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Assessor name	Mr Adrian Fell	Assessor number	3536
Client		Last modified	23/05/2019
Address	B3-A-09-05 West Cromwell Road, Kensington, London, W14 8		

### 1. Overall dwelling dimensions

	Area (m <sup>2</sup> )		Average storey height (m)		Volume (m <sup>3</sup> )
Lowest occupied	<input type="text" value="97.00"/> (1a)	x	<input type="text" value="2.55"/> (2a)	=	<input type="text" value="247.35"/> (3a)
Total floor area	(1a) + (1b) + (1c) + (1d)...(1n) = <input type="text" value="97.00"/> (4)				
Dwelling volume	(3a) + (3b) + (3c) + (3d)...(3n) = <input type="text" value="247.35"/> (5)				

### 2. Ventilation rate

			m <sup>3</sup> 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="0.12"/> (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 <sub>50</sub> , expressed in cubic metres per hour per square metre of envelope area	<input type="text" value="5.00"/> (17)
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If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)	<input type="text" value="0.37"/> (18)
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Number of sides on which the dwelling is sheltered	<input type="text" value="2"/> (19)
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Shelter factor	1 - [0.075 x (19)] = <input type="text" value="0.85"/> (20)
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Infiltration rate incorporating shelter factor	(18) x (20) = <input type="text" value="0.32"/> (21)
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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)
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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="0.39"/>	<input type="text" value="0.35"/>	<input type="text" value="0.34"/>	<input type="text" value="0.30"/>	<input type="text" value="0.30"/>	<input type="text" value="0.29"/>	<input type="text" value="0.32"/>	<input type="text" value="0.34"/>	<input type="text" value="0.36"/>	<input type="text" value="0.37"/> (22b)
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Calculate effective air change rate for the applicable case:

If mechanical ventilation: air change rate through system	<input type="text" value="N/A"/> (23a)
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If balanced with heat recovery: efficiency in % allowing for in-use factor from Table 4h	<input type="text" value="N/A"/> (23c)
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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)
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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)
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### 3. Heat losses and heat loss parameter

Element	Gross area, m <sup>2</sup>	Openings m <sup>2</sup>	Net area A, m <sup>2</sup>	U-value W/m <sup>2</sup> K	A x U W/K	κ-value, kJ/m <sup>2</sup> .K	A x κ, kJ/K						
Window			24.24	1.33	32.14		(27)						
External wall			35.68	0.18	6.42		(29a)						
Party wall			40.29	0.00	0.00		(32)						
Roof			40.40	0.13	5.25		(30)						
Total area of external elements ΣA, m <sup>2</sup>			100.32				(31)						
Fabric heat loss, W/K = Σ(A × U)					(26)...(30) + (32) =	43.81	(33)						
Heat capacity Cm = Σ(A × κ)					(28)...(30) + (32) + (32a)...(32e) =	N/A	(34)						
Thermal mass parameter (TMP) in kJ/m <sup>2</sup> K						250.00	(35)						
Thermal bridges: Σ(L × Ψ) calculated using Appendix K						5.02	(36)						
Total fabric heat loss					(33) + (36) =	48.83	(37)						
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ventilation heat loss calculated monthly 0.33 × (25)m × (5)	47.42	47.16	46.91	45.73	45.51	44.48	44.48	44.29	44.88	45.51	45.96	46.42	(38)
Heat transfer coefficient, W/K (37)m + (38)m	96.25	95.99	95.74	94.56	94.34	93.31	93.31	93.12	93.70	94.34	94.78	95.25	
	Average = Σ(39)1...12/12 =											94.56	(39)
Heat loss parameter (HLP), W/m <sup>2</sup> K (39)m ÷ (4)	0.99	0.99	0.99	0.97	0.97	0.96	0.96	0.96	0.97	0.97	0.98	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	(40)

