L1A 2006 Checklist: As Built - Final

This As Built Final submission provides evidence of compliance with Part L of the Building Regulations, in accordance with Appendix A of AD L1A. It has been carried out by an Authorised SAP Assessor and can be accepted for Building Control purposes without further checking. The Assessor has confirmed any changes from the Design Submission with the builder.

Assessor Name	Mr Martin Gill (OCDEA)	**Assessor Number**	1756
Client			
Date Last Modified	30/03/2009		
Address	16 Willingham Way, Kingston Upon Thames, Surrey, KT1 3JA		

No.	Check	Evidence		Produced by	OK?
1	**Criterion 1 - Predicted carbon dioxide emissions from proposed dwelling does not exceed the target**				
1.1	***TER*** (kg CO_2 /m^2/a)	*Main Fuel* *Fuel Factor* *TER*	= *Mains gas* = *1.00* = *23.14*	Authorised SAP Assessor	**N/A**
1.2	***DER*** for dwelling as built (kg CO_2 /m^2/a)	*DER*	= 20.09	Authorised SAP Assessor	**N/A**
1.3	Are emissions from dwelling as built less than or equal to the target?	*DER*	20.09 < *TER 23.14*	Authorised SAP Assessor	**Passed**
2	**Criterion 2 - The performance of the building fabric and the heating, hot water and fixed lighting systems should be no worse than the design limits**				
Fabric U-values					
2.1	Are all the U-values better than the design limits in Table 2?			Authorised SAP Assessor	

Element		Actual U-value	Worst Acceptable U-value	Area weighted avg U-value		
Roofs						
Roof 1		0.15	0.35	0.15	*(0.25)*	**Passed**
Floors						
Floor 1		0.79	0.70	0.79	*(0.25)*	**Failed**
Walls						
Wall 1		0.80	0.70	0.80	*(0.35)*	**Failed**
Openings						
kitchen	W 1	2.70	3.30	3.03	*(2.20)*	**Failed**
master bed	W 2	2.70	3.30	3.03	*(2.20)*	**Failed**
bed rear	W 3	2.70	3.30	3.03	*(2.20)*	**Failed**
living room	W 4	2.70	3.30	3.03	*(2.20)*	**Failed**
bath and T	W 5	2.70	3.30	3.03	*(2.20)*	**Failed**
living room	W 6	2.70	3.30	3.03	*(2.20)*	**Failed**

No.	Check	Evidence					Produced by	OK?
	front door	D 7	3.90	3.30	3.03	*(2.20)*		**Failed**
	hall	W 8	4.80	3.30	3.03	*(2.20)*		**Failed**
Common areas in building with multiple dwellings (where relevant)								
2.2	If the common areas are un-heated, are all U-values better then the limits in Table 2? (if heated, use L-2A)	Schedule of U-values					Builder's Submission	
Heating and hot water systems								
2.3	Does the efficiency of the heating system meet the minimum value set out in the Domestic Heating Compliance Guide?	***Main heating system**:* *Efficiency = 78.60 %* *SEDBUK database Performa* *Minimum permitted = 86.00 %* *Manufacturer description = N/A*					Authorised SAP Assessor	**Failed**
		Secondary heating : None						
2.4	Does the insulation of the hot water cylinder meet the standards set out in the Domestic Heating Compliance Guide?	Cylinder specification as output from SAP calculation *Cylinder: Volume = N/A litres*					Authorised SAP Assessor	
2.5	Do controls meet the minimum controls provision set out in the Domestic Heating Compliance Guide?	***Space heating controls*** *Programmer, room thermostat and TRV's*					Authorised SAP Assessor	**Passed**
		Hot water controls						
		Boiler interlock						**Passed**
		Cylinder thermostat						
		Separate water control						**Passed**
2.6	Does the heating and hot water system meet the other minimum provisions in the Domestic Heating Compliance Guide	Schedule of compliance provisions					Builder's Submission (See schedule below)	
		No solar water heating present						**N/A**

