27)					
External wall			77.72	0.18	13.99		(29a)					
Roof			9.20	0.13	1.20		(30)					
Total area of external elements ΣA, m ²			104.14				(31)					
Fabric heat loss, W/K = Σ(A x U)					(26)...(30) + (32) =	37.33	(33)					
Heat capacity Cm = Σ(A x κ)					(28)...(30) + (32) + (32a)...(32e) =	N/A	(34)					
Thermal mass parameter (TMP) in kJ/m ² K						250.00	(35)					
Thermal bridges: Σ(L x Ψ) calculated using Appendix K						13.06	(36)					
Total fabric heat loss						(33) + (36) =	50.40 (37)					
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ventilation heat loss calculated monthly 0.33 x (25)m x (5)	32.90	32.72	32.55	31.75	31.60	30.91	30.91	30.78	31.17	31.60	31.90	32.22
Heat transfer coefficient, W/K (37)m + (38)m	83.29	83.12	82.95	82.15	82.00	81.30	81.30	81.17	81.57	82.00	82.30	82.62
	Average = Σ(39)1...12/12 =											82.15 (39)
Heat loss parameter (HLP), W/m ² K (39)m ÷ (4)	1.21	1.21	1.20	1.19	1.19	1.18	1.18	1.18	1.18	1.19	1.19	1.20
	Average = Σ(40)1...12/12 =											1.19 (40)
Number of days in month (Table 1a)	31.00	28.00	31.00	30.00	31.00	30.00	31.00	31.00	30.00	31.00	30.00	31.00

4. Water heating energy requirement

Assumed occupancy, N												2.22	(42)
Annual average hot water usage in litres per day Vd,average = (25 x N) + 36												86.90	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)	95.59	92.12	88.64	85.17	81.69	78.21	78.21	81.69	85.17	88.64	92.12	95.59	
	Σ(44)1...12 =											1042.85	(44)
Energy content of hot water used = 4.18 x Vd,m x nm x Tm/3600 kWh/month (see Tables 1b, 1c 1d)	141.76	123.99	127.94	111.54	107.03	92.36	85.58	98.21	99.38	115.82	126.43	137.29	
	Σ(45)1...12 =											1367.34	(45)
Distribution loss 0.15 x (45)m	21.26	18.60	19.19	16.73	16.05	13.85	12.84	14.73	14.91	17.37	18.96	20.59	
Water storage loss calculated for each month (55) x (41)m	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
If the vessel contains dedicated solar storage or dedicated WWHRS (56)m x [(47) - Vs] ÷ (47), else (56)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Primary circuit loss for each month from Table 3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Combi loss for each month from Table 3a, 3b or 3c	48.71	42.40	45.17	42.00	41.63	38.57	39.86	41.63	42.00	45.17	45.43	48.71	
Total heat required for water heating calculated for each month 0.85 x (45)m + (46)m + (57)m + (59)m + (61)m	190.48	166.39	173.12	153.54	148.66	130.93	125.44	139.84	141.38	160.99	171.85	186.00	
Solar DHW input calculated using Appendix G or Appendix H													

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(63)
------	------	------	------	------	------	------	------	------	------	------	------	------	------

Output from water heater for each month (kWh/month) (62)m + (63)m

190.48	166.39	173.12	153.54	148.66	130.93	125.44	139.84	141.38	160.99	171.85	186.00	$\Sigma(64)1...12 =$	1888.62	(64)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	----------------------	---------	------

Heat gains from water heating (kWh/month) $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

59.32	51.83	53.83	47.59	45.99	40.35	38.42	43.06	43.54	49.80	53.39	57.83	(65)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

5. Internal gains

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

Metabolic gains (Table 5)

110.96	110.96	110.96	110.96	110.96	110.96	110.96	110.96	110.96	110.96	110.96	110.96	(66)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

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

17.37	15.42	12.54	9.50	7.10	5.99	6.48	8.42	11.30	14.35	16.74	17.85	(67)
-------	-------	-------	------	------	------	------	------	-------	-------	-------	-------	------

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

194.72	196.74	191.65	180.81	167.12	154.26	145.67	143.65	148.74	159.58	173.26	186.12	(68)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

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

34.10	34.10	34.10	34.10	34.10	34.10	34.10	34.10	34.10	34.10	34.10	34.10	(69)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Pump and fan gains (Table 5a)

3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	(70)
------	------	------	------	------	------	------	------	------	------	------	------	------

Losses e.g. evaporation (Table 5)

-88.77	-88.77	-88.77	-88.77	-88.77	-88.77	-88.77	-88.77	-88.77	-88.77	-88.77	-88.77	(71)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Water heating gains (Table 5)

79.72	77.12	72.36	66.10	61.82	56.04	51.64	57.88	60.48	66.94	74.16	77.73	(72)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

351.09	348.57	335.83	315.68	295.33	275.59	263.07	269.23	279.81	300.15	323.45	340.99	(73)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

6. Solar gains

	Access factor Table 6d	Area m ²	Solar flux W/m ²	g specific data or Table 6b	FF specific data or Table 6c	Gains W
--	---------------------------	------------------------	--------------------------------	-----------------------------------	------------------------------------	------------

SouthWest $\boxed{0.77} \times \boxed{4.62} \times \boxed{36.79} \times 0.9 \times \boxed{0.63} \times \boxed{0.70} = \boxed{51.95}$ (79)

SouthEast $\boxed{0.77} \times \boxed{2.31} \times \boxed{36.79} \times 0.9 \times \boxed{0.63} \times \boxed{0.70} = \boxed{25.98}$ (77)

NorthEast $\boxed{0.77} \times \boxed{8.19} \times \boxed{11.28} \times 0.9 \times \boxed{0.63} \times \boxed{0.70} = \boxed{28.24}$ (75)

Solar gains in watts $\Sigma(74)m...(82)m$

106.17	190.22	285.19	395.12	480.69	493.98	469.27	402.87	322.85	216.95	128.87	89.75	(83)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	------

Total gains - internal and solar (73)m + (83)m

457.26	538.79	621.02	710.81	776.02	769.57	732.35	672.10	602.66	517.11	452.32	430.74	(84)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

7. Mean internal temperature (heating season)

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

$\boxed{21.00}$ (85)

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

Utilisation factor for gains for living area n1,m (see Table 9a)

1.00	0.99	0.98	0.94	0.82	0.64	0.48	0.54	0.80	0.96	0.99	1.00	(86)
------	------	------	------	------	------	------	------	------	------	------	------	------

Mean internal temp of living area T1 (steps 3 to 7 in Table 9c)

19.74	19.92	20.20	20.56	20.83	20.96	20.99	20.99	20.89	20.52	20.06	19.71	(87)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

19.91	19.91	19.92	19.93	19.93	19.94	19.94	19.94	19.93	19.93	19.92	19.92	(88)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Utilisation factor for gains for rest of dwelling n2,m

1.00	0.99	0.97	0.91	0.77	0.55	0.37	0.42	0.72	0.95	0.99	1.00	(89)
------	------	------	------	------	------	------	------	------	------	------	------	------

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

18.24	18.50	18.91	19.42	19.77	19.91	19.93	19.93	19.85	19.38	18.72	18.20	(90)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Living area fraction

Living area ÷ (4) = (91)

Mean internal temperature for the whole dwelling fLA x T1 +(1 - fLA) x T2

18.98	19.20	19.54	19.98	20.29	20.43	20.45	20.45	20.36	19.94	19.38	18.94	(92)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

18.98	19.20	19.54	19.98	20.29	20.43	20.45	20.45	20.36	19.94	19.38	18.94	(93)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

8. Space heating requirement

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

Utilisation factor for gains, ηm

0.99	0.99	0.97	0.91	0.79	0.59	0.42	0.48	0.76	0.95	0.99	1.00	(94)
------	------	------	------	------	------	------	------	------	------	------	------	------

Useful gains, ηmGm, W (94)m x (84)m

454.78	532.31	602.34	650.02	611.36	456.21	310.62	323.84	455.40	489.82	447.32	428.95	(95)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Monthly average external temperature from Table U1

4.30	4.90	6.50	8.90	11.70	14.60	16.60	16.40	14.10	10.60	7.10	4.20	(96)
------	------	------	------	-------	-------	-------	-------	-------	-------	------	------	------

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

1222.65	1188.43	1081.98	909.97	704.61	473.95	313.38	328.86	510.83	766.06	1010.69	1217.84	(97)
---------	---------	---------	--------	--------	--------	--------	--------	--------	--------	---------	---------	------

Space heating requirement, kWh/month 0.024 x [(97)m - (95)m] x (41)m

571.30	440.91	356.86	187.16	69.38	0.00	0.00	0.00	0.00	205.52	405.62	586.93	(98)
--------	--------	--------	--------	-------	------	------	------	------	--------	--------	--------	------

Σ(98)1...5, 10...12 = (98)

Space heating requirement kWh/m²/year

(98) ÷ (4) = (99)

9a. Energy requirements - individual heating systems including micro-CHP

Space heating

Fraction of space heat from secondary/supplementary system (table 11)

(201)

Fraction of space heat from main system(s)

1 - (201) = (202)

Fraction of space heat from main system 2

(202)

Fraction of total space heat from main system 1

(202) x [1- (203)] = (204)

Fraction of total space heat from main system 2

(202) x (203) = (205)

Efficiency of main system 1 (%)

(206)

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

Space heating fuel (main system 1), kWh/month

611.67	472.06	382.07	200.38	74.28	0.00	0.00	0.00	0.00	220.04	434.29	628.41	(211)
--------	--------	--------	--------	-------	------	------	------	------	--------	--------	--------	-------

Σ(211)1...5, 10...12 = (211)

Water heating

Efficiency of water heater

87.64	87.39	86.83	85.55	83.26	80.30	80.30	80.30	80.30	85.67	87.14	87.74	(217)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

Water heating fuel, kWh/month

217.33	190.40	199.37	179.48	178.55	163.05	156.22	174.14	176.07	187.93	197.22	211.99	(219)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------

Σ(219a)1...12 = (219)

Annual totals

Space heating fuel - main system 1

Water heating fuel

Electricity for pumps, fans and electric keep-hot (Table 4f)

central heating pump or water pump within warm air heating unit

(230c)

boiler flue fan

(230e)

Total electricity for the above, kWh/year

(231)

Electricity for lighting (Appendix L)					306.70	(232)
Total delivered energy for all uses				(211)...(221) + (231) + (232)...(237b) =	5636.64	(238)

10a. Fuel costs - individual heating systems including micro-CHP

	Fuel kWh/year		Fuel price		Fuel cost £/year	
Space heating - main system 1	3023.21	x	3.48	x 0.01 =	105.21	(240)
Water heating	2231.73	x	3.48	x 0.01 =	77.66	(247)
Pumps and fans	75.00	x	13.19	x 0.01 =	9.89	(249)
Electricity for lighting	306.70	x	13.19	x 0.01 =	40.45	(250)
Additional standing charges					120.00	(251)
Total energy cost				(240)...(242) + (245)...(254) =	353.22	(255)

11a. SAP rating - individual heating systems including micro-CHP

Energy cost deflator (Table 12)	0.42	(256)
Energy cost factor (ECF)	1.30	(257)
SAP value	81.83	
SAP rating (section 13)	82	(258)
SAP band	B	

12a. CO₂ emissions - individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO ₂ /kWh		Emissions kg CO ₂ /year	
Space heating - main system 1	3023.21	x	0.216	=	653.01	(261)
Water heating	2231.73	x	0.216	=	482.05	(264)
Space and water heating				(261) + (262) + (263) + (264) =	1135.07	(265)
Pumps and fans	75.00	x	0.519	=	38.93	(267)
Electricity for lighting	306.70	x	0.519	=	159.18	(268)
Total CO ₂ , kg/year				(265)...(271) =	1333.17	(272)
Dwelling CO ₂ emission rate				(272) ÷ (4) =	19.35	(273)
EI value					84.32	
EI rating (section 14)					84	(274)
EI band					B	

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

	Energy kWh/year		Primary factor		Primary Energy kWh/year	
Space heating - main system 1	3023.21	x	1.22	=	3688.31	(261)
Water heating	2231.73	x	1.22	=	2722.72	(264)
Space and water heating				(261) + (262) + (263) + (264) =	6411.03	(265)
Pumps and fans	75.00	x	3.07	=	230.25	(267)
Electricity for lighting	306.70	x	3.07	=	941.56	(268)
Primary energy kWh/year					7582.84	(272)
Dwelling primary energy rate kWh/m ² /year					110.06	(273)

This design submission has been carried out using Approved SAP software. It has been prepared from plans and specifications and may not reflect the property as constructed.

Assessor name	Mr Stuart Searle	Assessor number	3519
Client	Avis Appleton & Associates	Last modified	14/09/2016
Address	PS2 Liffords Place, London, SW13		

1. Overall dwelling dimensions

	Area (m ²)	Average storey height (m)	Volume (m ³)
Lowest occupied	<input type="text" value="68.90"/> (1a) x	<input type="text" value="2.50"/> (2a) =	<input type="text" value="172.25"/> (3a)
Total floor area	(1a) + (1b) + (1c) + (1d)...(1n) = <input type="text" value="68.90"/> (4)		
Dwelling volume	(3a) + (3b) + (3c) + (3d)...(3n) = <input type="text" value="172.25"/> (5)		

2. Ventilation rate

		m ³ per hour
Number of chimneys	<input type="text" value="0"/> x 40 =	<input type="text" value="0"/> (6a)
Number of open flues	<input type="text" value="0"/> x 20 =	<input type="text" value="0"/> (6b)
Number of intermittent fans	<input type="text" value="2"/> x 10 =	<input type="text" value="20"/> (7a)
Number of passive vents	<input type="text" value="0"/> x 10 =	<input type="text" value="0"/> (7b)
Number of flueless gas fires	<input type="text" value="0"/> x 40 =	<input type="text" value="0"/> (7c)

	Air changes per hour
Infiltration due to chimneys, flues, fans, PSVs	(6a) + (6b) + (7a) + (7b) + (7c) = <input type="text" value="20"/> ÷ (5) = <input type="text" value="0.12"/> (8)

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

Air permeability value, q ₅₀ , expressed in cubic metres per hour per square metre of envelope area	<input type="text" value="5.00"/> (17)
--	--

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)	<input type="text" value="0.37"/> (18)
--	--

Number of sides on which the dwelling is sheltered	<input type="text" value="2"/> (19)
--	-------------------------------------

Shelter factor	1 - [0.075 x (19)] = <input type="text" value="0.85"/> (20)
----------------	---

Infiltration rate incorporating shelter factor	(18) x (20) = <input type="text" value="0.31"/> (21)
--	--

Infiltration rate modified for monthly wind speed:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table U2	<input type="text" value="5.10"/>	<input type="text" value="5.00"/>	<input type="text" value="4.90"/>	<input type="text" value="4.40"/>	<input type="text" value="4.30"/>	<input type="text" value="3.80"/>	<input type="text" value="3.80"/>	<input type="text" value="3.70"/>	<input type="text" value="4.00"/>	<input type="text" value="4.30"/>	<input type="text" value="4.50"/>	<input type="text" value="4.70"/>

Wind factor (22)m ÷ 4	<input type="text" value="1.28"/>	<input type="text" value="1.25"/>	<input type="text" value="1.23"/>	<input type="text" value="1.10"/>	<input type="text" value="1.08"/>	<input type="text" value="0.95"/>	<input type="text" value="0.95"/>	<input type="text" value="0.93"/>	<input type="text" value="1.00"/>	<input type="text" value="1.08"/>	<input type="text" value="1.13"/>	<input type="text" value="1.18"/>
-----------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------

Adjusted infiltration rate (allowing for shelter and wind factor) (21) x (22a)m	<input type="text" value="0.40"/>	<input type="text" value="0.39"/>	<input type="text" value="0.38"/>	<input type="text" value="0.34"/>	<input type="text" value="0.33"/>	<input type="text" value="0.30"/>	<input type="text" value="0.30"/>	<input type="text" value="0.29"/>	<input type="text" value="0.31"/>	<input type="text" value="0.33"/>	<input type="text" value="0.35"/>	<input type="text" value="0.37"/>
---	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------

Calculate effective air change rate for the applicable case:

If mechanical ventilation: air change rate through system	<input type="text" value="N/A"/> (23a)
---	--

If balanced with heat recovery: efficiency in % allowing for in-use factor from Table 4h	<input type="text" value="N/A"/> (23c)
--	--

d) natural ventilation or whole house positive input ventilation from loft	<input type="text" value="0.58"/>	<input type="text" value="0.58"/>	<input type="text" value="0.57"/>	<input type="text" value="0.56"/>	<input type="text" value="0.56"/>	<input type="text" value="0.54"/>	<input type="text" value="0.54"/>	<input type="text" value="0.54"/>	<input type="text" value="0.55"/>	<input type="text" value="0.56"/>	<input type="text" value="0.56"/>	<input type="text" value="0.57"/>
--	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in (25)	<input type="text" value="0.58"/>	<input type="text" value="0.58"/>	<input type="text" value="0.57"/>	<input type="text" value="0.56"/>	<input type="text" value="0.56"/>	<input type="text" value="0.54"/>	<input type="text" value="0.54"/>	<input type="text" value="0.54"/>	<input type="text" value="0.55"/>	<input type="text" value="0.56"/>	<input type="text" value="0.56"/>	<input type="text" value="0.57"/>
--	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------

3. Heat losses and heat loss parameter

Element	Gross area, m ²	Openings m ²	Net area A, m ²	U-value W/m ² K	A x U W/K	κ-value, kJ/m ² .K	A x κ, kJ/K						
Door			2.10	1.00	2.10		(26)						
Window			15.12	1.33	20.05		(27)						
External wall			57.97	0.18	10.43		(29a)						
Party wall			19.75	0.00	0.00		(32)						
Roof			9.20	0.13	1.20		(30)						
Total area of external elements $\sum A$, m ²			84.39				(31)						
Fabric heat loss, W/K = $\sum(A \times U)$					(26)...(30) + (32) =	33.78	(33)						
Heat capacity Cm = $\sum(A \times \kappa)$					(28)...(30) + (32) + (32a)...(32e) =	N/A	(34)						
Thermal mass parameter (TMP) in kJ/m ² K						250.00	(35)						
Thermal bridges: $\sum(L \times \Psi)$ calculated using Appendix K						11.81	(36)						
Total fabric heat loss						(33) + (36) =	45.58 (37)						
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ventilation heat loss calculated monthly 0.33 x (25)m x (5)	32.90	32.72	32.55	31.75	31.60	30.91	30.91	30.78	31.17	31.60	31.90	32.22	(38)
Heat transfer coefficient, W/K (37)m + (38)m	78.48	78.31	78.14	77.34	77.19	76.49	76.49	76.36	76.76	77.19	77.49	77.81	
	Average = $\sum(39)1...12/12 =$											77.33 (39)	
Heat loss parameter (HLP), W/m ² K (39)m ÷ (4)	1.14	1.14	1.13	1.12	1.12	1.11	1.11	1.11	1.11	1.12	1.12	1.13	
	Average = $\sum(40)1...12/12 =$											1.12 (40)	
Number of days in month (Table 1a)	31.00	28.00	31.00	30.00	31.00	30.00	31.00	31.00	30.00	31.00	30.00	31.00	(40)

4. Water heating energy requirement

Assumed occupancy, N													2.22	(42)	
Annual average hot water usage in litres per day Vd,average = (25 x N) + 36														86.90	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec			
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)	95.59	92.12	88.64	85.17	81.69	78.21	78.21	81.69	85.17	88.64	92.12	95.59			
	$\sum(44)1...12 =$											1042.85	(44)		
Energy content of hot water used = 4.18 x Vd,m x nm x Tm/3600 kWh/month (see Tables 1b, 1c 1d)	141.76	123.99	127.94	111.54	107.03	92.36	85.58	98.21	99.38	115.82	126.43	137.29			
	$\sum(45)1...12 =$											1367.34	(45)		
Distribution loss 0.15 x (45)m	21.26	18.60	19.19	16.73	16.05	13.85	12.84	14.73	14.91	17.37	18.96	20.59		(46)	
Water storage loss calculated for each month (55) x (41)m	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		(56)	
If the vessel contains dedicated solar storage or dedicated WWHRS (56)m x [(47) - Vs] ÷ (47), else (56)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		(57)	
Primary circuit loss for each month from Table 3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		(59)	
Combi loss for each month from Table 3a, 3b or 3c	48.71	42.40	45.17	42.00	41.63	38.57	39.86	41.63	42.00	45.17	45.43	48.71		(61)	
Total heat required for water heating calculated for each month 0.85 x (45)m + (46)m + (57)m + (59)m + (61)m	190.48	166.39	173.12	153.54	148.66	130.93	125.44	139.84	141.38	160.99	171.85	186.00		(62)	

Solar DHW input calculated using Appendix G or Appendix H

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
------	------	------	------	------	------	------	------	------	------	------	------	------

 (63)

Output from water heater for each month (kWh/month) (62)m + (63)m

190.48	166.39	173.12	153.54	148.66	130.93	125.44	139.84	141.38	160.99	171.85	186.00
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

$\Sigma(64)1...12 = 1888.62$ (64)

Heat gains from water heating (kWh/month) $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

59.32	51.83	53.83	47.59	45.99	40.35	38.42	43.06	43.54	49.80	53.39	57.83
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (65)