### 4. Water heating energy requirement

Assumed occupancy, N												2.71	(42)	
Annual average hot water usage in litres per day $V_{d,average} = (25 \times N) + 36$												98.56	(43)	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot water usage in litres per day for each month $V_{d,m} = \text{factor from Table 1c} \times (43)$														
	108.42	104.48	100.53	96.59	92.65	88.71	88.71	92.65	96.59	100.53	104.48	108.42		
												$\sum(44)_{1...12} =$	1182.74	(44)
Energy content of hot water used = $4.18 \times V_{d,m} \times n_m \times T_m / 3600$ kWh/month (see Tables 1b, 1c 1d)														
	160.78	140.62	145.11	126.51	121.39	104.75	97.06	111.38	112.71	131.36	143.39	155.71		
												$\sum(45)_{1...12} =$	1550.76	(45)
Distribution loss $0.15 \times (45)m$														
	24.12	21.09	21.77	18.98	18.21	15.71	14.56	16.71	16.91	19.70	21.51	23.36	(46)	
Storage volume (litres) including any solar or WWHRS storage within same vessel												4.00	(47)	
Water storage loss:														
a) If manufacturer's declared loss factor is known (kWh/day)												0.28	(48)	
Temperature factor from Table 2b												0.54	(49)	
Energy lost from water storage (kWh/day) $(48) \times (49)$												0.15	(50)	
Enter (50) or (54) in (55)												0.15	(55)	
Water storage loss calculated for each month $(55) \times (41)m$														
	4.67	4.22	4.67	4.52	4.67	4.52	4.67	4.67	4.52	4.67	4.52	4.67	(56)	
If the vessel contains dedicated solar storage or dedicated WWHRS $(56)m \times [(47) - V_s] \div (47)$ , else (56)														
	4.67	4.22	4.67	4.52	4.67	4.52	4.67	4.67	4.52	4.67	4.52	4.67	(57)	
Primary circuit loss for each month from Table 3														

23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)
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Combi loss for each month from Table 3a, 3b or 3c

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(61)
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Total heat required for water heating calculated for each month  $0.85 \times (45)m + (46)m + (57)m + (59)m + (61)m$

188.72	165.85	173.04	153.54	149.32	131.78	125.00	139.32	139.75	159.29	170.42	183.64	(62)
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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)
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Output from water heater for each month (kWh/month)  $(62)m + (63)m$

188.72	165.85	173.04	153.54	149.32	131.78	125.00	139.32	139.75	159.29	170.42	183.64	
$\Sigma(64)1...12 =$											1879.69	(64)

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

75.81	66.94	70.60	63.69	62.71	56.46	54.62	59.38	59.11	66.03	69.30	74.12	(65)
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## 5. Internal gains

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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Metabolic gains (Table 5)

135.50	135.50	135.50	135.50	135.50	135.50	135.50	135.50	135.50	135.50	135.50	135.50	(66)
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Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

22.41	19.91	16.19	12.26	9.16	7.73	8.36	10.86	14.58	18.51	21.61	23.03	(67)
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Appliance gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

251.38	253.99	247.42	233.43	215.76	199.16	188.07	185.46	192.03	206.02	223.69	240.29	(68)
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Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

36.55	36.55	36.55	36.55	36.55	36.55	36.55	36.55	36.55	36.55	36.55	36.55	(69)
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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)
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Losses e.g. evaporation (Table 5)

-108.40	-108.40	-108.40	-108.40	-108.40	-108.40	-108.40	-108.40	-108.40	-108.40	-108.40	-108.40	(71)
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Water heating gains (Table 5)

101.89	99.62	94.89	88.46	84.29	78.41	73.42	79.82	82.09	88.74	96.26	99.63	(72)
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Total internal gains  $(66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m$

442.34	440.17	425.15	400.79	375.86	351.95	336.49	342.79	355.35	379.93	408.20	429.60	(73)
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## 6. Solar gains

	Access factor Table 6d	Area m <sup>2</sup>	Solar flux W/m <sup>2</sup>	g specific data or Table 6b	FF specific data or Table 6c	Gains W	
NorthEast	0.77	x 14.22	x 11.28	x 0.9	x 0.63	x 0.70	= 49.03 (75)
NorthWest	0.77	x 10.02	x 11.28	x 0.9	x 0.63	x 0.70	= 34.55 (81)

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

83.58	170.14	306.54	503.42	676.70	721.43	674.88	538.02	373.52	207.92	105.17	68.26	(83)
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Total gains - internal and solar  $(73)m + (83)m$

525.92	610.30	731.68	904.21	1052.56	1073.38	1011.37	880.81	728.87	587.85	513.37	497.86	(84)
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## 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
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Utilisation factor for gains for living area n1,m (see Table 9a)

1.00	1.00	0.99	0.93	0.76	0.55	0.40	0.48	0.80	0.98	1.00	1.00	(86)
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Mean internal temp of living area T1 (steps 3 to 7 in Table 9c)

19.92	20.07	20.34	20.70	20.93	20.99	21.00	21.00	20.93	20.59	20.19	19.90	(87)
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Temperature during heating periods in the rest of dwelling from Table 9, Th2(°C)

20.09	20.09	20.09	20.10	20.11	20.12	20.12	20.12	20.11	20.11	20.10	20.10	(88)
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Utilisation factor for gains for rest of dwelling n2,m

1.00	1.00	0.98	0.91	0.71	0.48	0.32	0.39	0.73	0.97	1.00	1.00	(89)
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Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

18.64	18.85	19.24	19.76	20.04	20.11	20.11	20.12	20.06	19.63	19.05	18.61	(90)
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Living area fraction

Living area ÷ (4) = 0.40 (91)