No.	Check	Evidence	Produced by	OK?
Fixed internal and external lighting				
2.7	Does fixed internal lighting comply with paragraphs 42 to 44?	Schedule of installed fixed internal lighting *Standard fittings including non dedicated low E 10* *Low energy lights (dedicated only)* *0*	Builder's Submission (See schedule below)	**Failed**
2.8	Does the external lighting comply with paragraph 45?	Schedule of installed fixed external lighting *External lighting has not been assessed.*	Builder's Submission (See schedule below)	**NA**
3	**Criterion 3 - The dwelling has appropriate passive control measures to limit solar gains.**			
3.1	Does the dwelling have a strong tendency to high summertime temperatures?	*Region: Thames* *Thermal mass parameter: 6.00* *Ventilation rate in hot weather = 4.00 ach* *Cross ventilation possible: Yes* *Window ventilation:* *Curtains closed in daylight hours: No* *Fraction curtains closed: N/A* *Blind/curtain type: N/A* *Overheating risk - Not Significant*	Authorised SAP Assessor	**Passed**
4	**Criterion 4 - the performance of the dwelling, as built, is consistent with the *DER***			
4.1	Have the key features of the design been included (or bettered) in practice?		Authorised SAP Assessor	
	a. Any wall U-values less than 0.28 W/m²K?	*No*		
	b. Any floor U-values less than 0.20 W/m²K?	*No*		
	c. Any roof U-values less than 0.15 W/m²K?	*No*		
	d. Any window or door U-values less than 1.8 W/m²K?	*No*		
	e. Thermal bridging less than the default value for accredited details (0.08)?	*No*		
	f. Design air permeability less than 7m²/(h.m²) at 50 Pa?	*No*		
	g. Main heating system efficiency more than 4% better than minimum?	*No*		
	h. Any low carbon or renewable energy technology?	*Yes*		

No.	Check	Evidence		Produced by	OK?
	i. Is biofuel used for main heating?	*No*			
	ii. CHP or community heating?	*No*			
	iii. Heat pumps?	*No*			
	iv. Solar panel?	*No*			
	v. PV array?	*Peak power (kWp) = 3.87*			
	vi. Wind turbines?	*No*			
	vii. Special features?	*Mechanical ventilation not present (natural)*			
4a	**Fabric construction**				
4.2	Have accredited details been adopted?	Schedule of details used and their reference codes		Builder's submission	
4.3	Have non-accredited details been used?	Evidence that details conform to standards set out in IP 1/06		Builder's submission	
4.4	Has satisfactory documentary evidence of site inspection checks been produced?	Completed pro-formas showing checklists have been completed		Builder's submission	
4.5	***Design air permeability*** ($m^3/(h.m^2$ at 50Pa)	*Design air permeability = 7.28* *As Built air permeability = 7.28*	As Tested	Authorised SAP Assessor	**Passed**
4.6	Has evidence been provided that demonstrates that the ***design air permeability*** has been achieved satisfactorily (see paragraph 56)	Sample pressure test results in comparison to design value.		Builder's Submission (See schedule below)	
4b	**Commissioning heating and hot water systems**				
4.7	Evidence that the heating and hot water systems have been commissioned satisfatorily	Commissioning completion certificate		Builder's Submission (See schedule below)	
5	**Criterion 5 - the necessary provisions for energy efficient operations of the dwelling are put in place**				
5.1	Has all the relevant information been provided?	**O&M** instructions Data for Energy Performance Certificate SAP = 90.92 SAP Band = B		Builder's submission	

No.	Check	Evidence	Produced by	OK?

Schedule of supporting competencies

Check no.	Organisation providing evidence	Telephone No	Evidence of competency
2.6			
2.7			
2.8			
4.6			
4.7			

Key design features: As Built - Final

This As Built Final submission provides evidence of compliance with Part L of the Building Regulations, in accordance with Key design features of ADL-1A. It has been carried out by an Authorised SAP Assessor and can be accepted for Building Control purposes without further checking. The Assessor has confirmed any changes from the Design Submission with the builder.

Assessor Name	Mr Martin Gill (OCDEA)	**Assessor Number**	1756
Client			
Date Last Modified	30/03/2009		
Address	16 Willingham Way, Kingston Upon Thames, Surrey, KT1 3JA		

Important Design Features

Have the key features of the design been included (or bettered) in practice?	Authorised SAP Assessor
a. Any wall U-values less than 0.28 W/m²K?	
No	
b. Any floor U-values less than 0.20 W/m²K?	
No	
c. Any roof U-values less than 0.15 W/m²K?	
No	
d. Any window or door U-values less than 1.8 W/m²K?	
No	
e. Thermal bridging less than the default value for accredited details (0.08)?	*No*
f. Design air permeability less than 7m²/(h.m²) at 50 Pa?	*No*
g. Main heating system efficiency more than 4% better than minimum?	*No*
h. Any low carbon or renewable energy technology?	*Yes*
i. Is biofuel used for main heating?	*No*
ii. CHP or community heating?	*No*
iii. Heat pumps?	*No*
iv. Solar panel?	*No*
v. PV array?	*Peak power (kWp) = 3.87*
vi. Wind turbines?	*No*
vii. Special features?	*No*

DER Worksheet: As Built - Final

This As Built submission has been carried out by an Authorised SAP Assessor. The Assessor has confirmed any changes from the Design Submission with the builder.