5. Internal gains

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

Metabolic gains (Table 5)

110.96	110.96	110.96	110.96	110.96	110.96	110.96	110.96	110.96	110.96	110.96	110.96
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (66)

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

17.37	15.42	12.54	9.50	7.10	5.99	6.48	8.42	11.30	14.35	16.74	17.85
-------	-------	-------	------	------	------	------	------	-------	-------	-------	-------

 (67)

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

194.72	196.74	191.65	180.81	167.12	154.26	145.67	143.65	148.74	159.58	173.26	186.12
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (68)

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

34.10	34.10	34.10	34.10	34.10	34.10	34.10	34.10	34.10	34.10	34.10	34.10
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (69)

Pump and fan gains (Table 5a)

3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
------	------	------	------	------	------	------	------	------	------	------	------

 (70)

Losses e.g. evaporation (Table 5)

-88.77	-88.77	-88.77	-88.77	-88.77	-88.77	-88.77	-88.77	-88.77	-88.77	-88.77	-88.77
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (71)

Water heating gains (Table 5)

79.72	77.12	72.36	66.10	61.82	56.04	51.64	57.88	60.48	66.94	74.16	77.73
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (72)

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

351.09	348.57	335.83	315.68	295.33	275.59	263.07	269.23	279.81	300.15	323.45	340.99
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (73)

6. Solar gains

Access factor Table 6d Area m² Solar flux W/m² g specific data or Table 6b FF specific data or Table 6c Gains W

SouthWest $\frac{0.77}{\text{Access factor}} \times \frac{4.62}{\text{Area}} \times \frac{36.79}{\text{Solar flux}} \times 0.9 \times \frac{0.63}{\text{g}} \times \frac{0.70}{\text{FF}} = 51.95$ (79)

NorthWest $\frac{0.77}{\text{Access factor}} \times \frac{2.31}{\text{Area}} \times \frac{11.28}{\text{Solar flux}} \times 0.9 \times \frac{0.63}{\text{g}} \times \frac{0.70}{\text{FF}} = 7.97$ (81)

NorthEast $\frac{0.77}{\text{Access factor}} \times \frac{8.19}{\text{Area}} \times \frac{11.28}{\text{Solar flux}} \times 0.9 \times \frac{0.63}{\text{g}} \times \frac{0.70}{\text{FF}} = 28.24$ (75)

Solar gains in watts $\Sigma(74)m...(82)m$

88.16	162.19	253.86	368.09	461.16	479.32	453.17	380.45	292.90	187.87	107.78	74.03
-------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------

 (83)

Total gains - internal and solar (73)m + (83)m

439.25	510.76	589.69	683.77	756.49	754.91	716.24	649.68	572.70	488.02	431.23	415.01
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (84)

7. Mean internal temperature (heating season)

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

21.00

 (85)

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

Utilisation factor for gains for living area n1,m (see Table 9a)

1.00	0.99	0.98	0.94	0.81	0.62	0.46	0.53	0.80	0.97	0.99	1.00
------	------	------	------	------	------	------	------	------	------	------	------

 (86)

Mean internal temp of living area T1 (steps 3 to 7 in Table 9c)

19.81	19.97	20.24	20.60	20.86	20.97	21.00	20.99	20.90	20.55	20.11	19.78
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (87)

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

19.97	19.97	19.97	19.98	19.98	19.99	19.99	19.99	19.99	19.98	19.98	19.98
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (88)

Utilisation factor for gains for rest of dwelling n2,m

1.00	0.99	0.98	0.92	0.76	0.54	0.36	0.42	0.73	0.95	0.99	1.00	(99)
------	------	------	------	------	------	------	------	------	------	------	------	------

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

18.38	18.62	19.02	19.52	19.85	19.98	19.99	19.99	19.92	19.46	18.84	18.35	(90)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Living area fraction

Living area ÷ (4) = (91)

Mean internal temperature for the whole dwelling fLA x T1 +(1 - fLA) x T2

19.09	19.29	19.62	20.05	20.35	20.47	20.48	20.48	20.40	20.00	19.46	19.05	(92)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

19.09	19.29	19.62	20.05	20.35	20.47	20.48	20.48	20.40	20.00	19.46	19.05	(93)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

8. Space heating requirement

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

Utilisation factor for gains, ηm

1.00	0.99	0.97	0.92	0.78	0.58	0.41	0.47	0.76	0.95	0.99	1.00	(94)
------	------	------	------	------	------	------	------	------	------	------	------	------

Useful gains, ηmGm, W (94)m x (84)m

437.25	505.67	574.08	626.89	590.46	435.83	295.30	308.08	435.04	465.11	427.21	413.57	(95)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Monthly average external temperature from Table U1

4.30	4.90	6.50	8.90	11.70	14.60	16.60	16.40	14.10	10.60	7.10	4.20	(96)
------	------	------	------	-------	-------	-------	-------	-------	-------	------	------	------

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

1160.33	1126.53	1025.19	862.17	667.60	448.71	297.15	311.74	483.74	725.31	958.11	1155.48	(97)
---------	---------	---------	--------	--------	--------	--------	--------	--------	--------	--------	---------	------

Space heating requirement, kWh/month 0.024 x [(97)m - (95)m] x (41)m

537.97	417.22	335.63	169.40	57.39	0.00	0.00	0.00	0.00	193.58	382.24	551.98
--------	--------	--------	--------	-------	------	------	------	------	--------	--------	--------

Σ(98)1...5, 10...12 = (98)

Space heating requirement kWh/m²/year

(98) ÷ (4) = (99)

9a. Energy requirements - individual heating systems including micro-CHP

Space heating

Fraction of space heat from secondary/supplementary system (table 11)

(201)

Fraction of space heat from main system(s)

1 - (201) = (202)

Fraction of space heat from main system 2

(202)

Fraction of total space heat from main system 1

(202) x [1 - (203)] = (204)

Fraction of total space heat from main system 2

(202) x (203) = (205)

Efficiency of main system 1 (%)

(206)

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

Space heating fuel (main system 1), kWh/month

575.99	446.70	359.34	181.37	61.44	0.00	0.00	0.00	0.00	207.26	409.25	590.98
--------	--------	--------	--------	-------	------	------	------	------	--------	--------	--------

Σ(211)1...5, 10...12 = (211)

Water heating

Efficiency of water heater

87.52	87.27	86.69	85.30	82.88	80.30	80.30	80.30	80.30	85.52	87.01	87.62	(217)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

Water heating fuel, kWh/month

217.64	190.66	199.70	180.01	179.37	163.05	156.22	174.14	176.07	188.26	197.52	212.28
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

Σ(219a)1...12 = (219)

Annual totals

Space heating fuel - main system 1

Water heating fuel

Electricity for pumps, fans and electric keep-hot (Table 4f)

central heating pump or water pump within warm air heating unit

(230c)

boiler flue fan

(230e)

Total electricity for the above, kWh/year					75.00	(231)
Electricity for lighting (Appendix L)					306.70	(232)
Total delivered energy for all uses				(211)...(221) + (231) + (232)...(237b) =	5448.94	(238)

10a. Fuel costs - individual heating systems including micro-CHP

	Fuel kWh/year		Fuel price		Fuel cost £/year	
Space heating - main system 1	2832.35	x	3.48	x 0.01 =	98.57	(240)
Water heating	2234.90	x	3.48	x 0.01 =	77.77	(247)
Pumps and fans	75.00	x	13.19	x 0.01 =	9.89	(249)
Electricity for lighting	306.70	x	13.19	x 0.01 =	40.45	(250)
Additional standing charges					120.00	(251)
Total energy cost				(240)...(242) + (245)...(254) =	346.69	(255)

11a. SAP rating - individual heating systems including micro-CHP

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)		1.28	(257)
SAP value		82.17	
SAP rating (section 13)		82	(258)
SAP band		B	

12a. CO₂ emissions - individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO ₂ /kWh		Emissions kg CO ₂ /year	
Space heating - main system 1	2832.35	x	0.216	=	611.79	(261)
Water heating	2234.90	x	0.216	=	482.74	(264)
Space and water heating				(261) + (262) + (263) + (264) =	1094.53	(265)
Pumps and fans	75.00	x	0.519	=	38.93	(267)
Electricity for lighting	306.70	x	0.519	=	159.18	(268)
Total CO ₂ , kg/year				(265)...(271) =	1292.63	(272)
Dwelling CO ₂ emission rate				(272) ÷ (4) =	18.76	(273)
EI value					84.79	
EI rating (section 14)					85	(274)
EI band					B	

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

	Energy kWh/year		Primary factor		Primary Energy kWh/year	
Space heating - main system 1	2832.35	x	1.22	=	3455.46	(261)
Water heating	2234.90	x	1.22	=	2726.58	(264)
Space and water heating				(261) + (262) + (263) + (264) =	6182.04	(265)
Pumps and fans	75.00	x	3.07	=	230.25	(267)
Electricity for lighting	306.70	x	3.07	=	941.56	(268)
Primary energy kWh/year					7353.85	(272)
Dwelling primary energy rate kWh/m ² /year					106.73	(273)

This design submission has been carried out using Approved SAP software. It has been prepared from plans and specifications and may not reflect the property as constructed.

Assessor name	Mr Stuart Searle	Assessor number	3519
Client	Avis Appleton & Associates	Last modified	14/09/2016
Address	PS3 Liffords Place, London, SW13		

1. Overall dwelling dimensions

	Area (m ²)	Average storey height (m)	Volume (m ³)
Lowest occupied	<input type="text" value="102.40"/> (1a) x	<input type="text" value="2.50"/> (2a) =	<input type="text" value="256.00"/> (3a)
Total floor area	(1a) + (1b) + (1c) + (1d)...(1n) =		<input type="text" value="102.40"/> (4)
Dwelling volume	(3a) + (3b) + (3c) + (3d)...(3n) =		<input type="text" value="256.00"/> (5)

2. Ventilation rate

		m ³ per hour
Number of chimneys	<input type="text" value="0"/> x 40 =	<input type="text" value="0"/> (6a)
Number of open flues	<input type="text" value="0"/> x 20 =	<input type="text" value="0"/> (6b)
Number of intermittent fans	<input type="text" value="4"/> x 10 =	<input type="text" value="40"/> (7a)
Number of passive vents	<input type="text" value="0"/> x 10 =	<input type="text" value="0"/> (7b)
Number of flueless gas fires	<input type="text" value="0"/> x 40 =	<input type="text" value="0"/> (7c)

	Air changes per hour
Infiltration due to chimneys, flues, fans, PSVs	(6a) + (6b) + (7a) + (7b) + (7c) = <input type="text" value="40"/> ÷ (5) = <input type="text" value="0.16"/> (8)

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

Air permeability value, q ₅₀ , expressed in cubic metres per hour per square metre of envelope area	<input type="text" value="5.00"/> (17)
--	--

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)	<input type="text" value="0.41"/> (18)
--	--

Number of sides on which the dwelling is sheltered	<input type="text" value="2"/> (19)
--	-------------------------------------

Shelter factor	1 - [0.075 x (19)] = <input type="text" value="0.85"/> (20)
----------------	---

Infiltration rate incorporating shelter factor	(18) x (20) = <input type="text" value="0.35"/> (21)
--	--

Infiltration rate modified for monthly wind speed:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table U2	<input type="text" value="5.10"/>	<input type="text" value="5.00"/>	<input type="text" value="4.90"/>	<input type="text" value="4.40"/>	<input type="text" value="4.30"/>	<input type="text" value="3.80"/>	<input type="text" value="3.80"/>	<input type="text" value="3.70"/>	<input type="text" value="4.00"/>	<input type="text" value="4.30"/>	<input type="text" value="4.50"/>	<input type="text" value="4.70"/>

Wind factor (22)m ÷ 4	<input type="text" value="1.28"/>	<input type="text" value="1.25"/>	<input type="text" value="1.23"/>	<input type="text" value="1.10"/>	<input type="text" value="1.08"/>	<input type="text" value="0.95"/>	<input type="text" value="0.95"/>	<input type="text" value="0.93"/>	<input type="text" value="1.00"/>	<input type="text" value="1.08"/>	<input type="text" value="1.13"/>	<input type="text" value="1.18"/>
-----------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------

Adjusted infiltration rate (allowing for shelter and wind factor) (21) x (22a)m	<input type="text" value="0.44"/>	<input type="text" value="0.43"/>	<input type="text" value="0.42"/>	<input type="text" value="0.38"/>	<input type="text" value="0.37"/>	<input type="text" value="0.33"/>	<input type="text" value="0.33"/>	<input type="text" value="0.32"/>	<input type="text" value="0.35"/>	<input type="text" value="0.37"/>	<input type="text" value="0.39"/>	<input type="text" value="0.41"/>
---	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------

Calculate effective air change rate for the applicable case:

If mechanical ventilation: air change rate through system	<input type="text" value="N/A"/> (23a)
---	--

If balanced with heat recovery: efficiency in % allowing for in-use factor from Table 4h	<input type="text" value="N/A"/> (23c)
--	--

d) natural ventilation or whole house positive input ventilation from loft	<input type="text" value="0.60"/>	<input type="text" value="0.59"/>	<input type="text" value="0.59"/>	<input type="text" value="0.57"/>	<input type="text" value="0.57"/>	<input type="text" value="0.55"/>	<input type="text" value="0.55"/>	<input type="text" value="0.55"/>	<input type="text" value="0.56"/>	<input type="text" value="0.57"/>	<input type="text" value="0.58"/>	<input type="text" value="0.58"/>
--	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in (25)	<input type="text" value="0.60"/>	<input type="text" value="0.59"/>	<input type="text" value="0.59"/>	<input type="text" value="0.57"/>	<input type="text" value="0.57"/>	<input type="text" value="0.55"/>	<input type="text" value="0.55"/>	<input type="text" value="0.55"/>	<input type="text" value="0.56"/>	<input type="text" value="0.57"/>	<input type="text" value="0.58"/>	<input type="text" value="0.58"/>
--	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------

3. Heat losses and heat loss parameter

Element	Gross area, m ²	Openings m ²	Net area A, m ²	U-value W/m ² K	A x U W/K	κ-value, kJ/m ² .K	A x κ, kJ/K						
Door			2.10	1.00	= 2.10		(26)						
Window			18.32	1.33	= 24.29		(27)						
External wall			89.58	0.18	= 16.12		(29a)						
Total area of external elements ΣA, m ²			110.00				(31)						
Fabric heat loss, W/K = Σ(A x U)					(26)...(30) + (32) =	42.51	(33)						
Heat capacity Cm = Σ(A x κ)					(28)...(30) + (32) + (32a)...(32e) =	N/A	(34)						
Thermal mass parameter (TMP) in kJ/m ² K						250.00	(35)						
Thermal bridges: Σ(L x Ψ) calculated using Appendix K						8.34	(36)						
Total fabric heat loss					(33) + (36) =	50.85	(37)						
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ventilation heat loss calculated monthly 0.33 x (25)m x (5)	50.43	50.11	49.80	48.33	48.06	46.79	46.79	46.55	47.28	48.06	48.61	49.19	
Heat transfer coefficient, W/K (37)m + (38)m	101.28	100.96	100.65	99.19	98.91	97.64	97.64	97.40	98.13	98.91	99.47	100.05	
	Average = Σ(39)1...12/12 =											99.19	(39)
Heat loss parameter (HLP), W/m ² K (39)m ÷ (4)	0.99	0.99	0.98	0.97	0.97	0.95	0.95	0.95	0.96	0.97	0.97	0.98	
	Average = Σ(40)1...12/12 =											0.97	(40)
Number of days in month (Table 1a)	31.00	28.00	31.00	30.00	31.00	30.00	31.00	31.00	30.00	31.00	30.00	31.00	

4. Water heating energy requirement

Assumed occupancy, N													2.76	(42)	
Annual average hot water usage in litres per day Vd,average = (25 x N) + 36														99.77	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec			
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)	109.74	105.75	101.76	97.77	93.78	89.79	89.79	93.78	97.77	101.76	105.75	109.74			
	Σ(44)1...12 =												1197.19	(44)	
Energy content of hot water used = 4.18 x Vd,m x nm x Tm/3600 kWh/month (see Tables 1b, 1c 1d)	162.74	142.34	146.88	128.05	122.87	106.03	98.25	112.74	114.09	132.96	145.14	157.61			
	Σ(45)1...12 =												1569.70	(45)	
Distribution loss 0.15 x (45)m	24.41	21.35	22.03	19.21	18.43	15.90	14.74	16.91	17.11	19.94	21.77	23.64		(46)	
Water storage loss calculated for each month (55) x (41)m	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		(56)	
If the vessel contains dedicated solar storage or dedicated WWHRS (56)m x [(47) - Vs] ÷ (47), else (56)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		(57)	
Primary circuit loss for each month from Table 3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		(59)	
Combi loss for each month from Table 3a, 3b or 3c	50.96	46.03	50.96	48.22	47.79	44.28	45.76	47.79	48.22	50.96	49.32	50.96		(61)	
Total heat required for water heating calculated for each month 0.85 x (45)m + (46)m + (57)m + (59)m + (61)m	213.70	188.36	197.84	176.27	170.66	150.31	144.01	160.53	162.31	183.92	194.45	208.57		(62)	
Solar DHW input calculated using Appendix G or Appendix H	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		(63)	

Output from water heater for each month (kWh/month) (62)m + (63)m

213.70	188.36	197.84	176.27	170.66	150.31	144.01	160.53	162.31	183.92	194.45	208.57
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

$$\Sigma(64)1\dots12 = 2150.93 \quad (64)$$

Heat gains from water heating (kWh/month) $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

66.85	58.83	61.58	54.63	52.80	46.32	44.11	49.43	49.99	56.95	60.59	65.14
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(65)

5. Internal gains

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

Metabolic gains (Table 5)

138.03	138.03	138.03	138.03	138.03	138.03	138.03	138.03	138.03	138.03	138.03	138.03
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

(66)

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

23.71	21.06	17.13	12.97	9.69	8.18	8.84	11.49	15.43	19.59	22.86	24.37
-------	-------	-------	-------	------	------	------	-------	-------	-------	-------	-------

(67)

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

260.15	262.85	256.05	241.56	223.28	206.10	194.62	191.92	198.73	213.21	231.49	248.67
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

(68)

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

36.80	36.80	36.80	36.80	36.80	36.80	36.80	36.80	36.80	36.80	36.80	36.80
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(69)

Pump and fan gains (Table 5a)

3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
------	------	------	------	------	------	------	------	------	------	------	------

(70)

Losses e.g. evaporation (Table 5)

-110.43	-110.43	-110.43	-110.43	-110.43	-110.43	-110.43	-110.43	-110.43	-110.43	-110.43	-110.43
---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------

(71)

Water heating gains (Table 5)

89.86	87.55	82.76	75.88	70.97	64.34	59.28	66.44	69.43	76.54	84.15	87.56
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(72)

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

441.13	438.87	423.35	397.82	371.36	346.03	330.16	337.27	350.99	376.75	405.91	428.01
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

(73)

6. Solar gains

	Access factor Table 6d	Area m ²	Solar flux W/m ²	g specific data or Table 6b	FF specific data or Table 6c	Gains W
--	---------------------------	------------------------	--------------------------------	-----------------------------------	------------------------------------	------------

NorthWest $0.77 \times 8.64 \times 11.28 \times 0.9 \times 0.63 \times 0.70 = 29.79$ (81)

SouthEast $0.77 \times 9.68 \times 36.79 \times 0.9 \times 0.63 \times 0.70 = 108.85$ (77)

Solar gains in watts $\Sigma(74)m\dots(82)m$

138.64	246.05	362.95	493.77	593.27	606.67	577.53	500.59	407.82	279.03	167.86	117.48
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

(83)

Total gains - internal and solar (73)m + (83)m

579.77	684.92	786.29	891.58	964.63	952.70	907.69	837.86	758.81	655.78	573.77	545.49
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

(84)

7. Mean internal temperature (heating season)

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

21.00 (85)

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

Utilisation factor for gains for living area n1,m (see Table 9a)

1.00	1.00	0.99	0.95	0.83	0.64	0.47	0.53	0.80	0.97	1.00	1.00
------	------	------	------	------	------	------	------	------	------	------	------

(86)

Mean internal temp of living area T1 (steps 3 to 7 in Table 9c)

19.95	20.11	20.35	20.66	20.89	20.98	21.00	20.99	20.93	20.63	20.23	19.92
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(87)

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

20.09	20.10	20.10	20.11	20.11	20.12	20.12	20.12	20.12	20.11	20.11	20.10
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(88)

Utilisation factor for gains for rest of dwelling n2,m

1.00	0.99	0.98	0.93	0.78	0.56	0.38	0.43	0.73	0.96	0.99	1.00
------	------	------	------	------	------	------	------	------	------	------	------

(89)

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

18.68	18.91	19.27	19.72	20.01	20.11	20.12	20.12	20.07	19.68	19.10	18.65
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(90)

Living area fraction

Living area ÷ (4) = (91)

Mean internal temperature for the whole dwelling $fLA \times T1 + (1 - fLA) \times T2$

19.20	19.40	19.71	20.10	20.36	20.46	20.48	20.48	20.42	20.06	19.56	19.17
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(92)

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

19.20	19.40	19.71	20.10	20.36	20.46	20.48	20.48	20.42	20.06	19.56	19.17
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(93)