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

19.16	19.34	19.69	20.14	20.40	20.47	20.47	20.47	20.41	20.02	19.51	19.13	(92)
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Apply adjustment to the mean internal temperature from Table 4e where appropriate

19.16	19.34	19.69	20.14	20.40	20.47	20.47	20.47	20.41	20.02	19.51	19.13	(93)
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## 8. Space heating requirement

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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Utilisation factor for gains, ηm

1.00	0.99	0.98	0.91	0.73	0.50	0.36	0.43	0.75	0.97	1.00	1.00	(94)
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Useful gains, ηmGm, W (94)m x (84)m

524.77	607.05	717.51	823.94	767.73	541.98	360.76	377.59	547.75	568.22	510.88	497.06	(95)
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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)
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Heat loss rate for mean internal temperature, Lm, W [(39)m x [(93)m - (96)m]

1429.98	1386.28	1262.38	1062.72	820.70	547.39	361.34	379.20	591.69	888.44	1176.41	1422.30	(97)
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Space heating requirement, kWh/month 0.024 x [(97)m - (95)m] x (41)m

673.47	523.64	405.39	171.92	39.41	0.00	0.00	0.00	0.00	238.24	479.18	688.38	
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Σ(98)1...5, 10...12 = 3219.64 (98)

Space heating requirement kWh/m²/year

(98) ÷ (4) = 33.19 (99)

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

### Space heating

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

0.00 (201)

Fraction of space heat from main system(s)

1 - (201) = 1.00 (202)

Fraction of space heat from main system 2

0.00 (202)

Fraction of total space heat from main system 1

(202) x [1 - (203)] = 1.00 (204)

Fraction of total space heat from main system 2

(202) x (203) = 0.00 (205)

Efficiency of main system 1 (%)

93.50 (206)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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Space heating fuel (main system 1), kWh/month

720.29	560.05	433.57	183.87	42.15	0.00	0.00	0.00	0.00	254.80	512.49	736.23	
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Σ(211)1...5, 10...12 = 3443.46 (211)

### Water heating

Efficiency of water heater

87.92	87.67	87.01	85.12	81.82	79.80	79.80	79.80	79.80	85.89	87.42	88.01	(217)
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Water heating fuel, kWh/month

214.65	189.17	198.88	180.39	182.50	165.14	156.64	174.59	175.12	185.47	194.93	208.65	
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Σ(219a)1...12 = 2226.15 (219)

### Annual totals

Space heating fuel - main system 1

3443.46

Water heating fuel		2226.15	
Electricity for pumps, fans and electric keep-hot (Table 4f)			
central heating pump or water pump within warm air heating unit	30.00		(230c)
boiler flue fan	45.00		(230e)
Total electricity for the above, kWh/year		75.00	(231)
Electricity for lighting (Appendix L)		395.79	(232)
Total delivered energy for all uses	(211)...(221) + (231) + (232)...(237b) =		6140.40 (238)

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

	Fuel kWh/year		Fuel price		Fuel cost £/year	
Space heating - main system 1	3443.46	x	3.48	x 0.01 =	119.83	(240)
Water heating	2226.15	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	395.79	x	13.19	x 0.01 =	52.20	(250)
Additional standing charges					120.00	(251)
Total energy cost			(240)...(242) + (245)...(254) =		379.40	(255)

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

Energy cost deflator (Table 12)	0.42	(256)
Energy cost factor (ECF)	1.12	(257)
SAP value	84.35	
SAP rating (section 13)	84	(258)
SAP band	B	

#### 12a. CO<sub>2</sub> emissions - individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO <sub>2</sub> /kWh		Emissions kg CO <sub>2</sub> /year	
Space heating - main system 1	3443.46	x	0.216	=	743.79	(261)
Water heating	2226.15	x	0.216	=	480.85	(264)
Space and water heating			(261) + (262) + (263) + (264) =		1224.64	(265)
Pumps and fans	75.00	x	0.519	=	38.93	(267)
Electricity for lighting	395.79	x	0.519	=	205.41	(268)
Total CO <sub>2</sub> , kg/year				(265)...(271) =	1468.97	(272)
Dwelling CO <sub>2</sub> emission rate				(272) ÷ (4) =	15.14	(273)
EI value					86.14	
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	3443.46	x	1.22	=	4201.03	(261)
Water heating	2226.15	x	1.22	=	2715.90	(264)
Space and water heating			(261) + (262) + (263) + (264) =		6916.93	(265)
Pumps and fans	75.00	x	3.07	=	230.25	(267)
Electricity for lighting	395.79	x	3.07	=	1215.07	(268)
Primary energy kWh/year					8362.24	(272)
Dwelling primary energy rate kWh/m <sup>2</sup> /year					86.21	(273)