Assessor Name Mr Martin Gill (OCDEA) **Assessor Number** 1756

Client

Date Last Modified 30/03/2009

Address 16 Willingham Way, Kingston Upon Thames, Surrey, KT1 3JA

1. Overall dwelling dimensions

	Area (m^2)		Average storey height (m)		Volume (m^3)	
Ground Floor	38.24	(1a)	× 2.34	=	89.48	(1)
First Floor	38.34	(2a)	× 2.65	=	101.60	(2)
Total floor area (1a)+(2a)+(3a)+(4a)+(4b)+(4d)+(4f)+(4h) =	76.58	(5)				
Dwelling volume			(1)+(2)+(3)+(4)+(4c)+(4e)+(4g)+(4i) =		191.08	(6)

2. Ventilation rate

			m^3 per hour	
Number of chimneys	0	× 40 =	0	(7)
Number of open flues	0	× 20 =	0	(8)
Number of intermittent fans or passive vents	2	× 10 =	20	(9)
Number of flueless gas fires	0	× 40 =	0	(9a)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (7)+(8)+(9)+(9a) =	20	÷ box (6) =	0.10	(10)
If a pressurisation test has been carried out, proceed to box (19)				
Number of storeys in the dwelling	2	(11)		
Additional infiltration		[(11) - 1] × 0.1 =	N/A	(12)
Structural infiltration: *0.25 for steel or timber frame or 0.35 for masonry construction*			N/A	(13)
If suspended wooden floor, *enter 0.2 (unsealed) or 0.1 (sealed)*, else enter 0			N/A	(14)
If no draught lobby, enter 0.05, else enter 0			N/A	(15)
Percentage of windows and doors draught stripped	N/A	(16)		
Enter 100 in box (16) for new dwellings which are to comply with Building Regulations				
Window infiltration		0.25 - [0.2 × (16) ÷ 100] =	N/A	(17)
Infiltration rate		(10)+(12)+(13)+(14)+(15)+(17) =	N/A	(18)
If based on air permeability value, then [q_{50} ÷ 20] + (10) in box (19), otherwise (19) = (18)			0.47	(19)
Air permeability value applies if a pressurisation test has been done or the design air permeability is being used				
Number of sides on which sheltered			1	(20)
(Enter 2 in box (20) for new dwellings where location is not shown)				

Shelter factor	1 - [0.075 × (20)] =	0.93	(21)
Adjusted infiltration rate	(19) × (21) =	0.43	(22)
Calculate effective air change rate for the applicable case			
If balanced whole house mechanical ventilation system	air throughput (ach) =	N/A	(22a)
If balanced with heat recovery	efficiency in % allowing for in-use factor =	N/A	(22b)
a) If balanced whole house mechanical ventilation with heat recovery	(22) + (22a) × [1 – (22b) / 100] =	N/A	(23)
b) If balanced whole house mechanical ventilation without heat recovery	(22) + (22a) =	N/A	(23a)
c) If whole house extract ventilation or positive input ventilation from outside *if (22) < 0.25, then (23b) = 0.5; otherwise (23b) = 0.25 + (22)*		N/A	(23b)
d) If natural ventilation or whole house positive input ventilation from loft *if (22) ≥ 1, then (24) = (22); otherwise (24) = 0.5 + [(22)² × 0.5]*		0.59	(24)
Effective air change rate - enter (23) or (23a) or (23b) or (24) in box (25)		0.59	(25)

3. Heat losses and heat loss parameter

ELEMENT	Area (m²)		U - value		AXU (W/K)	
Windows *	11.53	×	2.44	=	28.09	(27)
Doors	1.72	×	3.90	=	6.72	(26)
Windows *	1.27	×	4.03	=	5.10	(27)
Ground Floor	38.24	×	0.79	=	30.21	(28)
Walls	73.10	×	0.80	=	58.48	(29)
Roof	38.24	×	0.15	=	5.74	(30)
Total area of elements ΣA, m²	164.10	(32)				

* *for windows and rooflights, use effective window U-value calculated as given in paragraph 3.2*

Fabric heat loss, W/K	(26)+(27)+(27a)+(27b)+(28)+(29)+(29a)+(30)+(30a)+(31) =	134.34	(33)
Thermal bridges - Σ (lxΨ) calculated using Appendix K *if details of thermal bridging are not known calculate y× (32) [see Appendix K] and enter in box (34)*		24.62	(34)
Total fabric heat loss	(33)+(34) =	158.96	(35)
Ventilation heat loss	(25) × 0.33 × (6) =	37.45	(36)
Heat loss coefficient, W/K	(35)+(36) =	196.41	(37)
Heat loss parameter (HLP), W/m²K	(37) ÷ (5) =	2.56	(38)