8. Space heating requirement

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

Utilisation factor for gains, η_m

1.00	0.99	0.98	0.93	0.80	0.59	0.42	0.47	0.76	0.96	0.99	1.00
------	------	------	------	------	------	------	------	------	------	------	------

(94)

Useful gains, $\eta_m G_m$, W (94)m x (84)m

578.20	680.07	769.81	827.86	769.76	560.64	377.24	394.45	573.41	628.35	570.12	544.44
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

(95)

Monthly average external temperature from Table U1

4.30	4.90	6.50	8.90	11.70	14.60	16.60	16.40	14.10	10.60	7.10	4.20
------	------	------	------	-------	-------	-------	-------	-------	-------	------	------

(96)

Heat loss rate for mean internal temperature, L_m , W [(39)m x [(93)m - (96)m]

1508.63	1463.87	1329.66	1110.91	857.01	572.59	378.56	397.08	620.09	936.16	1239.54	1497.57
---------	---------	---------	---------	--------	--------	--------	--------	--------	--------	---------	---------

(97)

Space heating requirement, kWh/month $0.024 \times [(97)m - (95)m] \times (41)m$

692.23	526.71	416.53	203.80	64.91	0.00	0.00	0.00	0.00	229.01	481.98	709.13
--------	--------	--------	--------	-------	------	------	------	------	--------	--------	--------

$\Sigma(98)1...5, 10...12 =$ (98)

Space heating requirement kWh/m²/year

$(98) \div (4) =$ (99)

9a. Energy requirements - individual heating systems including micro-CHP

Space heating

Fraction of space heat from secondary/supplementary system (table 11)

(201)

Fraction of space heat from main system(s)

$1 - (201) =$ (202)

Fraction of space heat from main system 2

(202)

Fraction of total space heat from main system 1

$(202) \times [1 - (203)] =$ (204)

Fraction of total space heat from main system 2

$(202) \times (203) =$ (205)

Efficiency of main system 1 (%)

(206)

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

Space heating fuel (main system 1), kWh/month

741.15	563.93	445.96	218.20	69.50	0.00	0.00	0.00	0.00	245.19	516.04	759.24
--------	--------	--------	--------	-------	------	------	------	------	--------	--------	--------

$\Sigma(211)1...5, 10...12 =$ (211)

Water heating

Efficiency of water heater

87.80	87.50	86.88	85.42	82.85	80.30	80.30	80.30	80.30	85.60	87.25	87.89
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(217)

Water heating fuel, kWh/month

243.41	215.27	227.71	206.36	205.98	187.18	179.33	199.92	202.12	214.85	222.88	237.31
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

$\Sigma(219a)1...12 =$ (219)

Annual totals

Space heating fuel - main system 1

Water heating fuel

Electricity for pumps, fans and electric keep-hot (Table 4f)

central heating pump or water pump within warm air heating unit

(230c)

boiler flue fan

(230e)

Total electricity for the above, kWh/year

(231)

Electricity for lighting (Appendix L)

(232)

Total delivered energy for all uses

$(211)...(221) + (231) + (232)...(237b) =$ (238)

10a. Fuel costs - individual heating systems including micro-CHP

	Fuel kWh/year		Fuel price		Fuel cost £/year	
Space heating - main system 1	3559.22	x	3.48	x 0.01 =	123.86	(240)
Water heating	2542.34	x	3.48	x 0.01 =	88.47	(247)
Pumps and fans	75.00	x	13.19	x 0.01 =	9.89	(249)
Electricity for lighting	418.75	x	13.19	x 0.01 =	55.23	(250)
Additional standing charges					120.00	(251)
Total energy cost				(240)...(242) + (245)...(254) =	397.46	(255)

11a. SAP rating - individual heating systems including micro-CHP

Energy cost deflator (Table 12)	0.42	(256)
Energy cost factor (ECF)	1.13	(257)
SAP value	84.20	
SAP rating (section 13)	84	(258)
SAP band	B	

12a. CO₂ emissions - individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO ₂ /kWh		Emissions kg CO ₂ /year	
Space heating - main system 1	3559.22	x	0.216	=	768.79	(261)
Water heating	2542.34	x	0.216	=	549.14	(264)
Space and water heating				(261) + (262) + (263) + (264) =	1317.94	(265)
Pumps and fans	75.00	x	0.519	=	38.93	(267)
Electricity for lighting	418.75	x	0.519	=	217.33	(268)
Total CO ₂ , kg/year				(265)...(271) =	1574.19	(272)
Dwelling CO ₂ emission rate				(272) ÷ (4) =	15.37	(273)
EI value					85.69	
EI rating (section 14)					86	(274)
EI band					B	

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

	Energy kWh/year		Primary factor		Primary Energy kWh/year	
Space heating - main system 1	3559.22	x	1.22	=	4342.25	(261)
Water heating	2542.34	x	1.22	=	3101.65	(264)
Space and water heating				(261) + (262) + (263) + (264) =	7443.90	(265)
Pumps and fans	75.00	x	3.07	=	230.25	(267)
Electricity for lighting	418.75	x	3.07	=	1285.55	(268)
Primary energy kWh/year					8959.70	(272)
Dwelling primary energy rate kWh/m ² /year					87.50	(273)

This design submission has been carried out using Approved SAP software. It has been prepared from plans and specifications and may not reflect the property as constructed.

Assessor name	Mr Stuart Searle	Assessor number	3519
Client	Avis Appleton & Associates	Last modified	14/09/2016
Address	PS4 Liffords Place, London, SW13		

1. Overall dwelling dimensions

	Area (m ²)	Average storey height (m)	Volume (m ³)
Lowest occupied	<input type="text" value="79.10"/> (1a)	<input type="text" value="2.50"/> (2a)	<input type="text" value="197.75"/> (3a)
Total floor area	(1a) + (1b) + (1c) + (1d)...(1n) =		<input type="text" value="79.10"/> (4)
Dwelling volume	(3a) + (3b) + (3c) + (3d)...(3n) =		<input type="text" value="197.75"/> (5)

2. Ventilation rate

		m ³ per hour
Number of chimneys	<input type="text" value="0"/> x 40 =	<input type="text" value="0"/> (6a)
Number of open flues	<input type="text" value="0"/> x 20 =	<input type="text" value="0"/> (6b)
Number of intermittent fans	<input type="text" value="3"/> x 10 =	<input type="text" value="30"/> (7a)
Number of passive vents	<input type="text" value="0"/> x 10 =	<input type="text" value="0"/> (7b)
Number of flueless gas fires	<input type="text" value="0"/> x 40 =	<input type="text" value="0"/> (7c)

	Air changes per hour
Infiltration due to chimneys, flues, fans, PSVs	(6a) + (6b) + (7a) + (7b) + (7c) = <input type="text" value="30"/> ÷ (5) = <input type="text" value="0.15"/> (8)

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

Air permeability value, q ₅₀ , expressed in cubic metres per hour per square metre of envelope area	<input type="text" value="5.00"/> (17)
--	--

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)	<input type="text" value="0.40"/> (18)
--	--

Number of sides on which the dwelling is sheltered	<input type="text" value="2"/> (19)
--	-------------------------------------

Shelter factor	1 - [0.075 x (19)] = <input type="text" value="0.85"/> (20)
----------------	---

Infiltration rate incorporating shelter factor	(18) x (20) = <input type="text" value="0.34"/> (21)
--	--

Infiltration rate modified for monthly wind speed:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table U2	<input type="text" value="5.10"/>	<input type="text" value="5.00"/>	<input type="text" value="4.90"/>	<input type="text" value="4.40"/>	<input type="text" value="4.30"/>	<input type="text" value="3.80"/>	<input type="text" value="3.80"/>	<input type="text" value="3.70"/>	<input type="text" value="4.00"/>	<input type="text" value="4.30"/>	<input type="text" value="4.50"/>	<input type="text" value="4.70"/> (22)

Wind factor (22)m ÷ 4	<input type="text" value="1.28"/>	<input type="text" value="1.25"/>	<input type="text" value="1.23"/>	<input type="text" value="1.10"/>	<input type="text" value="1.08"/>	<input type="text" value="0.95"/>	<input type="text" value="0.95"/>	<input type="text" value="0.93"/>	<input type="text" value="1.00"/>	<input type="text" value="1.08"/>	<input type="text" value="1.13"/>	<input type="text" value="1.18"/> (22a)
-----------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	---

Adjusted infiltration rate (allowing for shelter and wind factor) (21) x (22a)m	<input type="text" value="0.44"/>	<input type="text" value="0.43"/>	<input type="text" value="0.42"/>	<input type="text" value="0.38"/>	<input type="text" value="0.37"/>	<input type="text" value="0.32"/>	<input type="text" value="0.32"/>	<input type="text" value="0.32"/>	<input type="text" value="0.34"/>	<input type="text" value="0.37"/>	<input type="text" value="0.38"/>	<input type="text" value="0.40"/> (22b)
---	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	---

Calculate effective air change rate for the applicable case:

If mechanical ventilation: air change rate through system	<input type="text" value="N/A"/> (23a)
---	--

If balanced with heat recovery: efficiency in % allowing for in-use factor from Table 4h	<input type="text" value="N/A"/> (23c)
--	--

d) natural ventilation or whole house positive input ventilation from loft	<input type="text" value="0.59"/>	<input type="text" value="0.59"/>	<input type="text" value="0.59"/>	<input type="text" value="0.57"/>	<input type="text" value="0.57"/>	<input type="text" value="0.55"/>	<input type="text" value="0.55"/>	<input type="text" value="0.55"/>	<input type="text" value="0.56"/>	<input type="text" value="0.57"/>	<input type="text" value="0.57"/>	<input type="text" value="0.58"/> (24d)
--	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	---

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in (25)	<input type="text" value="0.59"/>	<input type="text" value="0.59"/>	<input type="text" value="0.59"/>	<input type="text" value="0.57"/>	<input type="text" value="0.57"/>	<input type="text" value="0.55"/>	<input type="text" value="0.55"/>	<input type="text" value="0.55"/>	<input type="text" value="0.56"/>	<input type="text" value="0.57"/>	<input type="text" value="0.57"/>	<input type="text" value="0.58"/> (25)
--	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	--

3. Heat losses and heat loss parameter

Element	Gross area, m ²	Openings m ²	Net area A, m ²	U-value W/m ² K	A x U W/K	κ-value, kJ/m ² .K	A x κ, kJ/K					
Door			2.10	1.00	2.10		(26)					
Window			12.10	1.33	16.04		(27)					
External wall			88.80	0.18	15.98		(29a)					
Total area of external elements ΣA, m ²			103.00				(31)					
Fabric heat loss, W/K = Σ(A x U)						(26)...(30) + (32) =	34.13 (33)					
Heat capacity Cm = Σ(A x κ)						(28)...(30) + (32) + (32a)...(32e) =	N/A (34)					
Thermal mass parameter (TMP) in kJ/m ² K							250.00 (35)					
Thermal bridges: Σ(L x Ψ) calculated using Appendix K							7.92 (36)					
Total fabric heat loss						(33) + (36) =	42.05 (37)					
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ventilation heat loss calculated monthly 0.33 x (25)m x (5)	38.81	38.57	38.34	37.23	37.02	36.06	36.06	35.88	36.43	37.02	37.44	37.88
Heat transfer coefficient, W/K (37)m + (38)m	80.86	80.62	80.39	79.28	79.07	78.11	78.11	77.93	78.48	79.07	79.49	79.93
	Average = Σ(39)1...12/12 =											79.28 (39)
Heat loss parameter (HLP), W/m ² K (39)m ÷ (4)	1.02	1.02	1.02	1.00	1.00	0.99	0.99	0.99	0.99	1.00	1.00	1.01
	Average = Σ(40)1...12/12 =											1.00 (40)
Number of days in month (Table 1a)	31.00	28.00	31.00	30.00	31.00	30.00	31.00	31.00	30.00	31.00	30.00	31.00

4. Water heating energy requirement

Assumed occupancy, N												2.45	(42)
Annual average hot water usage in litres per day Vd,average = (25 x N) + 36												92.28	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)	101.51	97.82	94.13	90.44	86.75	83.05	83.05	86.75	90.44	94.13	97.82	101.51	
	Σ(44)1...12 =											1107.39	(44)
Energy content of hot water used = 4.18 x Vd,m x nm x Tm/3600 kWh/month (see Tables 1b, 1c 1d)	150.54	131.66	135.86	118.45	113.65	98.07	90.88	104.29	105.53	122.99	134.25	145.79	
	Σ(45)1...12 =											1451.96	(45)
Distribution loss 0.15 x (45)m	22.58	19.75	20.38	17.77	17.05	14.71	13.63	15.64	15.83	18.45	20.14	21.87	
Water storage loss calculated for each month (55) x (41)m	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
If the vessel contains dedicated solar storage or dedicated WWHRS (56)m x [(47) - Vs] ÷ (47), else (56)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Primary circuit loss for each month from Table 3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Combi loss for each month from Table 3a, 3b or 3c	50.96	45.02	47.97	44.60	44.20	40.96	42.32	44.20	44.60	47.97	48.24	50.96	
Total heat required for water heating calculated for each month 0.85 x (45)m + (46)m + (57)m + (59)m + (61)m	201.50	176.68	183.83	163.05	157.86	139.03	133.20	148.49	150.13	170.95	182.49	196.75	
Solar DHW input calculated using Appendix G or Appendix H	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	

Output from water heater for each month (kWh/month) (62)m + (63)m

201.50	176.68	183.83	163.05	157.86	139.03	133.20	148.49	150.13	170.95	182.49	196.75
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

$$\Sigma(64)1\dots12 = 2003.96 \quad (64)$$

Heat gains from water heating (kWh/month) $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

62.79	55.03	57.17	50.53	48.84	42.85	40.80	45.73	46.24	52.88	56.70	61.21
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(65)

5. Internal gains

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

Metabolic gains (Table 5)

122.28	122.28	122.28	122.28	122.28	122.28	122.28	122.28	122.28	122.28	122.28	122.28
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

(66)

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

20.42	18.14	14.75	11.17	8.35	7.05	7.61	9.90	13.28	16.87	19.69	20.99
-------	-------	-------	-------	------	------	------	------	-------	-------	-------	-------

(67)

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

217.55	219.81	214.12	202.01	186.72	172.35	162.75	160.50	166.18	178.29	193.58	207.95
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

(68)

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

35.23	35.23	35.23	35.23	35.23	35.23	35.23	35.23	35.23	35.23	35.23	35.23
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(69)

Pump and fan gains (Table 5a)

3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
------	------	------	------	------	------	------	------	------	------	------	------

(70)

Losses e.g. evaporation (Table 5)

-97.82	-97.82	-97.82	-97.82	-97.82	-97.82	-97.82	-97.82	-97.82	-97.82	-97.82	-97.82
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

(71)

Water heating gains (Table 5)

84.40	81.89	76.84	70.19	65.65	59.51	54.84	61.46	64.22	71.08	78.75	82.28
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(72)

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

385.05	382.52	368.39	346.04	323.40	301.59	287.89	294.54	306.37	328.93	354.70	373.90
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

(73)

6. Solar gains

	Access factor Table 6d	Area m ²	Solar flux W/m ²	g specific data or Table 6b	FF specific data or Table 6c	Gains W
--	---------------------------	------------------------	--------------------------------	-----------------------------------	------------------------------------	------------

SouthWest $\left[\begin{array}{c} 0.77 \\ \times \\ 4.84 \\ \times \\ 36.79 \\ \times 0.9 \\ \times \\ 0.63 \\ \times \\ 0.70 \\ = \end{array} \right] = 54.42 \quad (79)$

NorthWest $\left[\begin{array}{c} 0.77 \\ \times \\ 4.84 \\ \times \\ 11.28 \\ \times 0.9 \\ \times \\ 0.63 \\ \times \\ 0.70 \\ = \end{array} \right] = 16.69 \quad (81)$

SouthEast $\left[\begin{array}{c} 0.77 \\ \times \\ 2.42 \\ \times \\ 36.79 \\ \times 0.9 \\ \times \\ 0.63 \\ \times \\ 0.70 \\ = \end{array} \right] = 27.21 \quad (77)$

Solar gains in watts $\Sigma(74)m\dots(82)m$

98.33	173.03	251.47	336.26	399.17	406.19	387.49	339.04	280.60	195.20	118.78	83.49
-------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------

(83)

Total gains - internal and solar (73)m + (83)m

483.38	555.55	619.86	682.31	722.57	707.79	675.38	633.58	586.97	524.13	473.48	457.39
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

(84)

7. Mean internal temperature (heating season)

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

$$21.00 \quad (85)$$

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

Utilisation factor for gains for living area n1,m (see Table 9a)

1.00	0.99	0.99	0.95	0.86	0.67	0.50	0.56	0.81	0.97	1.00	1.00
------	------	------	------	------	------	------	------	------	------	------	------

(86)

Mean internal temp of living area T1 (steps 3 to 7 in Table 9c)

19.94	20.09	20.33	20.62	20.86	20.97	21.00	20.99	20.92	20.62	20.23	19.92
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(87)

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

20.06	20.07	20.07	20.08	20.08	20.09	20.09	20.10	20.09	20.08	20.08	20.07
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(88)

Utilisation factor for gains for rest of dwelling n2,m

1.00	0.99	0.98	0.94	0.81	0.59	0.40	0.45	0.74	0.96	0.99	1.00
------	------	------	------	------	------	------	------	------	------	------	------

(89)

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

18.65	18.87	19.21	19.64	19.95	20.08	20.09	20.09	20.03	19.64	19.08	18.62	(90)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Living area fraction

Living area ÷ (4) = (91)

Mean internal temperature for the whole dwelling $FLA \times T1 + (1 - fLA) \times T2$

19.22	19.40	19.70	20.07	20.34	20.47	20.49	20.48	20.42	20.07	19.58	19.19	(92)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

19.22	19.40	19.70	20.07	20.34	20.47	20.49	20.48	20.42	20.07	19.58	19.19	(93)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

8. Space heating requirement

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

Utilisation factor for gains, η_m

1.00	0.99	0.98	0.94	0.82	0.63	0.45	0.50	0.77	0.96	0.99	1.00	(94)
------	------	------	------	------	------	------	------	------	------	------	------	------

Useful gains, $\eta_m G_m$, W (94)m x (84)m

481.53	550.80	606.44	638.25	595.82	443.84	301.77	315.19	452.02	500.80	469.53	456.08	(95)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Monthly average external temperature from Table U1

4.30	4.90	6.50	8.90	11.70	14.60	16.60	16.40	14.10	10.60	7.10	4.20	(96)
------	------	------	------	-------	-------	-------	-------	-------	-------	------	------	------

Heat loss rate for mean internal temperature, L_m , W [(39)m x ((93)m - (96)m)]

1206.18	1169.38	1060.77	885.36	683.45	458.26	303.55	318.35	495.85	748.44	991.91	1198.14	(97)
---------	---------	---------	--------	--------	--------	--------	--------	--------	--------	--------	---------	------

Space heating requirement, kWh/month $0.024 \times [(97)m - (95)m] \times (41)m$

539.14	415.69	338.02	177.92	65.20	0.00	0.00	0.00	0.00	184.24	376.11	552.09	(98)
--------	--------	--------	--------	-------	------	------	------	------	--------	--------	--------	------

$\Sigma(98)_{1...5, 10...12} =$ (98)

Space heating requirement kWh/m²/year

$(98) \div (4) =$ (99)

9a. Energy requirements - individual heating systems including micro-CHP

Space heating

Fraction of space heat from secondary/supplementary system (table 11)

(201)

Fraction of space heat from main system(s)

$1 - (201) =$ (202)

Fraction of space heat from main system 2

(202)

Fraction of total space heat from main system 1

$(202) \times [1 - (203)] =$ (204)

Fraction of total space heat from main system 2

$(202) \times (203) =$ (205)

Efficiency of main system 1 (%)

(206)

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

Space heating fuel (main system 1), kWh/month

577.24	445.06	361.91	190.49	69.81	0.00	0.00	0.00	0.00	197.26	402.69	591.11	(211)
--------	--------	--------	--------	-------	------	------	------	------	--------	--------	--------	-------

$\Sigma(211)_{1...5, 10...12} =$ (211)

Water heating

Efficiency of water heater

87.41	87.13	86.56	85.27	83.01	80.30	80.30	80.30	80.30	85.24	86.83	87.51	(217)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

Water heating fuel, kWh/month

230.52	202.78	212.36	191.21	190.17	173.14	165.88	184.92	186.96	200.56	210.16	224.83	(219)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------

$\Sigma(219a)_{1...12} =$ (219)

Annual totals

Space heating fuel - main system 1

Water heating fuel

Electricity for pumps, fans and electric keep-hot (Table 4f)

central heating pump or water pump within warm air heating unit

(230c)

boiler flue fan

(230e)

Total electricity for the above, kWh/year

(231)

Electricity for lighting (Appendix L)

(232)

10a. Fuel costs - individual heating systems including micro-CHP

	Fuel kWh/year		Fuel price		Fuel cost £/year	
Space heating - main system 1	2835.57	x	3.48	x 0.01 =	98.68	(240)
Water heating	2373.49	x	3.48	x 0.01 =	82.60	(247)
Pumps and fans	75.00	x	13.19	x 0.01 =	9.89	(249)
Electricity for lighting	360.60	x	13.19	x 0.01 =	47.56	(250)
Additional standing charges					120.00	(251)
Total energy cost				(240)...(242) + (245)...(254) =	358.73	(255)

11a. SAP rating - individual heating systems including micro-CHP

Energy cost deflator (Table 12)	0.42	(256)
Energy cost factor (ECF)	1.21	(257)
SAP value	83.06	
SAP rating (section 13)	83	(258)
SAP band	B	

12a. CO₂ emissions - individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO ₂ /kWh		Emissions kg CO ₂ /year	
Space heating - main system 1	2835.57	x	0.216	=	612.48	(261)
Water heating	2373.49	x	0.216	=	512.67	(264)
Space and water heating				(261) + (262) + (263) + (264) =	1125.16	(265)
Pumps and fans	75.00	x	0.519	=	38.93	(267)
Electricity for lighting	360.60	x	0.519	=	187.15	(268)
Total CO ₂ , kg/year				(265)...(271) =	1351.23	(272)
Dwelling CO ₂ emission rate				(272) ÷ (4) =	17.08	(273)
EI value					85.41	
EI rating (section 14)					85	(274)
EI band					B	

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

	Energy kWh/year		Primary factor		Primary Energy kWh/year	
Space heating - main system 1	2835.57	x	1.22	=	3459.40	(261)
Water heating	2373.49	x	1.22	=	2895.66	(264)
Space and water heating				(261) + (262) + (263) + (264) =	6355.06	(265)
Pumps and fans	75.00	x	3.07	=	230.25	(267)
Electricity for lighting	360.60	x	3.07	=	1107.04	(268)
Primary energy kWh/year					7692.34	(272)
Dwelling primary energy rate kWh/m ² /year					97.25	(273)

This design submission has been carried out using Approved SAP software. It has been prepared from plans and specifications and may not reflect the property as constructed.