4. Water heating energy requirement

	kWh/year	
Energy content of hot water used from Table 1 column (b)	1801.22	(39)
Distribution loss from Table 1 column (c) *If instantaneous water heating at point of use, enter "0" in boxes (40) to (45)* *For community heating use Table 1 (c) whether or not hot water tank is present*	317.86	(40)
Water storage loss:		
a) If manufacturer's declared loss factor is known (kWh/day):	N/A	(41)
Temperature factor from Table 2b	N/A	(41a)

Energy lost from water storage, kWh/year	(41)×(41a)×365 =	N/A	(42)

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

Cylinder volume (litres) including any solar storage within same cylinder *If community heating and no tank in dwelling, enter 110 litres in box (43)* *Otherwise, if no stored hot water (this includes instantaneous combi boilers), enter '0' in box (43)*		N/A	(43)
Hot water storage loss factor from Table 2 (kWh/litre/day) *If community heating and no tank in dwelling, use cylinder loss from Table 2 for 50 mm factory insulation in box (44)*		0.00	(44)
Volume factor from Table 2a		0.00	(44a)
Temperature factor from Table 2b		0.00	(44b)
Energy lost from water storage, kWh/year	(43)×(44)×(44a)×(44b)×365 =	0.00	(45)
Enter (42) or (45) in box (46)		0.00	(46)
If cylinder contains dedicated solar storage, box (47) = (46) × [(43) - (H11)] / (43), else (47) = (46)		0.00	(47)
Primary circuit loss from Table 3		0.00	(48)
Combi loss from Table 3a (enter "0" if no combi boiler)		596.62	(49)
Solar DHW input calculated using Appendix H (enter "0" if no solar collector)		0.00	(50)
Output from water heater, kWh/year	(39)+(40)+(47)+(48)+(49)-(50) =	2715.70	(51)
Heat gains from water heating *include (47) in calculation of (52) only if cylinder is in the dwelling or hot water is from community heating*	0.25 × [(39)+(49)]+0.8×[(40)+(47)+(48)] =	853.75	(52)

5. Internal gains

		Watts	
Lights, appliances, cooking and metabolic (Table 5)		463.24	(53)
Reduction of internal gains due to low energy lighting (calculated in Appendix L)		16.03	(53a)
Additional gains from Table 5a		10.00	(53b)
Water heating	(52) ÷ 8.76 =	97.46	(54)
Total internal gains	(53) + (53b) + (54) - (53a) =	554.67	(55)

6. Solar gains

	Access factor Table 6d		Area m²		Flux Table 6a		g Table 6b		FF Table 6c		Gains (W)	
West	0.77	×	7.67	×	48.00	x 0.9 x	0.76	×	0.70	=	135.67	(57)
East	0.77	×	3.86	×	48.00	x 0.9 x	0.76	×	0.70	=	68.36	(59)
East	0.77	×	1.27	×	48.00	x 0.9 x	0.85	×	0.40	=	14.33	(59)

Total solar gains:	[(56) + ... + (64)] =	218.36	(65)

Note: for new dwellings where overshading is not known, the solar access factor is '0.77'

Total gains, W	(55) + (65) =	773.03	(66)

Gain/loss ratio (GLR)	(66) ÷ (37) =	3.94	(67)
Utilisation factor (Table 7, using GLR in box (67))		0.99	(68)
Useful gains, W	(66) × (68) =	765.05	(69)

7. Mean internal temperature

		° C	
Mean internal temperature of the living area (Table 8)		18.80	(70)
Temperature adjustment from Table 4e, where appropriate		0.00	(71)
Adjustment for gains *R is obtained from the 'responsiveness' column of Table 4a or Table 4d*	{[(69) ÷ (37)] - 4.0} × 0.2 ×R =	-0.02	(72)
Adjusted living room temperature	(70) + (71) + (72) =	18.78	(73)
Temperature difference between zones (Table 9)		1.66	(74)
Living area fraction (0 to 1.0)	living room area ÷ (5) =	0.20	(75)
Rest-of-house fraction	1 - (75) =	0.80	(76)
Mean internal temperature	(73) - [(74) × (76)] =	17.45	(77)

8. Degree days

Temperature rise from gains	(69) ÷ (37) =	3.90	(78)
Base temperature	(77) - (78) =	13.56	(79)
Degree-days, *use box (79) and Table 10*		1682.58	(80)

9. Space heating requirements

Space heating requirement (useful), kWh/year	0.024 × (80) × (37) =	7931.47	(81)

For range cooker boilers where efficiency is obtained from the Boiler Efficiency Database or manufacturer's declared value, multiply the result in box (81) by (1 - Φ case/Φwater) where Φ case is the heat emission from the case of the range cooker at fullload (in kW); and Φ water is the heat transferred to water at full load (in kW).Φ case and Φ water are obtained from the database record for the range cooker boiler or manufacturer's declared value.