Assessor name	Mr Stuart Searle	Assessor number	3519
Client	Avis Appleton & Associates	Last modified	14/09/2016
Address	PT1 Liffords Place, London, SW13		

1. Overall dwelling dimensions

	Area (m ²)	Average storey height (m)	Volume (m ³)
Lowest occupied	<input type="text" value="52.40"/> (1a) x	<input type="text" value="2.50"/> (2a) =	<input type="text" value="131.00"/> (3a)
Total floor area	(1a) + (1b) + (1c) + (1d)...(1n) = <input type="text" value="52.40"/> (4)		
Dwelling volume	(3a) + (3b) + (3c) + (3d)...(3n) = <input type="text" value="131.00"/> (5)		

2. Ventilation rate

		m ³ per hour
Number of chimneys	<input type="text" value="0"/> x 40 =	<input type="text" value="0"/> (6a)
Number of open flues	<input type="text" value="0"/> x 20 =	<input type="text" value="0"/> (6b)
Number of intermittent fans	<input type="text" value="2"/> x 10 =	<input type="text" value="20"/> (7a)
Number of passive vents	<input type="text" value="0"/> x 10 =	<input type="text" value="0"/> (7b)
Number of flueless gas fires	<input type="text" value="0"/> x 40 =	<input type="text" value="0"/> (7c)

	Air changes per hour
Infiltration due to chimneys, flues, fans, PSVs	(6a) + (6b) + (7a) + (7b) + (7c) = <input type="text" value="20"/> ÷ (5) = <input type="text" value="0.15"/> (8)

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

Air permeability value, q ₅₀ , expressed in cubic metres per hour per square metre of envelope area	<input type="text" value="5.00"/> (17)
--	--

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)	<input type="text" value="0.40"/> (18)
--	--

Number of sides on which the dwelling is sheltered	<input type="text" value="2"/> (19)
--	-------------------------------------

Shelter factor	1 - [0.075 x (19)] = <input type="text" value="0.85"/> (20)
----------------	---

Infiltration rate incorporating shelter factor	(18) x (20) = <input type="text" value="0.34"/> (21)
--	--

Infiltration rate modified for monthly wind speed:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table U2	<input type="text" value="5.10"/>	<input type="text" value="5.00"/>	<input type="text" value="4.90"/>	<input type="text" value="4.40"/>	<input type="text" value="4.30"/>	<input type="text" value="3.80"/>	<input type="text" value="3.80"/>	<input type="text" value="3.70"/>	<input type="text" value="4.00"/>	<input type="text" value="4.30"/>	<input type="text" value="4.50"/>	<input type="text" value="4.70"/>

Wind factor (22)m ÷ 4	<input type="text" value="1.28"/>	<input type="text" value="1.25"/>	<input type="text" value="1.23"/>	<input type="text" value="1.10"/>	<input type="text" value="1.08"/>	<input type="text" value="0.95"/>	<input type="text" value="0.95"/>	<input type="text" value="0.93"/>	<input type="text" value="1.00"/>	<input type="text" value="1.08"/>	<input type="text" value="1.13"/>	<input type="text" value="1.18"/>
-----------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------

Adjusted infiltration rate (allowing for shelter and wind factor) (21) x (22a)m	<input type="text" value="0.44"/>	<input type="text" value="0.43"/>	<input type="text" value="0.42"/>	<input type="text" value="0.38"/>	<input type="text" value="0.37"/>	<input type="text" value="0.33"/>	<input type="text" value="0.33"/>	<input type="text" value="0.32"/>	<input type="text" value="0.34"/>	<input type="text" value="0.37"/>	<input type="text" value="0.39"/>	<input type="text" value="0.40"/>
---	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------

Calculate effective air change rate for the applicable case:

If mechanical ventilation: air change rate through system	<input type="text" value="N/A"/> (23a)
---	--

If balanced with heat recovery: efficiency in % allowing for in-use factor from Table 4h	<input type="text" value="N/A"/> (23c)
--	--

d) natural ventilation or whole house positive input ventilation from loft	<input type="text" value="0.60"/>	<input type="text" value="0.59"/>	<input type="text" value="0.59"/>	<input type="text" value="0.57"/>	<input type="text" value="0.57"/>	<input type="text" value="0.55"/>	<input type="text" value="0.55"/>	<input type="text" value="0.55"/>	<input type="text" value="0.56"/>	<input type="text" value="0.57"/>	<input type="text" value="0.57"/>	<input type="text" value="0.58"/>
--	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in (25)	<input type="text" value="0.60"/>	<input type="text" value="0.59"/>	<input type="text" value="0.59"/>	<input type="text" value="0.57"/>	<input type="text" value="0.57"/>	<input type="text" value="0.55"/>	<input type="text" value="0.55"/>	<input type="text" value="0.55"/>	<input type="text" value="0.56"/>	<input type="text" value="0.57"/>	<input type="text" value="0.57"/>	<input type="text" value="0.58"/>
--	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------

3. Heat losses and heat loss parameter

Element	Gross area, m ²	Openings m ²	Net area A, m ²	U-value W/m ² K	A x U W/K	κ-value, kJ/m ² .K	A x κ, kJ/K						
Door			2.10	1.00	2.10		(26)						
Window			10.99	1.33	14.57		(27)						
External wall			69.86	0.18	12.57		(29a)						
Roof			57.64	0.13	7.49		(30)						
Total area of external elements ΣA, m ²			140.59				(31)						
Fabric heat loss, W/K = Σ(A x U)					(26)...(30) + (32) =	36.74	(33)						
Heat capacity Cm = Σ(A x κ)					(28)...(30) + (32) + (32a)...(32e) =	N/A	(34)						
Thermal mass parameter (TMP) in kJ/m ² K						250.00	(35)						
Thermal bridges: Σ(L x Ψ) calculated using Appendix K						20.54	(36)						
Total fabric heat loss					(33) + (36) =	57.27	(37)						
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ventilation heat loss calculated monthly 0.33 x (25)m x (5)	25.73	25.57	25.41	24.68	24.54	23.90	23.90	23.78	24.15	24.54	24.82	25.11	
Heat transfer coefficient, W/K (37)m + (38)m	83.01	82.85	82.69	81.95	81.82	81.17	81.17	81.06	81.42	81.82	82.09	82.39	
	Average = Σ(39)1...12/12 =											81.95	(39)
Heat loss parameter (HLP), W/m ² K (39)m ÷ (4)	1.58	1.58	1.58	1.56	1.56	1.55	1.55	1.55	1.55	1.56	1.57	1.57	
	Average = Σ(40)1...12/12 =											1.56	(40)
Number of days in month (Table 1a)	31.00	28.00	31.00	30.00	31.00	30.00	31.00	31.00	30.00	31.00	30.00	31.00	
	(40)												

4. Water heating energy requirement

Assumed occupancy, N												1.76	(42)
Annual average hot water usage in litres per day Vd,average = (25 x N) + 36												76.02	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)	83.62	80.58	77.54	74.50	71.46	68.42	68.42	71.46	74.50	77.54	80.58	83.62	
	Σ(44)1...12 =											912.25	(44)
Energy content of hot water used = 4.18 x Vd,m x nm x Tm/3600 kWh/month (see Tables 1b, 1c 1d)	124.01	108.46	111.92	97.58	93.63	80.79	74.87	85.91	86.94	101.32	110.59	120.10	
	Σ(45)1...12 =											1196.10	(45)
Distribution loss 0.15 x (45)m	18.60	16.27	16.79	14.64	14.04	12.12	11.23	12.89	13.04	15.20	16.59	18.01	
	(46)												
Water storage loss calculated for each month (55) x (41)m	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
	(56)												
If the vessel contains dedicated solar storage or dedicated WWHRS (56)m x [(47) - Vs] ÷ (47), else (56)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
	(57)												
Primary circuit loss for each month from Table 3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
	(59)												
Combi loss for each month from Table 3a, 3b or 3c	42.61	37.09	39.51	36.74	36.41	33.74	34.87	36.41	36.74	39.51	39.74	42.61	
	(61)												
Total heat required for water heating calculated for each month 0.85 x (45)m + (46)m + (57)m + (59)m + (61)m	166.62	145.55	151.44	134.32	130.04	114.53	109.73	122.32	123.68	140.83	150.33	162.71	
	(62)												
Solar DHW input calculated using Appendix G or Appendix H													

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(63)
------	------	------	------	------	------	------	------	------	------	------	------	------	------

Output from water heater for each month (kWh/month) (62)m + (63)m

166.62	145.55	151.44	134.32	130.04	114.53	109.73	122.32	123.68	140.83	150.33	162.71	$\Sigma(64)1...12 =$ 1652.10	(64)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------------------------------	------

Heat gains from water heating (kWh/month) $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

51.89	45.34	47.09	41.63	40.23	35.30	33.61	37.67	38.09	43.57	46.71	50.59	(65)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

5. Internal gains

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

Metabolic gains (Table 5)

88.04	88.04	88.04	88.04	88.04	88.04	88.04	88.04	88.04	88.04	88.04	88.04	(66)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

13.72	12.19	9.91	7.50	5.61	4.73	5.12	6.65	8.93	11.33	13.23	14.10	(67)
-------	-------	------	------	------	------	------	------	------	-------	-------	-------	------

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

153.46	155.06	151.04	142.50	131.72	121.58	114.81	113.22	117.23	125.77	136.56	146.69	(68)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

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

31.80	31.80	31.80	31.80	31.80	31.80	31.80	31.80	31.80	31.80	31.80	31.80	(69)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Pump and fan gains (Table 5a)

3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	(70)
------	------	------	------	------	------	------	------	------	------	------	------	------

Losses e.g. evaporation (Table 5)

-70.43	-70.43	-70.43	-70.43	-70.43	-70.43	-70.43	-70.43	-70.43	-70.43	-70.43	-70.43	(71)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Water heating gains (Table 5)

69.74	67.46	63.30	57.82	54.08	49.03	45.17	50.63	52.90	58.56	64.87	67.99	(72)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

289.34	287.12	276.66	260.23	243.82	227.75	217.51	222.91	231.47	248.07	267.07	281.20	(73)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

6. Solar gains

	Access factor Table 6d	Area m ²	Solar flux W/m ²	g specific data or Table 6b	FF specific data or Table 6c	Gains W
--	---------------------------	------------------------	--------------------------------	-----------------------------------	------------------------------------	------------

SouthWest $0.77 \times 5.37 \times 36.79 \times 0.9 \times 0.63 \times 0.70 = 60.38$ (79)

NorthEast $0.77 \times 5.62 \times 11.28 \times 0.9 \times 0.63 \times 0.70 = 19.38$ (75)

Solar gains in watts $\Sigma(74)m...(82)m$

79.76	142.30	211.80	291.09	352.20	361.16	343.41	296.06	238.98	161.88	96.71	67.50	(83)
-------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	-------	------

Total gains - internal and solar (73)m + (83)m

369.10	429.42	488.46	551.32	596.02	588.92	560.92	518.97	470.46	409.96	363.78	348.70	(84)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

7. Mean internal temperature (heating season)

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

21.00 (85)

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

Utilisation factor for gains for living area n1,m (see Table 9a)

1.00	0.99	0.98	0.95	0.88	0.75	0.59	0.65	0.86	0.97	0.99	1.00	(86)
------	------	------	------	------	------	------	------	------	------	------	------	------

Mean internal temp of living area T1 (steps 3 to 7 in Table 9c)

19.31	19.49	19.80	20.22	20.61	20.87	20.96	20.94	20.74	20.24	19.70	19.27	(87)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

19.63	19.63	19.63	19.64	19.64	19.65	19.65	19.65	19.65	19.64	19.64	19.63	(88)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Utilisation factor for gains for rest of dwelling n2,m

0.99	0.99	0.98	0.94	0.83	0.64	0.43	0.49	0.78	0.95	0.99	1.00	(89)
------	------	------	------	------	------	------	------	------	------	------	------	------

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

17.42	17.69	18.15	18.75	19.27	19.56	19.64	19.63	19.44	18.79	18.00	17.38	(90)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Living area fraction

Living area ÷ (4) = (91)

Mean internal temperature for the whole dwelling $fLA \times T1 + (1 - fLA) \times T2$

18.29	18.52	18.91	19.43	19.89	20.17	20.25	20.24	20.04	19.46	18.79	18.26	(92)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

18.29	18.52	18.91	19.43	19.89	20.17	20.25	20.24	20.04	19.46	18.79	18.26	(93)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

8. Space heating requirement

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

Utilisation factor for gains, η_m

0.99	0.99	0.97	0.93	0.84	0.68	0.51	0.57	0.81	0.95	0.99	0.99	(94)
------	------	------	------	------	------	------	------	------	------	------	------	------

Useful gains, $\eta_m G_m$, W (94)m x (84)m

366.28	423.39	474.31	513.46	502.02	401.98	284.74	293.47	381.17	390.22	358.86	346.55	(95)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Monthly average external temperature from Table U1

4.30	4.90	6.50	8.90	11.70	14.60	16.60	16.40	14.10	10.60	7.10	4.20	(96)
------	------	------	------	-------	-------	-------	-------	-------	-------	------	------	------

Heat loss rate for mean internal temperature, L_m , W [(39)m x ((93)m - (96)m)]

1161.56	1128.59	1026.34	863.01	669.72	451.82	296.15	310.95	483.81	725.08	959.50	1157.96	(97)
---------	---------	---------	--------	--------	--------	--------	--------	--------	--------	--------	---------	------

Space heating requirement, kWh/month $0.024 \times [(97)m - (95)m] \times (41)m$

591.69	473.89	410.72	251.68	124.77	0.00	0.00	0.00	0.00	249.13	432.46	603.69	(98)
--------	--------	--------	--------	--------	------	------	------	------	--------	--------	--------	------

$\Sigma(98)_{1...5, 10...12} =$ (98)

Space heating requirement kWh/m²/year

$(98) \div (4) =$ (99)

9a. Energy requirements - individual heating systems including micro-CHP

Space heating

Fraction of space heat from secondary/supplementary system (table 11)

(201)

Fraction of space heat from main system(s)

$1 - (201) =$ (202)

Fraction of space heat from main system 2

(202)

Fraction of total space heat from main system 1

$(202) \times [1 - (203)] =$ (204)

Fraction of total space heat from main system 2

$(202) \times (203) =$ (205)

Efficiency of main system 1 (%)

(206)

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

Space heating fuel (main system 1), kWh/month

633.50	507.38	439.74	269.46	133.59	0.00	0.00	0.00	0.00	266.74	463.02	646.35	(211)
--------	--------	--------	--------	--------	------	------	------	------	--------	--------	--------	-------

$\Sigma(211)_{1...5, 10...12} =$ (211)

Water heating

Efficiency of water heater

87.97	87.80	87.44	86.61	84.95	80.30	80.30	80.30	80.30	86.47	87.56	88.05	(217)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

Water heating fuel, kWh/month

189.41	165.76	173.19	155.08	153.08	142.63	136.65	152.33	154.02	162.86	171.69	184.80	(219)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------

$\Sigma(219a)_{1...12} =$ (219)

Annual totals

Space heating fuel - main system 1

Water heating fuel

Electricity for pumps, fans and electric keep-hot (Table 4f)

central heating pump or water pump within warm air heating unit

(230c)

boiler flue fan

(230e)

Total electricity for the above, kWh/year

(231)

Electricity for lighting (Appendix L)

(232)

10a. Fuel costs - individual heating systems including micro-CHP

	Fuel kWh/year		Fuel price		Fuel cost £/year	
Space heating - main system 1	3359.77	x	3.48	x 0.01 =	116.92	(240)
Water heating	1941.52	x	3.48	x 0.01 =	67.56	(247)
Pumps and fans	75.00	x	13.19	x 0.01 =	9.89	(249)
Electricity for lighting	242.30	x	13.19	x 0.01 =	31.96	(250)
Additional standing charges					120.00	(251)
Total energy cost				(240)...(242) + (245)...(254) =	346.34	(255)

11a. SAP rating - individual heating systems including micro-CHP

Energy cost deflator (Table 12)	0.42	(256)
Energy cost factor (ECF)	1.49	(257)
SAP value	79.17	
SAP rating (section 13)	79	(258)
SAP band	C	

12a. CO₂ emissions - individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO ₂ /kWh		Emissions kg CO ₂ /year	
Space heating - main system 1	3359.77	x	0.216	=	725.71	(261)
Water heating	1941.52	x	0.216	=	419.37	(264)
Space and water heating				(261) + (262) + (263) + (264) =	1145.08	(265)
Pumps and fans	75.00	x	0.519	=	38.93	(267)
Electricity for lighting	242.30	x	0.519	=	125.75	(268)
Total CO ₂ , kg/year				(265)...(271) =	1309.76	(272)
Dwelling CO ₂ emission rate				(272) ÷ (4) =	25.00	(273)
EI value					81.98	
EI rating (section 14)					82	(274)
EI band					B	

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

	Energy kWh/year		Primary factor		Primary Energy kWh/year	
Space heating - main system 1	3359.77	x	1.22	=	4098.91	(261)
Water heating	1941.52	x	1.22	=	2368.65	(264)
Space and water heating				(261) + (262) + (263) + (264) =	6467.57	(265)
Pumps and fans	75.00	x	3.07	=	230.25	(267)
Electricity for lighting	242.30	x	3.07	=	743.87	(268)
Primary energy kWh/year					7441.68	(272)
Dwelling primary energy rate kWh/m ² /year					142.02	(273)

This design submission has been carried out using Approved SAP software. It has been prepared from plans and specifications and may not reflect the property as constructed.