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

Note: when space and water heating is provided by community heating use the alternative worksheet 9b

Space heating:

Fraction of heat from secondary/supplementary system (*use value from Table 11, Table 12a or Appendix F)*		0.10	(82)
Efficiency of main heating system, %		78.60	(83)
(SEDBUK or from Table 4a or 4b, adjusted where appropriate by the amount shown in the 'efficiency adjustment' column of Table 4c)			
Efficiency of secondary/supplementary heating system, % (use value from Table 4a or Appendix E)		100.00	(84)
Space heating fuel (main) requirement, kWh/year	[1- (82)] × (81) ×100 ÷ (83) =	9081.84	(85)
Space heating fuel (secondary), kWh/year	(82) × (81) ×100 ÷ (84) =	793.15	(85a)

Water heating:

Efficiency of water heater, %	78.60	(86)
(SEDBUK or from Table 4a or 4b, adjusted where appropriate by the amount shown in the 'efficiency adjustment' column of Table 4c)		
Energy required for water heating, kWh/year (51) × 100 ÷ (86) =	3455.09	(86a)

Electricity for pumps and fans:	**kWh/year**	
each central heating pump, (Table 4f)	130.00	(87a)
each boiler with a fan-assisted flue (Table 4f)	45.00	(87b)
warm air heating system fans (Table 4f)	0.00	(87c)
mechanical ventilation -balanced, extract or positive input from outside (Table 4f)	0.00	(87d)
maintaining keep-hot facility for gas combi boiler (Table 4f)	0.00	(87e)
pump for solar water heating (Table 4f)	0.00	(87f)
Total electricity for the above equipment, kWh/year (87a)+(87b)+(87c)+(87d)+(87e)+(87f) =	175.00	(87)

12a. Dwelling Carbon dioxide Emission Rate (DER) for individual heating systems (including micro-CHP) and community heating without CHP

Individual heating system:	**Energy** kWh/year		**Emission factor** kg CO_2/kWh		**Emissions** kgCO_2/year	
Space heating main from box (85)	9081.84	×	0.194	=	1761.88	(101)
Space heating secondary from box (85a)	793.15	×	0.422	=	334.71	(102)
Energy for water heating from box (86a)	3455.09	×	0.194	=	670.29	(103)
Energy for water heating (51) or [(87b*) × 100 ÷ (104)] =	N/A	×	N/A	=	N/A	(106)
Space and water heating	[(101) + (102) + (103)] or [(105) + (106)] =				2766.87	(107)
Energy for water heating (Type 1 fraction) × (87*) × 100 ÷ (104a) =	N/A	×	N/A	=	N/A	(106a)
Energy for water heating (Type 2 fraction) × (87*) × 100 ÷ (104b) =	N/A	×	0.000	=	N/A	(106b)
Space and water heating	[(105a) + (106a) + (105b) + (106b)] =				2766.87	(107)
Electricity for pumps and fans from box (87) or (88*)	175.00	×	0.422	=	73.85	(108)
Energy for lighting from Appendix L	605.42	×	0.422	=	255.49	(109)
Energy produced or saved in dwelling (Appendices M and N)						
PV energy produced or saved (95) or (95*) of SAP worksheet		×	0.57	=	1558.06	(110)
Wind energy produced or saved (95b1) or (95b1*) of SAP worksheet		×	N/A	=	N/A	(110b)
Micro-CHP energy produced or saved (95c1) or (95c1*) of SAP worksheet		×	N/A	=	N/A	(110c)
Micro-CHP energy consumed (96) or (96*) of SAP worksheet		×	N/A	=	0.00	(111)