Assessor name	Mr Stuart Searle	Assessor number	3519
Client	Avis Appleton & Associates	Last modified	14/09/2016
Address	PT2 Liffords Place, London, SW13		

1. Overall dwelling dimensions

	Area (m ²)	Average storey height (m)	Volume (m ³)
Lowest occupied	<input type="text" value="52.40"/> (1a)	<input type="text" value="2.50"/> (2a)	<input type="text" value="131.00"/> (3a)
Total floor area	(1a) + (1b) + (1c) + (1d)...(1n) =		<input type="text" value="52.40"/> (4)
Dwelling volume	(3a) + (3b) + (3c) + (3d)...(3n) =		<input type="text" value="131.00"/> (5)

2. Ventilation rate

		m ³ per hour
Number of chimneys	<input type="text" value="0"/> x 40 =	<input type="text" value="0"/> (6a)
Number of open flues	<input type="text" value="0"/> x 20 =	<input type="text" value="0"/> (6b)
Number of intermittent fans	<input type="text" value="2"/> x 10 =	<input type="text" value="20"/> (7a)
Number of passive vents	<input type="text" value="0"/> x 10 =	<input type="text" value="0"/> (7b)
Number of flueless gas fires	<input type="text" value="0"/> x 40 =	<input type="text" value="0"/> (7c)

	Air changes per hour
Infiltration due to chimneys, flues, fans, PSVs	(6a) + (6b) + (7a) + (7b) + (7c) = <input type="text" value="20"/> ÷ (5) = <input type="text" value="0.15"/> (8)

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

Air permeability value, q ₅₀ , expressed in cubic metres per hour per square metre of envelope area	<input type="text" value="5.00"/> (17)
--	--

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)	<input type="text" value="0.40"/> (18)
--	--

Number of sides on which the dwelling is sheltered	<input type="text" value="2"/> (19)
--	-------------------------------------

Shelter factor	1 - [0.075 x (19)] = <input type="text" value="0.85"/> (20)
----------------	---

Infiltration rate incorporating shelter factor	(18) x (20) = <input type="text" value="0.34"/> (21)
--	--

Infiltration rate modified for monthly wind speed:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table U2	<input type="text" value="5.10"/>	<input type="text" value="5.00"/>	<input type="text" value="4.90"/>	<input type="text" value="4.40"/>	<input type="text" value="4.30"/>	<input type="text" value="3.80"/>	<input type="text" value="3.80"/>	<input type="text" value="3.70"/>	<input type="text" value="4.00"/>	<input type="text" value="4.30"/>	<input type="text" value="4.50"/>	<input type="text" value="4.70"/>

Wind factor (22)m ÷ 4	<input type="text" value="1.28"/>	<input type="text" value="1.25"/>	<input type="text" value="1.23"/>	<input type="text" value="1.10"/>	<input type="text" value="1.08"/>	<input type="text" value="0.95"/>	<input type="text" value="0.95"/>	<input type="text" value="0.93"/>	<input type="text" value="1.00"/>	<input type="text" value="1.08"/>	<input type="text" value="1.13"/>	<input type="text" value="1.18"/>
-----------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------

Adjusted infiltration rate (allowing for shelter and wind factor) (21) x (22a)m	<input type="text" value="0.44"/>	<input type="text" value="0.43"/>	<input type="text" value="0.42"/>	<input type="text" value="0.38"/>	<input type="text" value="0.37"/>	<input type="text" value="0.33"/>	<input type="text" value="0.33"/>	<input type="text" value="0.32"/>	<input type="text" value="0.34"/>	<input type="text" value="0.37"/>	<input type="text" value="0.39"/>	<input type="text" value="0.40"/>
---	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------

Calculate effective air change rate for the applicable case:

If mechanical ventilation: air change rate through system	<input type="text" value="N/A"/> (23a)
---	--

If balanced with heat recovery: efficiency in % allowing for in-use factor from Table 4h	<input type="text" value="N/A"/> (23c)
--	--

d) natural ventilation or whole house positive input ventilation from loft	<input type="text" value="0.60"/>	<input type="text" value="0.59"/>	<input type="text" value="0.59"/>	<input type="text" value="0.57"/>	<input type="text" value="0.57"/>	<input type="text" value="0.55"/>	<input type="text" value="0.55"/>	<input type="text" value="0.55"/>	<input type="text" value="0.56"/>	<input type="text" value="0.57"/>	<input type="text" value="0.57"/>	<input type="text" value="0.58"/>
--	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in (25)	<input type="text" value="0.60"/>	<input type="text" value="0.59"/>	<input type="text" value="0.59"/>	<input type="text" value="0.57"/>	<input type="text" value="0.57"/>	<input type="text" value="0.55"/>	<input type="text" value="0.55"/>	<input type="text" value="0.55"/>	<input type="text" value="0.56"/>	<input type="text" value="0.57"/>	<input type="text" value="0.57"/>	<input type="text" value="0.58"/>
--	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------

3. Heat losses and heat loss parameter

Element	Gross area, m ²	Openings m ²	Net area A, m ²	U-value W/m ² K	A x U W/K	κ-value, kJ/m ² .K	A x κ, kJ/K						
Door			2.10	1.00	2.10		(26)						
Window			10.99	1.33	14.57		(27)						
External wall			56.11	0.18	10.10		(29a)						
Party wall			13.75	0.00	0.00		(32)						
Roof			57.64	0.13	7.49		(30)						
Total area of external elements $\sum A, m^2$			126.84				(31)						
Fabric heat loss, W/K = $\sum(A \times U)$					(26)...(30) + (32) =	34.26	(33)						
Heat capacity Cm = $\sum(A \times \kappa)$					(28)...(30) + (32) + (32a)...(32e) =	N/A	(34)						
Thermal mass parameter (TMP) in kJ/m ² K						250.00	(35)						
Thermal bridges: $\sum(L \times \Psi)$ calculated using Appendix K						16.92	(36)						
Total fabric heat loss						(33) + (36) =	51.18 (37)						
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ventilation heat loss calculated monthly $0.33 \times (25)m \times (5)$	25.73	25.57	25.41	24.68	24.54	23.90	23.90	23.78	24.15	24.54	24.82	25.11	(38)
Heat transfer coefficient, W/K (37)m + (38)m	76.92	76.76	76.60	75.86	75.73	75.08	75.08	74.97	75.33	75.73	76.00	76.30	
	Average = $\sum(39)1...12/12 =$											75.86 (39)	
Heat loss parameter (HLP), W/m ² K (39)m ÷ (4)	1.47	1.46	1.46	1.45	1.45	1.43	1.43	1.43	1.44	1.45	1.45	1.46	
	Average = $\sum(40)1...12/12 =$											1.45 (40)	
Number of days in month (Table 1a)	31.00	28.00	31.00	30.00	31.00	30.00	31.00	31.00	30.00	31.00	30.00	31.00	(40)

4. Water heating energy requirement

Assumed occupancy, N													1.76	(42)	
Annual average hot water usage in litres per day $V_{d,average} = (25 \times N) + 36$														76.02	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec			
Hot water usage in litres per day for each month $V_{d,m} = \text{factor from Table 1c} \times (43)$	83.62	80.58	77.54	74.50	71.46	68.42	68.42	71.46	74.50	77.54	80.58	83.62			
	$\sum(44)1...12 =$											912.25	(44)		
Energy content of hot water used = $4.18 \times V_{d,m} \times nm \times T_m/3600$ kWh/month (see Tables 1b, 1c 1d)	124.01	108.46	111.92	97.58	93.63	80.79	74.87	85.91	86.94	101.32	110.59	120.10			
	$\sum(45)1...12 =$											1196.10	(45)		
Distribution loss $0.15 \times (45)m$	18.60	16.27	16.79	14.64	14.04	12.12	11.23	12.89	13.04	15.20	16.59	18.01		(46)	
Water storage loss calculated for each month (55) x (41)m	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		(56)	
If the vessel contains dedicated solar storage or dedicated WWHRS (56)m x [(47) - Vs] ÷ (47), else (56)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		(57)	
Primary circuit loss for each month from Table 3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		(59)	
Combi loss for each month from Table 3a, 3b or 3c	42.61	37.09	39.51	36.74	36.41	33.74	34.87	36.41	36.74	39.51	39.74	42.61		(61)	
Total heat required for water heating calculated for each month $0.85 \times (45)m + (46)m + (57)m + (59)m + (61)m$	166.62	145.55	151.44	134.32	130.04	114.53	109.73	122.32	123.68	140.83	150.33	162.71		(62)	

Solar DHW input calculated using Appendix G or Appendix H

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
------	------	------	------	------	------	------	------	------	------	------	------	------

 (63)

Output from water heater for each month (kWh/month) (62)m + (63)m

166.62	145.55	151.44	134.32	130.04	114.53	109.73	122.32	123.68	140.83	150.33	162.71
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

$\Sigma(64)1...12 = 1652.10$ (64)

Heat gains from water heating (kWh/month) $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

51.89	45.34	47.09	41.63	40.23	35.30	33.61	37.67	38.09	43.57	46.71	50.59
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (65)

5. Internal gains

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

Metabolic gains (Table 5)

88.04	88.04	88.04	88.04	88.04	88.04	88.04	88.04	88.04	88.04	88.04	88.04
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (66)

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

13.72	12.19	9.91	7.50	5.61	4.73	5.12	6.65	8.93	11.33	13.23	14.10
-------	-------	------	------	------	------	------	------	------	-------	-------	-------

 (67)

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

153.46	155.06	151.04	142.50	131.72	121.58	114.81	113.22	117.23	125.77	136.56	146.69
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (68)

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

31.80	31.80	31.80	31.80	31.80	31.80	31.80	31.80	31.80	31.80	31.80	31.80
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (69)

Pump and fan gains (Table 5a)

3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
------	------	------	------	------	------	------	------	------	------	------	------

 (70)

Losses e.g. evaporation (Table 5)

-70.43	-70.43	-70.43	-70.43	-70.43	-70.43	-70.43	-70.43	-70.43	-70.43	-70.43	-70.43
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (71)

Water heating gains (Table 5)

69.74	67.46	63.30	57.82	54.08	49.03	45.17	50.63	52.90	58.56	64.87	67.99
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (72)

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

289.34	287.12	276.66	260.23	243.82	227.75	217.51	222.91	231.47	248.07	267.07	281.20
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (73)

6. Solar gains

Access factor Table 6d	Area m ²	Solar flux W/m ²	g specific data or Table 6b	FF specific data or Table 6c	Gains W
----------------------------------	-------------------------------	---------------------------------------	--	---	-------------------

SouthWest $\boxed{0.77} \times \boxed{5.37} \times \boxed{36.79} \times 0.9 \times \boxed{0.63} \times \boxed{0.70} = \boxed{60.38}$ (79)

NorthEast $\boxed{0.77} \times \boxed{5.62} \times \boxed{11.28} \times 0.9 \times \boxed{0.63} \times \boxed{0.70} = \boxed{19.38}$ (75)

Solar gains in watts $\Sigma(74)m... (82)m$

79.76	142.30	211.80	291.09	352.20	361.16	343.41	296.06	238.98	161.88	96.71	67.50
-------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	-------

 (83)

Total gains - internal and solar (73)m + (83)m

369.10	429.42	488.46	551.32	596.02	588.92	560.92	518.97	470.46	409.96	363.78	348.70
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (84)

7. Mean internal temperature (heating season)

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

21.00

 (85)

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

Utilisation factor for gains for living area n1,m (see Table 9a)

1.00	0.99	0.98	0.95	0.87	0.72	0.56	0.62	0.85	0.97	0.99	1.00
------	------	------	------	------	------	------	------	------	------	------	------

 (86)

Mean internal temp of living area T1 (steps 3 to 7 in Table 9c)

19.45	19.63	19.93	20.33	20.68	20.90	20.97	20.96	20.79	20.34	19.82	19.41
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (87)

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

19.71	19.71	19.72	19.73	19.73	19.74	19.74	19.74	19.73	19.73	19.72	19.72
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (88)

Utilisation factor for gains for rest of dwelling n2,m

0.99	0.99	0.97	0.93	0.82	0.61	0.41	0.47	0.76	0.95	0.99	1.00
------	------	------	------	------	------	------	------	------	------	------	------

 (89)

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

17.68	17.95	18.38	18.96	19.43	19.68	19.73	19.72	19.57	18.98	18.23	17.64	(90)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Living area fraction

Living area ÷ (4) = (91)

Mean internal temperature for the whole dwelling fLA x T1 +(1 - fLA) x T2

18.50	18.72	19.10	19.59	20.01	20.24	20.30	20.30	20.14	19.61	18.96	18.46	(92)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

18.50	18.72	19.10	19.59	20.01	20.24	20.30	20.30	20.14	19.61	18.96	18.46	(93)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

8. Space heating requirement

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

Utilisation factor for gains, ηm

0.99	0.99	0.97	0.93	0.83	0.66	0.48	0.54	0.79	0.95	0.99	0.99	(94)
------	------	------	------	------	------	------	------	------	------	------	------	------

Useful gains, ηmGm, W (94)m x (84)m

366.39	423.43	473.90	510.97	494.06	387.74	270.72	280.27	373.76	389.24	358.91	346.66	(95)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Monthly average external temperature from Table U1

4.30	4.90	6.50	8.90	11.70	14.60	16.60	16.40	14.10	10.60	7.10	4.20	(96)
------	------	------	------	-------	-------	-------	-------	-------	-------	------	------	------

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

1091.93	1060.93	964.97	811.06	628.99	423.66	278.12	292.03	454.74	681.93	901.77	1087.90	(97)
---------	---------	--------	--------	--------	--------	--------	--------	--------	--------	--------	---------	------

Space heating requirement, kWh/month 0.024 x [(97)m - (95)m] x (41)m

539.80	428.40	365.36	216.06	100.39	0.00	0.00	0.00	0.00	217.76	390.86	551.49	(98)
--------	--------	--------	--------	--------	------	------	------	------	--------	--------	--------	------

Σ(98)1...5, 10...12 = (98)

Space heating requirement kWh/m²/year

(98) ÷ (4) = (99)

9a. Energy requirements - individual heating systems including micro-CHP

Space heating

Fraction of space heat from secondary/supplementary system (table 11)

(201)

Fraction of space heat from main system(s)

1 - (201) = (202)

Fraction of space heat from main system 2

(202)

Fraction of total space heat from main system 1

(202) x [1- (203)] = (204)

Fraction of total space heat from main system 2

(202) x (203) = (205)

Efficiency of main system 1 (%)

(206)

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

Space heating fuel (main system 1), kWh/month

577.95	458.67	391.18	231.33	107.48	0.00	0.00	0.00	0.00	233.15	418.48	590.46	(211)
--------	--------	--------	--------	--------	------	------	------	------	--------	--------	--------	-------

Σ(211)1...5, 10...12 = (211)

Water heating

Efficiency of water heater

87.80	87.61	87.19	86.24	84.41	80.30	80.30	80.30	80.30	86.14	87.35	87.88	(217)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

Water heating fuel, kWh/month

189.79	166.14	173.69	155.74	154.06	142.63	136.65	152.33	154.02	163.48	172.11	185.15	(219)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------

Σ(219a)1...12 = (219)

Annual totals

Space heating fuel - main system 1

Water heating fuel

Electricity for pumps, fans and electric keep-hot (Table 4f)

central heating pump or water pump within warm air heating unit

(230c)

boiler flue fan

(230e)

Total electricity for the above, kWh/year

(231)

Electricity for lighting (Appendix L)					242.30	(232)
Total delivered energy for all uses				(211)...(221) + (231) + (232)...(237b) =	5271.79	(238)

10a. Fuel costs - individual heating systems including micro-CHP

	Fuel kWh/year		Fuel price		Fuel cost £/year	
Space heating - main system 1	3008.70	x	3.48	x 0.01 =	104.70	(240)
Water heating	1945.79	x	3.48	x 0.01 =	67.71	(247)
Pumps and fans	75.00	x	13.19	x 0.01 =	9.89	(249)
Electricity for lighting	242.30	x	13.19	x 0.01 =	31.96	(250)
Additional standing charges					120.00	(251)
Total energy cost				(240)...(242) + (245)...(254) =	334.27	(255)

11a. SAP rating - individual heating systems including micro-CHP

Energy cost deflator (Table 12)	0.42	(256)
Energy cost factor (ECF)	1.44	(257)
SAP value	79.89	
SAP rating (section 13)	80	(258)
SAP band	C	

12a. CO₂ emissions - individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO ₂ /kWh		Emissions kg CO ₂ /year	
Space heating - main system 1	3008.70	x	0.216	=	649.88	(261)
Water heating	1945.79	x	0.216	=	420.29	(264)
Space and water heating				(261) + (262) + (263) + (264) =	1070.17	(265)
Pumps and fans	75.00	x	0.519	=	38.93	(267)
Electricity for lighting	242.30	x	0.519	=	125.75	(268)
Total CO ₂ , kg/year				(265)...(271) =	1234.85	(272)
Dwelling CO ₂ emission rate				(272) ÷ (4) =	23.57	(273)
EI value					83.01	
EI rating (section 14)					83	(274)
EI band					B	

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

	Energy kWh/year		Primary factor		Primary Energy kWh/year	
Space heating - main system 1	3008.70	x	1.22	=	3670.62	(261)
Water heating	1945.79	x	1.22	=	2373.86	(264)
Space and water heating				(261) + (262) + (263) + (264) =	6044.48	(265)
Pumps and fans	75.00	x	3.07	=	230.25	(267)
Electricity for lighting	242.30	x	3.07	=	743.87	(268)
Primary energy kWh/year					7018.60	(272)
Dwelling primary energy rate kWh/m ² /year					133.94	(273)

This design submission has been carried out using Approved SAP software. It has been prepared from plans and specifications and may not reflect the property as constructed.

Assessor name	Mr Stuart Searle	Assessor number	3519
Client	Avis Appleton & Associates	Last modified	14/09/2016
Address	PT3 Liffords Place, London, SW13		

1. Overall dwelling dimensions

	Area (m ²)	Average storey height (m)	Volume (m ³)
Lowest occupied	<input type="text" value="37.00"/> (1a) x	<input type="text" value="2.50"/> (2a) =	<input type="text" value="92.50"/> (3a)
Total floor area	(1a) + (1b) + (1c) + (1d)...(1n) = <input type="text" value="37.00"/> (4)		
Dwelling volume	(3a) + (3b) + (3c) + (3d)...(3n) =		<input type="text" value="92.50"/> (5)

2. Ventilation rate

		m ³ per hour
Number of chimneys	<input type="text" value="0"/> x 40 =	<input type="text" value="0"/> (6a)
Number of open flues	<input type="text" value="0"/> x 20 =	<input type="text" value="0"/> (6b)
Number of intermittent fans	<input type="text" value="2"/> x 10 =	<input type="text" value="20"/> (7a)
Number of passive vents	<input type="text" value="0"/> x 10 =	<input type="text" value="0"/> (7b)
Number of flueless gas fires	<input type="text" value="0"/> x 40 =	<input type="text" value="0"/> (7c)

	Air changes per hour
Infiltration due to chimneys, flues, fans, PSVs	(6a) + (6b) + (7a) + (7b) + (7c) = <input type="text" value="20"/> ÷ (5) = <input type="text" value="0.22"/> (8)

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

Air permeability value, q ₅₀ , expressed in cubic metres per hour per square metre of envelope area	<input type="text" value="5.00"/> (17)
--	--

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)	<input type="text" value="0.47"/> (18)
--	--

Number of sides on which the dwelling is sheltered	<input type="text" value="2"/> (19)
--	-------------------------------------

Shelter factor	1 - [0.075 x (19)] = <input type="text" value="0.85"/> (20)
----------------	---

Infiltration rate incorporating shelter factor	(18) x (20) = <input type="text" value="0.40"/> (21)
--	--

Infiltration rate modified for monthly wind speed:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table U2	<input type="text" value="5.10"/>	<input type="text" value="5.00"/>	<input type="text" value="4.90"/>	<input type="text" value="4.40"/>	<input type="text" value="4.30"/>	<input type="text" value="3.80"/>	<input type="text" value="3.80"/>	<input type="text" value="3.70"/>	<input type="text" value="4.00"/>	<input type="text" value="4.30"/>	<input type="text" value="4.50"/>	<input type="text" value="4.70"/>

Wind factor (22)m ÷ 4	<input type="text" value="1.28"/>	<input type="text" value="1.25"/>	<input type="text" value="1.23"/>	<input type="text" value="1.10"/>	<input type="text" value="1.08"/>	<input type="text" value="0.95"/>	<input type="text" value="0.95"/>	<input type="text" value="0.93"/>	<input type="text" value="1.00"/>	<input type="text" value="1.08"/>	<input type="text" value="1.13"/>	<input type="text" value="1.18"/>
-----------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------

Adjusted infiltration rate (allowing for shelter and wind factor) (21) x (22a)m	<input type="text" value="0.51"/>	<input type="text" value="0.50"/>	<input type="text" value="0.49"/>	<input type="text" value="0.44"/>	<input type="text" value="0.43"/>	<input type="text" value="0.38"/>	<input type="text" value="0.38"/>	<input type="text" value="0.37"/>	<input type="text" value="0.40"/>	<input type="text" value="0.43"/>	<input type="text" value="0.45"/>	<input type="text" value="0.47"/>
---	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------

Calculate effective air change rate for the applicable case:

If mechanical ventilation: air change rate through system	<input type="text" value="N/A"/> (23a)
---	--

If balanced with heat recovery: efficiency in % allowing for in-use factor from Table 4h	<input type="text" value="N/A"/> (23c)
--	--

d) natural ventilation or whole house positive input ventilation from loft	<input type="text" value="0.63"/>	<input type="text" value="0.62"/>	<input type="text" value="0.62"/>	<input type="text" value="0.60"/>	<input type="text" value="0.59"/>	<input type="text" value="0.57"/>	<input type="text" value="0.57"/>	<input type="text" value="0.57"/>	<input type="text" value="0.58"/>	<input type="text" value="0.59"/>	<input type="text" value="0.60"/>	<input type="text" value="0.61"/>
--	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in (25)	<input type="text" value="0.63"/>	<input type="text" value="0.62"/>	<input type="text" value="0.62"/>	<input type="text" value="0.60"/>	<input type="text" value="0.59"/>	<input type="text" value="0.57"/>	<input type="text" value="0.57"/>	<input type="text" value="0.57"/>	<input type="text" value="0.58"/>	<input type="text" value="0.59"/>	<input type="text" value="0.60"/>	<input type="text" value="0.61"/>
--	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------

3. Heat losses and heat loss parameter

Element	Gross area, m ²	Openings m ²	Net area A, m ²	U-value W/m ² K	A x U W/K	κ-value, kJ/m ² .K	A x κ, kJ/K						
Door			2.10	1.00	= 2.10		(26)						
Window			6.22	1.33	= 8.25		(27)						
External wall			40.93	0.18	= 7.37		(29a)						
Party wall			13.75	0.00	= 0.00		(32)						
Roof			40.70	0.13	= 5.29		(30)						
Total area of external elements $\sum A$, m ²			89.95				(31)						
Fabric heat loss, W/K = $\sum(A \times U)$					(26)...(30) + (32) =	23.00	(33)						
Heat capacity Cm = $\sum(A \times \kappa)$					(28)...(30) + (32) + (32a)...(32e) =	N/A	(34)						
Thermal mass parameter (TMP) in kJ/m ² K						250.00	(35)						
Thermal bridges: $\sum(L \times \Psi)$ calculated using Appendix K						9.70	(36)						
Total fabric heat loss						(33) + (36) =	32.70 (37)						
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ventilation heat loss calculated monthly 0.33 x (25)m x (5)	19.16	19.01	18.86	18.16	18.03	17.43	17.43	17.31	17.66	18.03	18.30	18.57	(38)
Heat transfer coefficient, W/K (37)m + (38)m	51.86	51.71	51.56	50.87	50.74	50.13	50.13	50.02	50.36	50.74	51.00	51.28	
													Average = $\sum(39)1...12/12 =$ 50.87 (39)
Heat loss parameter (HLP), W/m ² K (39)m ÷ (4)	1.40	1.40	1.39	1.37	1.37	1.35	1.35	1.35	1.36	1.37	1.38	1.39	
													Average = $\sum(40)1...12/12 =$ 1.37 (40)
Number of days in month (Table 1a)	31.00	28.00	31.00	30.00	31.00	30.00	31.00	31.00	30.00	31.00	30.00	31.00	(40)

4. Water heating energy requirement

Assumed occupancy, N													1.33	(42)	
Annual average hot water usage in litres per day Vd,average = (25 x N) + 36														65.77	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec			
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)	72.34	69.71	67.08	64.45	61.82	59.19	59.19	61.82	64.45	67.08	69.71	72.34			
													$\sum(44)1...12 =$ 789.19	(44)	
Energy content of hot water used = 4.18 x Vd,m x nm x Tm/3600 kWh/month (see Tables 1b, 1c 1d)	107.28	93.83	96.82	84.41	81.00	69.89	64.77	74.32	75.21	87.65	95.67	103.90			
													$\sum(45)1...12 =$ 1034.75	(45)	
Distribution loss 0.15 x (45)m	16.09	14.07	14.52	12.66	12.15	10.48	9.71	11.15	11.28	13.15	14.35	15.58	(46)		
Water storage loss calculated for each month (55) x (41)m	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(56)		
If the vessel contains dedicated solar storage or dedicated WWHRS (56)m x [(47) - Vs] ÷ (47), else (56)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(57)		
Primary circuit loss for each month from Table 3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(59)		
Combi loss for each month from Table 3a, 3b or 3c	36.86	32.09	34.18	31.78	31.50	29.19	30.16	31.50	31.78	34.18	34.38	36.86	(61)		
Total heat required for water heating calculated for each month 0.85 x (45)m + (46)m + (57)m + (59)m + (61)m	144.15	125.92	131.01	116.20	112.50	99.08	94.93	105.82	106.99	121.83	130.05	140.76	(62)		

Solar DHW input calculated using Appendix G or Appendix H

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
------	------	------	------	------	------	------	------	------	------	------	------	------

 (63)

Output from water heater for each month (kWh/month) (62)m + (63)m

144.15	125.92	131.01	116.20	112.50	99.08	94.93	105.82	106.99	121.83	130.05	140.76
--------	--------	--------	--------	--------	-------	-------	--------	--------	--------	--------	--------

$\Sigma(64)1...12 = 1429.24$ (64)

Heat gains from water heating (kWh/month) $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

44.89	39.22	40.74	36.01	34.81	30.54	29.08	32.59	32.95	37.69	40.41	43.76
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (65)

5. Internal gains

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

Metabolic gains (Table 5)

66.45	66.45	66.45	66.45	66.45	66.45	66.45	66.45	66.45	66.45	66.45	66.45
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (66)

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

10.51	9.33	7.59	5.75	4.30	3.63	3.92	5.09	6.84	8.68	10.13	10.80
-------	------	------	------	------	------	------	------	------	------	-------	-------

 (67)

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

114.07	115.25	112.27	105.92	97.90	90.37	85.34	84.15	87.14	93.49	101.50	109.04
--------	--------	--------	--------	-------	-------	-------	-------	-------	-------	--------	--------

 (68)

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

29.65	29.65	29.65	29.65	29.65	29.65	29.65	29.65	29.65	29.65	29.65	29.65
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (69)

Pump and fan gains (Table 5a)

3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
------	------	------	------	------	------	------	------	------	------	------	------

 (70)

Losses e.g. evaporation (Table 5)

-53.16	-53.16	-53.16	-53.16	-53.16	-53.16	-53.16	-53.16	-53.16	-53.16	-53.16	-53.16
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (71)

Water heating gains (Table 5)

60.33	58.36	54.76	50.02	46.78	42.41	39.08	43.80	45.77	50.66	56.12	58.82
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (72)

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

230.85	228.89	220.56	207.62	194.92	182.35	174.27	178.98	185.68	198.76	213.69	224.59
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (73)

6. Solar gains

Access factor Table 6d Area m² Solar flux W/m² g specific data or Table 6b FF specific data or Table 6c Gains W

SouthWest $\boxed{0.77} \times \boxed{4.84} \times \boxed{36.79} \times 0.9 \times \boxed{0.63} \times \boxed{0.70} = \boxed{54.42}$ (79)

SouthEast $\boxed{0.77} \times \boxed{1.38} \times \boxed{36.79} \times 0.9 \times \boxed{0.63} \times \boxed{0.70} = \boxed{15.52}$ (77)

Solar gains in watts $\Sigma(74)m... (82)m$

69.94	119.14	163.01	201.98	226.23	224.59	216.53	198.44	176.50	131.67	83.77	59.86
-------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	-------

 (83)

Total gains - internal and solar (73)m + (83)m

300.79	348.02	383.56	409.60	421.15	406.94	390.80	377.42	362.18	330.43	297.47	284.45
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (84)

7. Mean internal temperature (heating season)

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

21.00

 (85)

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

Utilisation factor for gains for living area n1,m (see Table 9a)

0.99	0.99	0.97	0.94	0.86	0.71	0.54	0.58	0.80	0.95	0.99	0.99
------	------	------	------	------	------	------	------	------	------	------	------

 (86)

Mean internal temp of living area T1 (steps 3 to 7 in Table 9c)

19.62	19.81	20.09	20.43	20.73	20.92	20.98	20.97	20.86	20.48	19.99	19.59
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (87)

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

19.76	19.77	19.77	19.78	19.79	19.80	19.80	19.80	19.79	19.79	19.78	19.77
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (88)

Utilisation factor for gains for rest of dwelling n2,m

0.99	0.98	0.96	0.91	0.80	0.61	0.41	0.44	0.71	0.92	0.98	0.99
------	------	------	------	------	------	------	------	------	------	------	------

 (89)

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

17.97	18.25	18.65	19.14	19.53	19.75	19.79	19.79	19.69	19.21	18.51	17.93	(90)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Living area fraction

Living area ÷ (4) = (91)

Mean internal temperature for the whole dwelling fLA x T1 +(1 - fLA) x T2

18.84	19.07	19.41	19.82	20.16	20.36	20.42	20.41	20.30	19.88	19.29	18.81	(92)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

18.84	19.07	19.41	19.82	20.16	20.36	20.42	20.41	20.30	19.88	19.29	18.81	(93)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

8. Space heating requirement

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

Utilisation factor for gains, ηm

0.99	0.98	0.96	0.91	0.82	0.66	0.48	0.52	0.75	0.93	0.98	0.99	(94)
------	------	------	------	------	------	------	------	------	------	------	------	------

Useful gains, ηmGm, W (94)m x (84)m

297.30	340.51	367.71	374.30	346.06	267.09	187.14	194.82	271.69	305.83	291.10	281.80	(95)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Monthly average external temperature from Table U1

4.30	4.90	6.50	8.90	11.70	14.60	16.60	16.40	14.10	10.60	7.10	4.20	(96)
------	------	------	------	-------	-------	-------	-------	-------	-------	------	------	------

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

754.17	732.82	665.52	555.61	429.30	288.99	191.40	200.77	312.42	470.72	621.73	749.04	(97)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Space heating requirement, kWh/month 0.024 x [(97)m - (95)m] x (41)m

339.91	263.63	221.58	130.54	61.93	0.00	0.00	0.00	0.00	122.68	238.05	347.63	Σ(98)1...5, 10...12 = <input type="text" value="1725.94"/> (98)
--------	--------	--------	--------	-------	------	------	------	------	--------	--------	--------	---

Space heating requirement kWh/m²/year

(98) ÷ (4) = (99)

9a. Energy requirements - individual heating systems including micro-CHP

Space heating

Fraction of space heat from secondary/supplementary system (table 11)

(201)

Fraction of space heat from main system(s)

1 - (201) = (202)

Fraction of space heat from main system 2

(202)

Fraction of total space heat from main system 1

(202) x [1- (203)] = (204)

Fraction of total space heat from main system 2

(202) x (203) = (205)

Efficiency of main system 1 (%)

(206)

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

Space heating fuel (main system 1), kWh/month

363.93	282.26	237.23	139.76	66.30	0.00	0.00	0.00	0.00	131.35	254.87	372.19	Σ(211)1...5, 10...12 = <input type="text" value="1847.90"/> (211)
--------	--------	--------	--------	-------	------	------	------	------	--------	--------	--------	---

Water heating

Efficiency of water heater

87.14	86.87	86.36	85.34	83.62	80.30	80.30	80.30	80.30	85.07	86.55	87.24	(217)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

Water heating fuel, kWh/month

165.43	144.95	151.69	136.15	134.54	123.39	118.22	131.79	133.24	143.22	150.26	161.35	Σ(219a)1...12 = <input type="text" value="1694.22"/> (219)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--

Annual totals

Space heating fuel - main system 1

Water heating fuel

Electricity for pumps, fans and electric keep-hot (Table 4f)

central heating pump or water pump within warm air heating unit

(230c)

boiler flue fan

(230e)

Total electricity for the above, kWh/year

(231)

Electricity for lighting (Appendix L)					185.61	(232)
Total delivered energy for all uses				(211)...(221) + (231) + (232)...(237b) =	3802.73	(238)

10a. Fuel costs - individual heating systems including micro-CHP

	Fuel kWh/year		Fuel price		Fuel cost £/year	
Space heating - main system 1	1847.90	x	3.48	x 0.01 =	64.31	(240)
Water heating	1694.22	x	3.48	x 0.01 =	58.96	(247)
Pumps and fans	75.00	x	13.19	x 0.01 =	9.89	(249)
Electricity for lighting	185.61	x	13.19	x 0.01 =	24.48	(250)
Additional standing charges					120.00	(251)
Total energy cost				(240)...(242) + (245)...(254) =	277.64	(255)

11a. SAP rating - individual heating systems including micro-CHP

Energy cost deflator (Table 12)	0.42	(256)
Energy cost factor (ECF)	1.42	(257)
SAP value	80.16	
SAP rating (section 13)	80	(258)
SAP band	C	

12a. CO₂ emissions - individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO ₂ /kWh		Emissions kg CO ₂ /year	
Space heating - main system 1	1847.90	x	0.216	=	399.15	(261)
Water heating	1694.22	x	0.216	=	365.95	(264)
Space and water heating				(261) + (262) + (263) + (264) =	765.10	(265)
Pumps and fans	75.00	x	0.519	=	38.93	(267)
Electricity for lighting	185.61	x	0.519	=	96.33	(268)
Total CO ₂ , kg/year				(265)...(271) =	900.35	(272)
Dwelling CO ₂ emission rate				(272) ÷ (4) =	24.33	(273)
EI value					85.29	
EI rating (section 14)					85	(274)
EI band					B	

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

	Energy kWh/year		Primary factor		Primary Energy kWh/year	
Space heating - main system 1	1847.90	x	1.22	=	2254.44	(261)
Water heating	1694.22	x	1.22	=	2066.95	(264)
Space and water heating				(261) + (262) + (263) + (264) =	4321.39	(265)
Pumps and fans	75.00	x	3.07	=	230.25	(267)
Electricity for lighting	185.61	x	3.07	=	569.81	(268)
Primary energy kWh/year					5121.45	(272)
Dwelling primary energy rate kWh/m ² /year					138.42	(273)

This design submission has been carried out using Approved SAP software. It has been prepared from plans and specifications and may not reflect the property as constructed.

Assessor name	Mr Stuart Searle	Assessor number	3519
Client	Avis Appleton & Associates	Last modified	14/09/2016
Address	PT4 Liffords Place, London, SW13		

1. Overall dwelling dimensions

	Area (m ²)	Average storey height (m)	Volume (m ³)
Lowest occupied	<input type="text" value="45.80"/> (1a)	<input type="text" value="2.50"/> (2a)	<input type="text" value="114.50"/> (3a)
Total floor area	(1a) + (1b) + (1c) + (1d)...(1n) =		<input type="text" value="45.80"/> (4)
Dwelling volume	(3a) + (3b) + (3c) + (3d)...(3n) =		<input type="text" value="114.50"/> (5)

2. Ventilation rate

		m ³ per hour
Number of chimneys	<input type="text" value="0"/> x 40 =	<input type="text" value="0"/> (6a)
Number of open flues	<input type="text" value="0"/> x 20 =	<input type="text" value="0"/> (6b)
Number of intermittent fans	<input type="text" value="2"/> x 10 =	<input type="text" value="20"/> (7a)
Number of passive vents	<input type="text" value="0"/> x 10 =	<input type="text" value="0"/> (7b)
Number of flueless gas fires	<input type="text" value="0"/> x 40 =	<input type="text" value="0"/> (7c)

	Air changes per hour
Infiltration due to chimneys, flues, fans, PSVs	(6a) + (6b) + (7a) + (7b) + (7c) = <input type="text" value="20"/> ÷ (5) = <input type="text" value="0.17"/> (8)

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

Air permeability value, q ₅₀ , expressed in cubic metres per hour per square metre of envelope area	<input type="text" value="5.00"/> (17)
--	--

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)	<input type="text" value="0.42"/> (18)
--	--

Number of sides on which the dwelling is sheltered	<input type="text" value="2"/> (19)
--	-------------------------------------

Shelter factor	1 - [0.075 x (19)] = <input type="text" value="0.85"/> (20)
----------------	---

Infiltration rate incorporating shelter factor	(18) x (20) = <input type="text" value="0.36"/> (21)
--	--

Infiltration rate modified for monthly wind speed:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table U2	<input type="text" value="5.10"/>	<input type="text" value="5.00"/>	<input type="text" value="4.90"/>	<input type="text" value="4.40"/>	<input type="text" value="4.30"/>	<input type="text" value="3.80"/>	<input type="text" value="3.80"/>	<input type="text" value="3.70"/>	<input type="text" value="4.00"/>	<input type="text" value="4.30"/>	<input type="text" value="4.50"/>	<input type="text" value="4.70"/>

Wind factor (22)m ÷ 4	<input type="text" value="1.28"/>	<input type="text" value="1.25"/>	<input type="text" value="1.23"/>	<input type="text" value="1.10"/>	<input type="text" value="1.08"/>	<input type="text" value="0.95"/>	<input type="text" value="0.95"/>	<input type="text" value="0.93"/>	<input type="text" value="1.00"/>	<input type="text" value="1.08"/>	<input type="text" value="1.13"/>	<input type="text" value="1.18"/>
-----------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------

Adjusted infiltration rate (allowing for shelter and wind factor) (21) x (22a)m	<input type="text" value="0.46"/>	<input type="text" value="0.45"/>	<input type="text" value="0.44"/>	<input type="text" value="0.40"/>	<input type="text" value="0.39"/>	<input type="text" value="0.34"/>	<input type="text" value="0.34"/>	<input type="text" value="0.33"/>	<input type="text" value="0.36"/>	<input type="text" value="0.39"/>	<input type="text" value="0.41"/>	<input type="text" value="0.42"/>
---	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------

Calculate effective air change rate for the applicable case:

If mechanical ventilation: air change rate through system	<input type="text" value="N/A"/> (23a)
---	--

If balanced with heat recovery: efficiency in % allowing for in-use factor from Table 4h	<input type="text" value="N/A"/> (23c)
--	--

d) natural ventilation or whole house positive input ventilation from loft	<input type="text" value="0.61"/>	<input type="text" value="0.60"/>	<input type="text" value="0.60"/>	<input type="text" value="0.58"/>	<input type="text" value="0.58"/>	<input type="text" value="0.56"/>	<input type="text" value="0.56"/>	<input type="text" value="0.56"/>	<input type="text" value="0.57"/>	<input type="text" value="0.58"/>	<input type="text" value="0.58"/>	<input type="text" value="0.59"/>
--	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in (25)	<input type="text" value="0.61"/>	<input type="text" value="0.60"/>	<input type="text" value="0.60"/>	<input type="text" value="0.58"/>	<input type="text" value="0.58"/>	<input type="text" value="0.56"/>	<input type="text" value="0.56"/>	<input type="text" value="0.56"/>	<input type="text" value="0.57"/>	<input type="text" value="0.58"/>	<input type="text" value="0.58"/>	<input type="text" value="0.59"/>
--	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------

3. Heat losses and heat loss parameter

Element	Gross area, m ²	Openings m ²	Net area A, m ²	U-value W/m ² K	A x U W/K	κ-value, kJ/m ² .K	A x κ, kJ/K							
Door			2.10	1.00	2.10		(26)							
Window			8.32	1.33	11.03		(27)							
External wall			43.83	0.18	7.89		(29a)							
Party wall			17.75	0.00	0.00		(32)							
Roof			50.38	0.13	6.55		(30)							
Total area of external elements $\sum A$, m ²			104.63				(31)							
Fabric heat loss, W/K = $\sum(A \times U)$					(26)...(30) + (32) =	27.57	(33)							
Heat capacity Cm = $\sum(A \times \kappa)$					(28)...(30) + (32) + (32a)...(32e) =	N/A	(34)							
Thermal mass parameter (TMP) in kJ/m ² K						250.00	(35)							
Thermal bridges: $\sum(L \times \Psi)$ calculated using Appendix K						11.64	(36)							
Total fabric heat loss						(33) + (36) =	39.21 (37)							
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Ventilation heat loss calculated monthly 0.33 x (25)m x (5)	22.89	22.74	22.59	21.87	21.74	21.11	21.11	21.00	21.35	21.74	22.01	22.29	(38)	
Heat transfer coefficient, W/K (37)m + (38)m	62.10	61.95	61.80	61.08	60.95	60.32	60.32	60.21	60.56	60.95	61.22	61.50		
													Average = $\sum(39)1...12/12 =$	61.08 (39)
Heat loss parameter (HLP), W/m ² K (39)m ÷ (4)	1.36	1.35	1.35	1.33	1.33	1.32	1.32	1.31	1.32	1.33	1.34	1.34		
													Average = $\sum(40)1...12/12 =$	1.33 (40)
Number of days in month (Table 1a)	31.00	28.00	31.00	30.00	31.00	30.00	31.00	31.00	30.00	31.00	30.00	31.00	(40)	

4. Water heating energy requirement

Assumed occupancy, N													1.57	(42)	
Annual average hot water usage in litres per day Vd,average = (25 x N) + 36														71.43	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec			
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)	78.57	75.72	72.86	70.00	67.14	64.29	64.29	67.14	70.00	72.86	75.72	78.57			
													$\sum(44)1...12 =$	857.16 (44)	
Energy content of hot water used = 4.18 x Vd,m x nm x Tm/3600 kWh/month (see Tables 1b, 1c 1d)	116.52	101.91	105.16	91.68	87.97	75.91	70.34	80.72	81.69	95.20	103.92	112.85			
													$\sum(45)1...12 =$	1123.87 (45)	
Distribution loss 0.15 x (45)m	17.48	15.29	15.77	13.75	13.20	11.39	10.55	12.11	12.25	14.28	15.59	16.93	(46)		
Water storage loss calculated for each month (55) x (41)m	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(56)		
If the vessel contains dedicated solar storage or dedicated WWHRS (56)m x [(47) - Vs] ÷ (47), else (56)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(57)		
Primary circuit loss for each month from Table 3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(59)		
Combi loss for each month from Table 3a, 3b or 3c	40.04	34.85	37.13	34.52	34.22	31.70	32.76	34.22	34.52	37.13	37.34	40.04	(61)		
Total heat required for water heating calculated for each month 0.85 x (45)m + (46)m + (57)m + (59)m + (61)m	156.56	136.76	142.29	126.20	122.19	107.62	103.10	114.94	116.21	132.33	141.25	152.89	(62)		

Solar DHW input calculated using Appendix G or Appendix H

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
------	------	------	------	------	------	------	------	------	------	------	------	------

 (63)

Output from water heater for each month (kWh/month) (62)m + (63)m

156.56	136.76	142.29	126.20	122.19	107.62	103.10	114.94	116.21	132.33	141.25	152.89
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

$\Sigma(64)1...12 = 1552.34$ (64)

Heat gains from water heating (kWh/month) $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

48.75	42.60	44.25	39.12	37.80	33.17	31.58	35.39	35.79	40.94	43.89	47.53
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (65)

5. Internal gains

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

Metabolic gains (Table 5)

78.38	78.38	78.38	78.38	78.38	78.38	78.38	78.38	78.38	78.38	78.38	78.38
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (66)

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

12.40	11.01	8.95	6.78	5.07	4.28	4.62	6.01	8.07	10.24	11.95	12.74
-------	-------	------	------	------	------	------	------	------	-------	-------	-------

 (67)

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

136.35	137.76	134.19	126.60	117.02	108.02	102.00	100.59	104.15	111.74	121.32	130.33
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (68)