Energy produced or saved in dwelling (Appendix Q)	(s1) or (s1*) of SAP worksheet	×	N/A	=	0.00	(s1a)
Energy consumed by the technology (Appendix Q)	(s2) or (s2*) of SAP worksheet	×	N/A	=	0.00	(s2a)
Total CO_2 kg/year	(107) + (108) + (109) - (110) + (111) - (s1a) + (s2a)			=	1538.15	(112)
Dwelling Carbon dioxide Emission Rate (DER)	(112) ÷ (5)			=	20.09	(113)
EI rating					83	
EI band					B	
Space heating from CHP or recovered/geothermal heat, box (86*)		N/A	×	N/A	box (107*) =	N/A
Space heating from boilers	(87*) × 100 ÷ (109*) =	N/A	×	N/A	Table 12 =	-1.00
Electricity for pumps and fans, box (88*)		N/A	×	N/A	Table 12 =	N/A
Total PE associated with boilers, CHP or recovered/geothermal heat *If negative, enter "0" in box (115*)*	[(108*) + (110*) + ... + (114*)] =					-1.00
Energy for lighting from Appendix L		605.42	×	2.80	Table 12 =	1695.18
Energy produced or saved in dwelling (Appendix M)						
PV energy produced or saved	(95*) of SAP worksheet		×	2.80	Table 12 =	7680.56
Wind energy produced or saved	(95b1*) of SAP worksheet		×	N/A	Table 12 =	N/A

TER Worksheet: As Built - Final

This As Built submission has been carried out by an Authorised SAP Assessor. The Assessor has confirmed any changes from the Design Submission with the builder.

Assessor Name Mr Martin Gill (OCDEA) **Assessor Number** 1756

Client

Date Last Modified 30/03/2009

Address 16 Willingham Way, Kingston Upon Thames, Surrey, KT1 3JA

1. Overall dwelling dimensions

	Area (m^2)		Average storey height (m)		Volume (m^3)	
Ground Floor	38.24	(1a)	× 2.34	=	89.48	(1)
First Floor	38.34	(2a)	× 2.65	=	101.60	(2)
Total floor area (1a)+(2a)+(3a)+(4a)+(4b)+(4d)+(4f)+(4h) =	76.58	(5)				
Dwelling volume			(1)+(2)+(3)+(4)+(4c)+(4e)+(4g)+(4i) =		191.08	(6)

2. Ventilation rate

			m^3 per hour	
Number of chimneys	0	× 40 =	0	(7)
Number of open flues	0	× 20 =	0	(8)
Number of intermittent fans or passive vents	2	× 10 =	20	(9)
Number of flueless gas fires	0	× 40 =	0	(9a)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (7)+(8)+(9)+(9a) =	20	÷ box (6) =	0.10	(10)
If a pressurisation test has been carried out, proceed to box (19)				
Number of storeys in the dwelling	2	(11)		
Additional infiltration		[(11) - 1] × 0.1 =	N/A	(12)
Structural infiltration: *0.25 for steel or timber frame or 0.35 for masonry construction*			N/A	(13)
If suspended wooden floor, *enter 0.2 (unsealed) or 0.1 (sealed)*, else enter 0			N/A	(14)
If no draught lobby, enter 0.05, else enter 0			N/A	(15)
Percentage of windows and doors draught stripped	N/A	(16)		
Enter 100 in box (16) for new dwellings which are to comply with Building Regulations				
Window infiltration		0.25 - [0.2 × (16) ÷ 100] =	N/A	(17)
Infiltration rate		(10)+(12)+(13)+(14)+(15)+(17) =	N/A	(18)
If based on air permeability value, then [q_{50} ÷ 20] + (10) in box (19), otherwise (19) = (18)			0.60	(19)
Air permeability value applies if a pressurisation test has been done or the design air permeability is being used				
Number of sides on which sheltered			2	(20)
(Enter 2 in box (20) for new dwellings where location is not shown)				

Shelter factor	1 - [0.075 × (20)] =	0.85	(21)
Adjusted infiltration rate	(19) × (21) =	0.51	(22)
Calculate effective air change rate for the applicable case			
If balanced whole house mechanical ventilation system	air throughput (ach) =	N/A	(22a)
If balanced with heat recovery	efficiency in % allowing for in-use factor =	N/A	(22b)
a) If balanced whole house mechanical ventilation with heat recovery	(22) + (22a) × [1 – (22b) / 100] =	N/A	(23)
b) If balanced whole house mechanical ventilation without heat recovery	(22) + (22a) =	N/A	(23a)
c) If whole house extract ventilation or positive input ventilation from outside *if (22) < 0.25, then (23b) = 0.5; otherwise (23b) = 0.25 + (22)*		N/A	(23b)
d) If natural ventilation or whole house positive input ventilation from loft *if (22) ≥ 1, then (24) = (22); otherwise (24) = 0.5 + [(22)² × 0.5]*		0.63	(24)
Effective air change rate - enter (23) or (23a) or (23b) or (24) in box (25)		0.63	(25)

3. Heat losses and heat loss parameter

ELEMENT	Area (m²)		U - value		AXU (W/K)	
Doors	1.85	×	2.00	=	3.70	(26)
Windows *	17.29	×	1.85	=	32.03	(27)
Ground Floor	38.24	×	0.25	=	9.56	(28)
Walls	68.48	×	0.35	=	23.97	(29)
Roof	38.24	×	0.16	=	6.12	(30)
Total area of elements ΣA, m²	164.10	(32)				