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

30.84	30.84	30.84	30.84	30.84	30.84	30.84	30.84	30.84	30.84	30.84	30.84
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (69)

Pump and fan gains (Table 5a)

3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
------	------	------	------	------	------	------	------	------	------	------	------

 (70)

Losses e.g. evaporation (Table 5)

-62.70	-62.70	-62.70	-62.70	-62.70	-62.70	-62.70	-62.70	-62.70	-62.70	-62.70	-62.70
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (71)

Water heating gains (Table 5)

65.53	63.39	59.47	54.33	50.81	46.07	42.45	47.57	49.71	55.02	60.95	63.89
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (72)

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

263.78	261.67	252.14	237.22	222.42	207.88	198.58	203.68	211.44	226.52	243.74	256.47
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (73)

6. Solar gains

Access factor Table 6d	Area m ²	Solar flux W/m ²	g specific data or Table 6b	FF specific data or Table 6c	Gains W
----------------------------------	-------------------------------	---------------------------------------	--	---	-------------------

NorthWest $\boxed{0.77} \times \boxed{4.52} \times \boxed{11.28} \times 0.9 \times \boxed{0.63} \times \boxed{0.70} = \boxed{15.59}$ (81)

SouthEast $\boxed{0.77} \times \boxed{3.80} \times \boxed{36.79} \times 0.9 \times \boxed{0.63} \times \boxed{0.70} = \boxed{42.73}$ (77)

Solar gains in watts $\Sigma(74)m... (82)m$

58.32	104.51	156.75	217.27	264.39	271.74	258.13	221.56	177.48	119.21	70.79	49.30
-------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	-------

 (83)

Total gains - internal and solar (73)m + (83)m

322.10	366.18	408.88	454.49	486.81	479.61	456.72	425.24	388.92	345.73	314.54	305.77
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (84)

7. Mean internal temperature (heating season)

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

21.00

 (85)

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

Utilisation factor for gains for living area n1,m (see Table 9a)

1.00	0.99	0.98	0.95	0.87	0.72	0.56	0.62	0.85	0.97	0.99	1.00
------	------	------	------	------	------	------	------	------	------	------	------

 (86)

Mean internal temp of living area T1 (steps 3 to 7 in Table 9c)

19.58	19.75	20.02	20.39	20.72	20.92	20.98	20.97	20.82	20.41	19.93	19.56
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (87)

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

19.80	19.80	19.80	19.81	19.82	19.83	19.83	19.83	19.82	19.82	19.81	19.81
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (88)

Utilisation factor for gains for rest of dwelling n2,m

0.99	0.99	0.98	0.93	0.82	0.62	0.42	0.48	0.77	0.95	0.99	1.00
------	------	------	------	------	------	------	------	------	------	------	------

 (89)

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

17.94	18.18	18.58	19.11	19.54	19.77	19.82	19.82	19.68	19.14	18.46	17.91	(90)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Living area fraction

Living area ÷ (4) = (91)

Mean internal temperature for the whole dwelling fLA x T1 +(1 - fLA) x T2

18.80	19.00	19.33	19.78	20.16	20.37	20.43	20.42	20.28	19.80	19.23	18.77	(92)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

18.80	19.00	19.33	19.78	20.16	20.37	20.43	20.42	20.28	19.80	19.23	18.77	(93)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

8. Space heating requirement

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

Utilisation factor for gains, ηm

0.99	0.99	0.97	0.93	0.84	0.67	0.49	0.55	0.80	0.95	0.99	0.99	(94)
------	------	------	------	------	------	------	------	------	------	------	------	------

Useful gains, ηmGm, W (94)m x (84)m

319.88	361.59	398.07	424.48	409.01	321.19	225.54	233.56	312.02	329.40	310.58	304.07	(95)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Monthly average external temperature from Table U1

4.30	4.90	6.50	8.90	11.70	14.60	16.60	16.40	14.10	10.60	7.10	4.20	(96)
------	------	------	------	-------	-------	-------	-------	-------	-------	------	------	------

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

900.56	873.40	793.12	664.74	515.62	348.34	230.92	242.10	374.35	560.98	742.51	896.13	(97)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Space heating requirement, kWh/month 0.024 x [(97)m - (95)m] x (41)m

432.03	343.94	293.92	172.98	79.32	0.00	0.00	0.00	0.00	172.29	310.99	440.49	(98)
--------	--------	--------	--------	-------	------	------	------	------	--------	--------	--------	------

Σ(98)1...5, 10...12 = (98)

Space heating requirement kWh/m²/year

(98) ÷ (4) = (99)

9a. Energy requirements - individual heating systems including micro-CHP

Space heating

Fraction of space heat from secondary/supplementary system (table 11)

(201)

Fraction of space heat from main system(s)

1 - (201) = (202)

Fraction of space heat from main system 2

(202)

Fraction of total space heat from main system 1

(202) x [1- (203)] = (204)

Fraction of total space heat from main system 2

(202) x (203) = (205)

Efficiency of main system 1 (%)

(206)

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

Space heating fuel (main system 1), kWh/month

462.56	368.24	314.68	185.20	84.92	0.00	0.00	0.00	0.00	184.47	332.97	471.61	(211)
--------	--------	--------	--------	-------	------	------	------	------	--------	--------	--------	-------

Σ(211)1...5, 10...12 = (211)

Water heating

Efficiency of water heater

87.47	87.28	86.84	85.85	83.99	80.30	80.30	80.30	80.30	85.72	86.98	87.56	(217)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

Water heating fuel, kWh/month

178.98	156.70	163.86	147.01	145.47	134.02	128.40	143.14	144.72	154.38	162.39	174.60	(219)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------

Σ(219a)1...12 = (219)

Annual totals

Space heating fuel - main system 1

Water heating fuel

Electricity for pumps, fans and electric keep-hot (Table 4f)

central heating pump or water pump within warm air heating unit

(230c)

boiler flue fan

(230e)

Total electricity for the above, kWh/year

(231)

Electricity for lighting (Appendix L)					218.93	(232)
Total delivered energy for all uses				(211)...(221) + (231) + (232)...(237b) =	4532.26	(238)

10a. Fuel costs - individual heating systems including micro-CHP

	Fuel kWh/year		Fuel price		Fuel cost £/year	
Space heating - main system 1	2404.66	x	3.48	x 0.01 =	83.68	(240)
Water heating	1833.67	x	3.48	x 0.01 =	63.81	(247)
Pumps and fans	75.00	x	13.19	x 0.01 =	9.89	(249)
Electricity for lighting	218.93	x	13.19	x 0.01 =	28.88	(250)
Additional standing charges					120.00	(251)
Total energy cost				(240)...(242) + (245)...(254) =	306.26	(255)

11a. SAP rating - individual heating systems including micro-CHP

Energy cost deflator (Table 12)	0.42	(256)
Energy cost factor (ECF)	1.42	(257)
SAP value	80.24	
SAP rating (section 13)	80	(258)
SAP band	C	

12a. CO₂ emissions - individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO ₂ /kWh		Emissions kg CO ₂ /year	
Space heating - main system 1	2404.66	x	0.216	=	519.41	(261)
Water heating	1833.67	x	0.216	=	396.07	(264)
Space and water heating				(261) + (262) + (263) + (264) =	915.48	(265)
Pumps and fans	75.00	x	0.519	=	38.93	(267)
Electricity for lighting	218.93	x	0.519	=	113.63	(268)
Total CO ₂ , kg/year				(265)...(271) =	1068.03	(272)
Dwelling CO ₂ emission rate				(272) ÷ (4) =	23.32	(273)
EI value					84.24	
EI rating (section 14)					84	(274)
EI band					B	

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

	Energy kWh/year		Primary factor		Primary Energy kWh/year	
Space heating - main system 1	2404.66	x	1.22	=	2933.69	(261)
Water heating	1833.67	x	1.22	=	2237.07	(264)
Space and water heating				(261) + (262) + (263) + (264) =	5170.76	(265)
Pumps and fans	75.00	x	3.07	=	230.25	(267)
Electricity for lighting	218.93	x	3.07	=	672.12	(268)
Primary energy kWh/year					6073.13	(272)
Dwelling primary energy rate kWh/m ² /year					132.60	(273)

This design submission has been carried out using Approved SAP software. It has been prepared from plans and specifications and may not reflect the property as constructed.

Assessor name	Mr Stuart Searle	Assessor number	3519
Client	Avis Appleton & Associates	Last modified	14/09/2016
Address	PT5 Liffords Place, London, SW13		

1. Overall dwelling dimensions

	Area (m ²)	Average storey height (m)	Volume (m ³)
Lowest occupied	<input type="text" value="45.80"/> (1a) x	<input type="text" value="2.50"/> (2a) =	<input type="text" value="114.50"/> (3a)
Total floor area	(1a) + (1b) + (1c) + (1d)...(1n) = <input type="text" value="45.80"/> (4)		
Dwelling volume	(3a) + (3b) + (3c) + (3d)...(3n) =		<input type="text" value="114.50"/> (5)

2. Ventilation rate

		m ³ per hour
Number of chimneys	<input type="text" value="0"/> x 40 =	<input type="text" value="0"/> (6a)
Number of open flues	<input type="text" value="0"/> x 20 =	<input type="text" value="0"/> (6b)
Number of intermittent fans	<input type="text" value="2"/> x 10 =	<input type="text" value="20"/> (7a)
Number of passive vents	<input type="text" value="0"/> x 10 =	<input type="text" value="0"/> (7b)
Number of flueless gas fires	<input type="text" value="0"/> x 40 =	<input type="text" value="0"/> (7c)

	Air changes per hour
Infiltration due to chimneys, flues, fans, PSVs	(6a) + (6b) + (7a) + (7b) + (7c) = <input type="text" value="20"/> ÷ (5) = <input type="text" value="0.17"/> (8)

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

Air permeability value, q ₅₀ , expressed in cubic metres per hour per square metre of envelope area	<input type="text" value="5.00"/> (17)
--	--

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)	<input type="text" value="0.42"/> (18)
--	--

Number of sides on which the dwelling is sheltered	<input type="text" value="2"/> (19)
--	-------------------------------------

Shelter factor	1 - [0.075 x (19)] = <input type="text" value="0.85"/> (20)
----------------	---

Infiltration rate incorporating shelter factor	(18) x (20) = <input type="text" value="0.36"/> (21)
--	--

Infiltration rate modified for monthly wind speed:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table U2	<input type="text" value="5.10"/>	<input type="text" value="5.00"/>	<input type="text" value="4.90"/>	<input type="text" value="4.40"/>	<input type="text" value="4.30"/>	<input type="text" value="3.80"/>	<input type="text" value="3.80"/>	<input type="text" value="3.70"/>	<input type="text" value="4.00"/>	<input type="text" value="4.30"/>	<input type="text" value="4.50"/>	<input type="text" value="4.70"/>

Wind factor (22)m ÷ 4	<input type="text" value="1.28"/>	<input type="text" value="1.25"/>	<input type="text" value="1.23"/>	<input type="text" value="1.10"/>	<input type="text" value="1.08"/>	<input type="text" value="0.95"/>	<input type="text" value="0.95"/>	<input type="text" value="0.93"/>	<input type="text" value="1.00"/>	<input type="text" value="1.08"/>	<input type="text" value="1.13"/>	<input type="text" value="1.18"/>
-----------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------

Adjusted infiltration rate (allowing for shelter and wind factor) (21) x (22a)m	<input type="text" value="0.46"/>	<input type="text" value="0.45"/>	<input type="text" value="0.44"/>	<input type="text" value="0.40"/>	<input type="text" value="0.39"/>	<input type="text" value="0.34"/>	<input type="text" value="0.34"/>	<input type="text" value="0.33"/>	<input type="text" value="0.36"/>	<input type="text" value="0.39"/>	<input type="text" value="0.41"/>	<input type="text" value="0.42"/>
---	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------

Calculate effective air change rate for the applicable case:

If mechanical ventilation: air change rate through system	<input type="text" value="N/A"/> (23a)
---	--

If balanced with heat recovery: efficiency in % allowing for in-use factor from Table 4h	<input type="text" value="N/A"/> (23c)
--	--

d) natural ventilation or whole house positive input ventilation from loft	<input type="text" value="0.61"/>	<input type="text" value="0.60"/>	<input type="text" value="0.60"/>	<input type="text" value="0.58"/>	<input type="text" value="0.58"/>	<input type="text" value="0.56"/>	<input type="text" value="0.56"/>	<input type="text" value="0.56"/>	<input type="text" value="0.57"/>	<input type="text" value="0.58"/>	<input type="text" value="0.58"/>	<input type="text" value="0.59"/>
--	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in (25)	<input type="text" value="0.61"/>	<input type="text" value="0.60"/>	<input type="text" value="0.60"/>	<input type="text" value="0.58"/>	<input type="text" value="0.58"/>	<input type="text" value="0.56"/>	<input type="text" value="0.56"/>	<input type="text" value="0.56"/>	<input type="text" value="0.57"/>	<input type="text" value="0.58"/>	<input type="text" value="0.58"/>	<input type="text" value="0.59"/>
--	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------

3. Heat losses and heat loss parameter

Element	Gross area, m ²	Openings m ²	Net area A, m ²	U-value W/m ² K	A x U W/K	κ-value, kJ/m ² .K	A x κ, kJ/K						
Door			2.10	1.00	2.10		(26)						
Window			8.32	1.33	11.03		(27)						
External wall			43.83	0.18	7.89		(29a)						
Party wall			17.75	0.00	0.00		(32)						
Roof			50.38	0.13	6.55		(30)						
Total area of external elements $\sum A, m^2$			104.63				(31)						
Fabric heat loss, W/K = $\sum(A \times U)$					(26)...(30) + (32) =	27.57	(33)						
Heat capacity Cm = $\sum(A \times \kappa)$					(28)...(30) + (32) + (32a)...(32e) =	N/A	(34)						
Thermal mass parameter (TMP) in kJ/m ² K						250.00	(35)						
Thermal bridges: $\sum(L \times \Psi)$ calculated using Appendix K						11.64	(36)						
Total fabric heat loss						(33) + (36) =	39.21 (37)						
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ventilation heat loss calculated monthly $0.33 \times (25)m \times (5)$	22.89	22.74	22.59	21.87	21.74	21.11	21.11	21.00	21.35	21.74	22.01	22.29	(38)
Heat transfer coefficient, W/K (37)m + (38)m	62.10	61.95	61.80	61.08	60.95	60.32	60.32	60.21	60.56	60.95	61.22	61.50	
	Average = $\sum(39)1...12/12 =$											61.08 (39)	
Heat loss parameter (HLP), W/m ² K (39)m ÷ (4)	1.36	1.35	1.35	1.33	1.33	1.32	1.32	1.31	1.32	1.33	1.34	1.34	
	Average = $\sum(40)1...12/12 =$											1.33 (40)	
Number of days in month (Table 1a)	31.00	28.00	31.00	30.00	31.00	30.00	31.00	31.00	30.00	31.00	30.00	31.00	(40)

4. Water heating energy requirement

Assumed occupancy, N													1.57	(42)	
Annual average hot water usage in litres per day $V_{d,average} = (25 \times N) + 36$														71.43	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec			
Hot water usage in litres per day for each month $V_{d,m} = \text{factor from Table 1c} \times (43)$	78.57	75.72	72.86	70.00	67.14	64.29	64.29	67.14	70.00	72.86	75.72	78.57			
	$\sum(44)1...12 =$											857.16	(44)		
Energy content of hot water used = $4.18 \times V_{d,m} \times nm \times T_m/3600$ kWh/month (see Tables 1b, 1c 1d)	116.52	101.91	105.16	91.68	87.97	75.91	70.34	80.72	81.69	95.20	103.92	112.85			
	$\sum(45)1...12 =$											1123.87	(45)		
Distribution loss $0.15 \times (45)m$	17.48	15.29	15.77	13.75	13.20	11.39	10.55	12.11	12.25	14.28	15.59	16.93		(46)	
Water storage loss calculated for each month (55) x (41)m	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		(56)	
If the vessel contains dedicated solar storage or dedicated WWHRS (56)m x [(47) - Vs] ÷ (47), else (56)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		(57)	
Primary circuit loss for each month from Table 3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		(59)	
Combi loss for each month from Table 3a, 3b or 3c	40.04	34.85	37.13	34.52	34.22	31.70	32.76	34.22	34.52	37.13	37.34	40.04		(61)	
Total heat required for water heating calculated for each month $0.85 \times (45)m + (46)m + (57)m + (59)m + (61)m$	156.56	136.76	142.29	126.20	122.19	107.62	103.10	114.94	116.21	132.33	141.25	152.89		(62)	

Solar DHW input calculated using Appendix G or Appendix H

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
------	------	------	------	------	------	------	------	------	------	------	------	------

 (63)

Output from water heater for each month (kWh/month) (62)m + (63)m

156.56	136.76	142.29	126.20	122.19	107.62	103.10	114.94	116.21	132.33	141.25	152.89
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

$\Sigma(64)1...12 = 1552.34$ (64)

Heat gains from water heating (kWh/month) $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

48.75	42.60	44.25	39.12	37.80	33.17	31.58	35.39	35.79	40.94	43.89	47.53
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (65)

5. Internal gains

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

Metabolic gains (Table 5)

78.38	78.38	78.38	78.38	78.38	78.38	78.38	78.38	78.38	78.38	78.38	78.38
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (66)

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

12.40	11.01	8.95	6.78	5.07	4.28	4.62	6.01	8.07	10.24	11.95	12.74
-------	-------	------	------	------	------	------	------	------	-------	-------	-------

 (67)

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

136.35	137.76	134.19	126.60	117.02	108.02	102.00	100.59	104.15	111.74	121.32	130.33
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (68)

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

30.84	30.84	30.84	30.84	30.84	30.84	30.84	30.84	30.84	30.84	30.84	30.84
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (69)

Pump and fan gains (Table 5a)

3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
------	------	------	------	------	------	------	------	------	------	------	------

 (70)

Losses e.g. evaporation (Table 5)

-62.70	-62.70	-62.70	-62.70	-62.70	-62.70	-62.70	-62.70	-62.70	-62.70	-62.70	-62.70
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (71)

Water heating gains (Table 5)

65.53	63.39	59.47	54.33	50.81	46.07	42.45	47.57	49.71	55.02	60.95	63.89
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (72)

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

263.78	261.67	252.14	237.22	222.42	207.88	198.58	203.68	211.44	226.52	243.74	256.47
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (73)

6. Solar gains

Access factor Table 6d	Area m ²	Solar flux W/m ²	g specific data or Table 6b	FF specific data or Table 6c	Gains W
----------------------------------	-------------------------------	---------------------------------------	--	---	-------------------

NorthWest $\frac{0.77}{\text{Access factor}} \times \frac{4.52}{\text{Area}} \times \frac{11.28}{\text{Solar flux}} \times 0.9 \times \frac{0.63}{\text{g}} \times \frac{0.70}{\text{FF}} = 15.59$ (81)

SouthEast $\frac{0.77}{\text{Access factor}} \times \frac{3.80}{\text{Area}} \times \frac{36.79}{\text{Solar flux}} \times 0.9 \times \frac{0.63}{\text{g}} \times \frac{0.70}{\text{FF}} = 42.73$ (77)

Solar gains in watts $\Sigma(74)m... (82)m$

58.32	104.51	156.75	217.27	264.39	271.74	258.13	221.56	177.48	119.21	70.79	49.30
-------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	-------

 (83)

Total gains - internal and solar (73)m + (83)m

322.10	366.18	408.88	454.49	486.81	479.61	456.72	425.24	388.92	345.73	314.54	305.77
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (84)

7. Mean internal temperature (heating season)

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

21.00

 (85)

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

Utilisation factor for gains for living area n1,m (see Table 9a)

1.00	0.99	0.98	0.95	0.87	0.72	0.56	0.62	0.85	0.97	0.99	1.00
------	------	------	------	------	------	------	------	------	------	------	------

 (86)

Mean internal temp of living area T1 (steps 3 to 7 in Table 9c)

19.58	19.75	20.02	20.39	20.72	20.92	20.98	20.97	20.82	20.41	19.93	19.56
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (87)

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

19.80	19.80	19.80	19.81	19.82	19.83	19.83	19.83	19.82	19.82	19.81	19.81
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (88)

Utilisation factor for gains for rest of dwelling n2,m

0.99	0.99	0.98	0.93	0.82	0.62	0.42	0.48	0.77	0.95	0.99	1.00
------	------	------	------	------	------	------	------	------	------	------	------

 (89)

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

17.94	18.18	18.58	19.11	19.54	19.77	19.82	19.82	19.68	19.14	18.46	17.91	(90)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Living area fraction

Living area ÷ (4) = (91)

Mean internal temperature for the whole dwelling fLA x T1 +(1 - fLA) x T2

18.80	19.00	19.33	19.78	20.16	20.37	20.43	20.42	20.28	19.80	19.23	18.77	(92)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

18.80	19.00	19.33	19.78	20.16	20.37	20.43	20.42	20.28	19.80	19.23	18.77	(93)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

8. Space heating requirement

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

Utilisation factor for gains, ηm

0.99	0.99	0.97	0.93	0.84	0.67	0.49	0.55	0.80	0.95	0.99	0.99	(94)
------	------	------	------	------	------	------	------	------	------	------	------	------

Useful gains, ηmGm, W (94)m x (84)m

319.88	361.59	398.07	424.48	409.01	321.19	225.54	233.56	312.02	329.40	310.58	304.07	(95)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Monthly average external temperature from Table U1