* *for windows and rooflights, use effective window U-value calculated as given in paragraph 3.2*

Fabric heat loss, W/K	(26)+(27)+(27a)+(27b)+(28)+(29)+(29a)+(30)+(30a)+(31) =	75.37	(33)
Thermal bridges - Σ (lxΨ) calculated using Appendix K *if details of thermal bridging are not known calculate y× (32) [see Appendix K] and enter in box (34)*		18.05	(34)
Total fabric heat loss	(33)+(34) =	93.42	(35)
Ventilation heat loss	(25) × 0.33 × (6) =	39.86	(36)
Heat loss coefficient, W/K	(35)+(36) =	133.28	(37)
Heat loss parameter (HLP), W/m²K	(37) ÷ (5) =	1.74	(38)

4. Water heating energy requirement

	kWh/year	
Energy content of hot water used from Table 1 column (b)	1801.22	(39)
Distribution loss from Table 1 column (c) *If instantaneous water heating at point of use, enter "0" in boxes (40) to (45)* *For community heating use Table 1 (c) whether or not hot water tank is present*	317.86	(40)
Water storage loss:		
a) If manufacturer's declared loss factor is known (kWh/day):	N/A	(41)
Temperature factor from Table 2b	N/A	(41a)

Energy lost from water storage, kWh/year	(41)×(41a)×365 =	N/A	(42)

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

Cylinder volume (litres) including any solar storage within same cylinder *If community heating and no tank in dwelling, enter 110 litres in box (43)* *Otherwise, if no stored hot water (this includes instantaneous combi boilers), enter '0' in box (43)*		150.00	(43)
Hot water storage loss factor from Table 2 (kWh/litre/day) *If community heating and no tank in dwelling, use cylinder loss from Table 2 for 50 mm factory insulation in box (44)*		0.02	(44)
Volume factor from Table 2a		0.93	(44a)
Temperature factor from Table 2b		0.54	(44b)
Energy lost from water storage, kWh/year	(43)×(44)×(44a)×(44b)×365 =	524.28	(45)
Enter (42) or (45) in box (46)		524.28	(46)
If cylinder contains dedicated solar storage, box (47) = (46) × [(43) - (H11)] / (43), else (47) = (46)		524.28	(47)
Primary circuit loss from Table 3		610.00	(48)
Combi loss from Table 3a (enter "0" if no combi boiler)		0.00	(49)
Solar DHW input calculated using Appendix H (enter "0" if no solar collector)		0.00	(50)
Output from water heater, kWh/year	(39)+(40)+(47)+(48)+(49)-(50) =	3253.37	(51)
Heat gains from water heating *include (47) in calculation of (52) only if cylinder is in the dwelling or hot water is from community heating*	0.25 × [(39)+(49)]+0.8×[(40)+(47)+(48)] =	1612.02	(52)

5. Internal gains

		Watts	
Lights, appliances, cooking and metabolic (Table 5)		463.24	(53)
Reduction of internal gains due to low energy lighting (calculated in Appendix L)		15.38	(53a)
Additional gains from Table 5a		10.00	(53b)
Water heating	(52) ÷ 8.76 =	184.02	(54)
Total internal gains	(53) + (53b) + (54) - (53a) =	641.88	(55)

6. Solar gains

	Access factor Table 6d		Area m²		Flux Table 6a		g Table 6b		FF Table 6c		Gains (W)	
West	0.77	×	17.29	×	48.00	x 0.9 x	0.72	×	0.70	=	289.95	(57)

Total solar gains:	[(56) + ... + (64)] =	289.95	(65)
Note: for new dwellings where overshading is not known, the solar access factor is '0.77'			
Total gains, W	(55) + (65) =	931.83	(66)
Gain/loss ratio (GLR)	(66) ÷ (37) =	6.99	(67)
Utilisation factor (Table 7, using GLR in box (67))		0.92	(68)

Useful gains, W	(66) × (68) =	860.84	(69)

7. Mean internal temperature

		° C	
Mean internal temperature of the living area (Table 8)		18.87	(70)
Temperature adjustment from Table 4e, where appropriate		0.00	(71)
Adjustment for gains *R is obtained from the 'responsiveness' column of Table 4a or Table 4d*	{[(69) ÷ (37)] - 4.0} × 0.2 ×R =	0.49	(72)
Adjusted living room temperature	(70) + (71) + (72) =	19.36	(73)
Temperature difference between zones (Table 9)		1.53	(74)
Living area fraction (0 to 1.0)	living room area ÷ (5) =	0.20	(75)
Rest-of-house fraction	1 - (75) =	0.80	(76)
Mean internal temperature	(73) - [(74) × (76)] =	18.13	(77)