4.30	4.90	6.50	8.90	11.70	14.60	16.60	16.40	14.10	10.60	7.10	4.20	(96)
------	------	------	------	-------	-------	-------	-------	-------	-------	------	------	------

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

900.56	873.40	793.12	664.74	515.62	348.34	230.92	242.10	374.35	560.98	742.51	896.13	(97)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Space heating requirement, kWh/month 0.024 x [(97)m - (95)m] x (41)m

432.03	343.94	293.92	172.98	79.32	0.00	0.00	0.00	0.00	172.29	310.99	440.49	(98)
--------	--------	--------	--------	-------	------	------	------	------	--------	--------	--------	------

Σ(98)1...5, 10...12 = (98)

Space heating requirement kWh/m²/year

(98) ÷ (4) = (99)

9a. Energy requirements - individual heating systems including micro-CHP

Space heating

Fraction of space heat from secondary/supplementary system (table 11)

(201)

Fraction of space heat from main system(s)

1 - (201) = (202)

Fraction of space heat from main system 2

(202)

Fraction of total space heat from main system 1

(202) x [1 - (203)] = (204)

Fraction of total space heat from main system 2

(202) x (203) = (205)

Efficiency of main system 1 (%)

(206)

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

Space heating fuel (main system 1), kWh/month

462.56	368.24	314.68	185.20	84.92	0.00	0.00	0.00	0.00	184.47	332.97	471.61	(211)
--------	--------	--------	--------	-------	------	------	------	------	--------	--------	--------	-------

Σ(211)1...5, 10...12 = (211)

Water heating

Efficiency of water heater

87.47	87.28	86.84	85.85	83.99	80.30	80.30	80.30	80.30	85.72	86.98	87.56	(217)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

Water heating fuel, kWh/month

178.98	156.70	163.86	147.01	145.47	134.02	128.40	143.14	144.72	154.38	162.39	174.60	(219)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------

Σ(219a)1...12 = (219)

Annual totals

Space heating fuel - main system 1

Water heating fuel

Electricity for pumps, fans and electric keep-hot (Table 4f)

central heating pump or water pump within warm air heating unit

(230c)

boiler flue fan

(230e)

Total electricity for the above, kWh/year

(231)

Electricity for lighting (Appendix L)					218.93	(232)
Total delivered energy for all uses				(211)...(221) + (231) + (232)...(237b) =	4532.26	(238)

10a. Fuel costs - individual heating systems including micro-CHP

	Fuel kWh/year		Fuel price		Fuel cost £/year	
Space heating - main system 1	2404.66	x	3.48	x 0.01 =	83.68	(240)
Water heating	1833.67	x	3.48	x 0.01 =	63.81	(247)
Pumps and fans	75.00	x	13.19	x 0.01 =	9.89	(249)
Electricity for lighting	218.93	x	13.19	x 0.01 =	28.88	(250)
Additional standing charges					120.00	(251)
Total energy cost				(240)...(242) + (245)...(254) =	306.26	(255)

11a. SAP rating - individual heating systems including micro-CHP

Energy cost deflator (Table 12)	0.42	(256)
Energy cost factor (ECF)	1.42	(257)
SAP value	80.24	
SAP rating (section 13)	80	(258)
SAP band	C	

12a. CO₂ emissions - individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO ₂ /kWh		Emissions kg CO ₂ /year	
Space heating - main system 1	2404.66	x	0.216	=	519.41	(261)
Water heating	1833.67	x	0.216	=	396.07	(264)
Space and water heating				(261) + (262) + (263) + (264) =	915.48	(265)
Pumps and fans	75.00	x	0.519	=	38.93	(267)
Electricity for lighting	218.93	x	0.519	=	113.63	(268)
Total CO ₂ , kg/year				(265)...(271) =	1068.03	(272)
Dwelling CO ₂ emission rate				(272) ÷ (4) =	23.32	(273)
EI value					84.24	
EI rating (section 14)					84	(274)
EI band					B	

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

	Energy kWh/year		Primary factor		Primary Energy kWh/year	
Space heating - main system 1	2404.66	x	1.22	=	2933.69	(261)
Water heating	1833.67	x	1.22	=	2237.07	(264)
Space and water heating				(261) + (262) + (263) + (264) =	5170.76	(265)
Pumps and fans	75.00	x	3.07	=	230.25	(267)
Electricity for lighting	218.93	x	3.07	=	672.12	(268)
Primary energy kWh/year					6073.13	(272)
Dwelling primary energy rate kWh/m ² /year					132.60	(273)

This design submission has been carried out using Approved SAP software. It has been prepared from plans and specifications and may not reflect the property as constructed.

Assessor name	Mr Stuart Searle	Assessor number	3519
Client	Avis Appleton & Associates	Last modified	14/09/2016
Address	PT6 Liffords Place, London, SW13		

1. Overall dwelling dimensions

	Area (m ²)	Average storey height (m)	Volume (m ³)
Lowest occupied	<input type="text" value="79.10"/> (1a) x	<input type="text" value="2.50"/> (2a) =	<input type="text" value="197.75"/> (3a)
Total floor area	(1a) + (1b) + (1c) + (1d)...(1n) = <input type="text" value="79.10"/> (4)		
Dwelling volume	(3a) + (3b) + (3c) + (3d)...(3n) =		<input type="text" value="197.75"/> (5)

2. Ventilation rate

		m ³ per hour
Number of chimneys	<input type="text" value="0"/> x 40 =	<input type="text" value="0"/> (6a)
Number of open flues	<input type="text" value="0"/> x 20 =	<input type="text" value="0"/> (6b)
Number of intermittent fans	<input type="text" value="3"/> x 10 =	<input type="text" value="30"/> (7a)
Number of passive vents	<input type="text" value="0"/> x 10 =	<input type="text" value="0"/> (7b)
Number of flueless gas fires	<input type="text" value="0"/> x 40 =	<input type="text" value="0"/> (7c)

	Air changes per hour
Infiltration due to chimneys, flues, fans, PSVs	(6a) + (6b) + (7a) + (7b) + (7c) = <input type="text" value="30"/> ÷ (5) = <input type="text" value="0.15"/> (8)

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

Air permeability value, q₅₀, expressed in cubic metres per hour per square metre of envelope area (17)

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16) (18)

Number of sides on which the dwelling is sheltered (19)

Shelter factor 1 - [0.075 x (19)] = (20)

Infiltration rate incorporating shelter factor (18) x (20) = (21)

Infiltration rate modified for monthly wind speed:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table U2	<input type="text" value="5.10"/>	<input type="text" value="5.00"/>	<input type="text" value="4.90"/>	<input type="text" value="4.40"/>	<input type="text" value="4.30"/>	<input type="text" value="3.80"/>	<input type="text" value="3.80"/>	<input type="text" value="3.70"/>	<input type="text" value="4.00"/>	<input type="text" value="4.30"/>	<input type="text" value="4.50"/>	<input type="text" value="4.70"/>

Wind factor (22)m ÷ 4	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	<input type="text" value="1.28"/>	<input type="text" value="1.25"/>	<input type="text" value="1.23"/>	<input type="text" value="1.10"/>	<input type="text" value="1.08"/>	<input type="text" value="0.95"/>	<input type="text" value="0.95"/>	<input type="text" value="0.93"/>	<input type="text" value="1.00"/>	<input type="text" value="1.08"/>	<input type="text" value="1.13"/>	<input type="text" value="1.18"/>

Adjusted infiltration rate (allowing for shelter and wind factor) (21) x (22a)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	<input type="text" value="0.44"/>	<input type="text" value="0.43"/>	<input type="text" value="0.42"/>	<input type="text" value="0.38"/>	<input type="text" value="0.37"/>	<input type="text" value="0.32"/>	<input type="text" value="0.32"/>	<input type="text" value="0.32"/>	<input type="text" value="0.34"/>	<input type="text" value="0.37"/>	<input type="text" value="0.38"/>	<input type="text" value="0.40"/>

Calculate effective air change rate for the applicable case:

If mechanical ventilation: air change rate through system (23a)

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

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
<input type="text" value="0.59"/>	<input type="text" value="0.59"/>	<input type="text" value="0.59"/>	<input type="text" value="0.57"/>	<input type="text" value="0.57"/>	<input type="text" value="0.55"/>	<input type="text" value="0.55"/>	<input type="text" value="0.55"/>	<input type="text" value="0.56"/>	<input type="text" value="0.57"/>	<input type="text" value="0.57"/>	<input type="text" value="0.58"/>

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in (25)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	<input type="text" value="0.59"/>	<input type="text" value="0.59"/>	<input type="text" value="0.59"/>	<input type="text" value="0.57"/>	<input type="text" value="0.57"/>	<input type="text" value="0.55"/>	<input type="text" value="0.55"/>	<input type="text" value="0.55"/>	<input type="text" value="0.56"/>	<input type="text" value="0.57"/>	<input type="text" value="0.57"/>	<input type="text" value="0.58"/>

3. Heat losses and heat loss parameter

Element	Gross area, m ²	Openings m ²	Net area A, m ²	U-value W/m ² K	A x U W/K	κ-value, kJ/m ² .K	A x κ, kJ/K						
Door			2.10	1.00	2.10		(26)						
Window			12.10	1.33	16.04		(27)						
External wall			88.80	0.18	15.98		(29a)						
Roof			87.01	0.13	11.31		(30)						
Total area of external elements ΣA, m ²			190.01				(31)						
Fabric heat loss, W/K = Σ(A x U)					(26)...(30) + (32) =	45.44	(33)						
Heat capacity Cm = Σ(A x κ)					(28)...(30) + (32) + (32a)...(32e) =	N/A	(34)						
Thermal mass parameter (TMP) in kJ/m ² K						250.00	(35)						
Thermal bridges: Σ(L x Ψ) calculated using Appendix K						24.79	(36)						
Total fabric heat loss						(33) + (36) =	70.22 (37)						
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ventilation heat loss calculated monthly 0.33 x (25)m x (5)	38.81	38.57	38.34	37.23	37.02	36.06	36.06	35.88	36.43	37.02	37.44	37.88	(38)
Heat transfer coefficient, W/K (37)m + (38)m	109.04	108.80	108.56	107.45	107.25	106.28	106.28	106.11	106.66	107.25	107.67	108.10	
	Average = Σ(39)1...12/12 =											107.45 (39)	
Heat loss parameter (HLP), W/m ² K (39)m ÷ (4)	1.38	1.38	1.37	1.36	1.36	1.34	1.34	1.34	1.35	1.36	1.36	1.37	
	Average = Σ(40)1...12/12 =											1.36 (40)	
Number of days in month (Table 1a)	31.00	28.00	31.00	30.00	31.00	30.00	31.00	31.00	30.00	31.00	30.00	31.00	(40)

4. Water heating energy requirement

Assumed occupancy, N													2.45	(42)	
Annual average hot water usage in litres per day Vd,average = (25 x N) + 36														92.28	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec			
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)	101.51	97.82	94.13	90.44	86.75	83.05	83.05	86.75	90.44	94.13	97.82	101.51			
	Σ(44)1...12 =											1107.39	(44)		
Energy content of hot water used = 4.18 x Vd,m x nm x Tm/3600 kWh/month (see Tables 1b, 1c 1d)	150.54	131.66	135.86	118.45	113.65	98.07	90.88	104.29	105.53	122.99	134.25	145.79			
	Σ(45)1...12 =											1451.96	(45)		
Distribution loss 0.15 x (45)m	22.58	19.75	20.38	17.77	17.05	14.71	13.63	15.64	15.83	18.45	20.14	21.87	(46)		
Water storage loss calculated for each month (55) x (41)m	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(56)		
If the vessel contains dedicated solar storage or dedicated WWHRS (56)m x [(47) - Vs] ÷ (47), else (56)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(57)		
Primary circuit loss for each month from Table 3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(59)		
Combi loss for each month from Table 3a, 3b or 3c	50.96	45.02	47.97	44.60	44.20	40.96	42.32	44.20	44.60	47.97	48.24	50.96	(61)		
Total heat required for water heating calculated for each month 0.85 x (45)m + (46)m + (57)m + (59)m + (61)m	201.50	176.68	183.83	163.05	157.86	139.03	133.20	148.49	150.13	170.95	182.49	196.75	(62)		
Solar DHW input calculated using Appendix G or Appendix H															

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(63)
------	------	------	------	------	------	------	------	------	------	------	------	------	------

Output from water heater for each month (kWh/month) (62)m + (63)m

201.50	176.68	183.83	163.05	157.86	139.03	133.20	148.49	150.13	170.95	182.49	196.75	$\Sigma(64)1...12 =$	2003.96	(64)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	----------------------	---------	------

Heat gains from water heating (kWh/month) $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

62.79	55.03	57.17	50.53	48.84	42.85	40.80	45.73	46.24	52.88	56.70	61.21	(65)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

5. Internal gains

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

Metabolic gains (Table 5)

122.28	122.28	122.28	122.28	122.28	122.28	122.28	122.28	122.28	122.28	122.28	122.28	(66)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

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

20.42	18.14	14.75	11.17	8.35	7.05	7.61	9.90	13.28	16.87	19.69	20.99	(67)
-------	-------	-------	-------	------	------	------	------	-------	-------	-------	-------	------

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

217.55	219.81	214.12	202.01	186.72	172.35	162.75	160.50	166.18	178.29	193.58	207.95	(68)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

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

35.23	35.23	35.23	35.23	35.23	35.23	35.23	35.23	35.23	35.23	35.23	35.23	(69)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Pump and fan gains (Table 5a)

3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	(70)
------	------	------	------	------	------	------	------	------	------	------	------	------

Losses e.g. evaporation (Table 5)

-97.82	-97.82	-97.82	-97.82	-97.82	-97.82	-97.82	-97.82	-97.82	-97.82	-97.82	-97.82	(71)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Water heating gains (Table 5)

84.40	81.89	76.84	70.19	65.65	59.51	54.84	61.46	64.22	71.08	78.75	82.28	(72)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

385.05	382.52	368.39	346.04	323.40	301.59	287.89	294.54	306.37	328.93	354.70	373.90	(73)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

6. Solar gains

	Access factor Table 6d	Area m ²	Solar flux W/m ²	g specific data or Table 6b	FF specific data or Table 6c	Gains W	
SouthWest	0.77	4.84	36.79	0.9 x 0.63	0.70	54.42	(79)
NorthWest	0.77	4.84	11.28	0.9 x 0.63	0.70	16.69	(81)
SouthEast	0.77	2.42	36.79	0.9 x 0.63	0.70	27.21	(77)

Solar gains in watts $\Sigma(74)m...(82)m$

98.33	173.03	251.47	336.26	399.17	406.19	387.49	339.04	280.60	195.20	118.78	83.49	(83)
-------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	------

Total gains - internal and solar (73)m + (83)m

483.38	555.55	619.86	682.31	722.57	707.79	675.38	633.58	586.97	524.13	473.48	457.39	(84)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

7. Mean internal temperature (heating season)

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

21.00	(85)
-------	------

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

Utilisation factor for gains for living area n1,m (see Table 9a)

1.00	1.00	0.99	0.97	0.92	0.80	0.64	0.70	0.90	0.98	1.00	1.00	(86)
------	------	------	------	------	------	------	------	------	------	------	------	------

Mean internal temp of living area T1 (steps 3 to 7 in Table 9c)

19.47	19.63	19.90	20.27	20.62	20.87	20.96	20.95	20.76	20.31	19.83	19.45	(87)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

19.78	19.78	19.78	19.80	19.80	19.81	19.81	19.81	19.80	19.80	19.79	19.79	(88)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Utilisation factor for gains for rest of dwelling n2,m

1.00	0.99	0.99	0.96	0.88	0.70	0.49	0.55	0.83	0.97	0.99	1.00	(89)
------	------	------	------	------	------	------	------	------	------	------	------	------

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

17.77	18.00	18.40	18.93	19.41	19.71	19.79	19.79	19.60	19.00	18.29	17.73	(90)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Living area fraction

Living area ÷ (4) = (91)

Mean internal temperature for the whole dwelling fLA x T1 +(1 - fLA) x T2

18.51	18.71	19.05	19.52	19.94	20.22	20.30	20.29	20.11	19.57	18.96	18.48	(92)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

18.51	18.71	19.05	19.52	19.94	20.22	20.30	20.29	20.11	19.57	18.96	18.48	(93)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

8. Space heating requirement

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

Utilisation factor for gains, ηm

1.00	0.99	0.98	0.96	0.89	0.74	0.56	0.61	0.85	0.97	0.99	1.00	(94)
------	------	------	------	------	------	------	------	------	------	------	------	------

Useful gains, ηmGm, W (94)m x (84)m

481.30	550.98	608.92	651.96	640.88	524.52	377.87	389.30	498.75	507.16	469.68	455.84	(95)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Monthly average external temperature from Table U1

4.30	4.90	6.50	8.90	11.70	14.60	16.60	16.40	14.10	10.60	7.10	4.20	(96)
------	------	------	------	-------	-------	-------	-------	-------	-------	------	------	------

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

1549.54	1502.71	1362.79	1140.64	883.41	597.13	393.59	413.00	640.51	962.03	1277.17	1543.79	(97)
---------	---------	---------	---------	--------	--------	--------	--------	--------	--------	---------	---------	------

Space heating requirement, kWh/month 0.024 x [(97)m - (95)m] x (41)m

794.77	639.56	560.88	351.85	180.44	0.00	0.00	0.00	0.00	338.43	581.39	809.43	(98)
--------	--------	--------	--------	--------	------	------	------	------	--------	--------	--------	------

Σ(98)1...5, 10...12 = (98)

Space heating requirement kWh/m²/year

(98) ÷ (4) = (99)

9a. Energy requirements - individual heating systems including micro-CHP

Space heating

Fraction of space heat from secondary/supplementary system (table 11)

(201)

Fraction of space heat from main system(s)

1 - (201) = (202)

Fraction of space heat from main system 2

(202)

Fraction of total space heat from main system 1

(202) x [1- (203)] = (204)

Fraction of total space heat from main system 2

(202) x (203) = (205)

Efficiency of main system 1 (%)

(206)

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

Space heating fuel (main system 1), kWh/month

850.93	684.75	600.51	376.71	193.19	0.00	0.00	0.00	0.00	362.34	622.47	866.63	(211)
--------	--------	--------	--------	--------	------	------	------	------	--------	--------	--------	-------

Σ(211)1...5, 10...12 = (211)

Water heating

Efficiency of water heater

88.16	88.00	87.68	86.94	85.39	80.30	80.30	80.30	80.30	86.74	87.76	88.23	(217)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

Water heating fuel, kWh/month

228.56	200.77	209.66	187.54	184.87	173.14	165.88	184.92	186.96	197.09	207.93	222.99	(219)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------

Σ(219a)1...12 = (219)

Annual totals

Space heating fuel - main system 1

Water heating fuel

Electricity for pumps, fans and electric keep-hot (Table 4f)

central heating pump or water pump within warm air heating unit

(230c)

boiler flue fan

(230e)

Total electricity for the above, kWh/year

(231)

Electricity for lighting (Appendix L)					360.60	(232)
Total delivered energy for all uses				(211)...(221) + (231) + (232)...(237b) =	7343.48	(238)

10a. Fuel costs - individual heating systems including micro-CHP

	Fuel kWh/year		Fuel price		Fuel cost £/year	
Space heating - main system 1	4557.55	x	3.48	x 0.01 =	158.60	(240)
Water heating	2350.33	x	3.48	x 0.01 =	81.79	(247)
Pumps and fans	75.00	x	13.19	x 0.01 =	9.89	(249)
Electricity for lighting	360.60	x	13.19	x 0.01 =	47.56	(250)
Additional standing charges					120.00	(251)
Total energy cost				(240)...(242) + (245)...(254) =	417.85	(255)

11a. SAP rating - individual heating systems including micro-CHP

Energy cost deflator (Table 12)	0.42	(256)
Energy cost factor (ECF)	1.41	(257)
SAP value	80.27	
SAP rating (section 13)	80	(258)
SAP band	C	

12a. CO₂ emissions - individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO ₂ /kWh		Emissions kg CO ₂ /year	
Space heating - main system 1	4557.55	x	0.216	=	984.43	(261)
Water heating	2350.33	x	0.216	=	507.67	(264)
Space and water heating				(261) + (262) + (263) + (264) =	1492.10	(265)
Pumps and fans	75.00	x	0.519	=	38.93	(267)
Electricity for lighting	360.60	x	0.519	=	187.15	(268)
Total CO ₂ , kg/year				(265)...(271) =	1718.18	(272)
Dwelling CO ₂ emission rate				(272) ÷ (4) =	21.72	(273)
EI value					81.45	
EI rating (section 14)					81	(274)
EI band					B	

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

	Energy kWh/year		Primary factor		Primary Energy kWh/year	
Space heating - main system 1	4557.55	x	1.22	=	5560.21	(261)
Water heating	2350.33	x	1.22	=	2867.41	(264)
Space and water heating				(261) + (262) + (263) + (264) =	8427.62	(265)
Pumps and fans	75.00	x	3.07	=	230.25	(267)
Electricity for lighting	360.60	x	3.07	=	1107.04	(268)
Primary energy kWh/year					9764.90	(272)
Dwelling primary energy rate kWh/m ² /year					123.45	(273)