8. Degree days

Temperature rise from gains	(69) ÷ (37) =	6.46	(78)
Base temperature	(77) - (78) =	11.68	(79)
Degree-days, *use box (79) and Table 10*		1276.84	(80)

9. Space heating requirements

Space heating requirement (useful), kWh/year	0.024 × (80) × (37) =	4084.27	(81)

For range cooker boilers where efficiency is obtained from the Boiler Efficiency Database or manufacturer's declared value, multiply the result in box (81) by (1 - Φ_{case}/Φ_{water}) where Φ_{case} is the heat emission from the case of the range cooker at fullload (in kW); and Φ_{water} is the heat transferred to water at full load (in kW).Φ_{case} and Φ_{water} are obtained from the database record for the range cooker boiler or manufacturer's declared value.

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

Note: when space and water heating is provided by community heating use the alternative worksheet 9b

Space heating:

Fraction of heat from secondary/supplementary system (*use value from Table 11, Table 12a or Appendix F)*		0.10	(82)
Efficiency of main heating system, %		78.00	(83)
(SEDBUK or from Table 4a or 4b, adjusted where appropriate by the amount shown in the 'efficiency adjustment' column of Table 4c)			
Efficiency of secondary/supplementary heating system, % (use value from Table 4a or Appendix E)		100.00	(84)
Space heating fuel (main) requirement, kWh/year	[1- (82)] × (81) ×100 ÷ (83) =	4712.62	(85)
Space heating fuel (secondary), kWh/year	(82) × (81) ×100 ÷ (84) =	408.43	(85a)

Water heating:

Efficiency of water heater, %		78.00	(86)
(SEDBUK or from Table 4a or 4b, adjusted where appropriate by the amount shown in the 'efficiency adjustment' column of Table 4c)			
Energy required for water heating, kWh/year	(51) × 100 ÷ (86) =	4170.98	(86a)

Electricity for pumps and fans:	**kWh/year**	
each central heating pump, (Table 4f)	130.00	(87a)
each boiler with a fan-assisted flue (Table 4f)	45.00	(87b)
warm air heating system fans (Table 4f)	0.00	(87c)
mechanical ventilation -balanced, extract or positive input from outside (Table 4f)	0.00	(87d)
maintaining keep-hot facility for gas combi boiler (Table 4f)	0.00	(87e)
pump for solar water heating (Table 4f)	0.00	(87f)

Total electricity for the above equipment, kWh/year (87a)+(87b)+(87c)+(87d)+(87e)+(87f) = 175.00 (87)

12a. Carbon dioxide emissions rate for individual heating systems (including micro-CHP) and community heating without CHP

Individual heating system:	**Energy** kWh/year		**Emission factor** kg CO_2/kWh		**Emissions** kgCO_2/year	
Space heating main from box (85)	4712.62	×	0.194	=	914.25	(101)
Space heating secondary from box (85a)	408.43	×	0.422	=	172.36	(102)
Energy for water heating from box (86a)	4170.98	×	0.194	=	809.17	(103)
Energy for water heating (51) or [(87b*) × 100 ÷ (104)] =	N/A	×	N/A	=	N/A	(106)
Space and water heating	[(101) + (102) + (103)] or [(105) + (106)] =				1895.77	(107)
Energy for water heating (Type 1 fraction) × (87*) × 100 ÷ (104a) =	N/A	×	N/A	=	N/A	(106a)
Energy for water heating (Type 2 fraction) × (87*) × 100 ÷ (104b) =	N/A	×	0.000	=	N/A	(106b)
Space and water heating	[(105a) + (106a) + (105b) + (106b)] =				1895.77	(107)
Electricity for pumps and fans from box (87) or (88*)	175.00	×	0.422	=	73.85	(108)
Energy for lighting from Appendix L	581.05	×	0.422	=	245.20	(109)
Energy produced or saved in dwelling (Appendices M and N)						
PV energy produced or saved (95) or (95*) of SAP worksheet		×	N/A	=	N/A	(110)
Wind energy produced or saved (95b1) or (95b1*) of SAP worksheet		×	N/A	=	N/A	(110b)
Micro-CHP energy produced or saved (95c1) or (95c1*) of SAP worksheet		×	N/A	=	N/A	(110c)
Micro-CHP energy consumed (96) or (96*) of SAP worksheet		×	N/A	=	0.00	(111)
Energy produced or saved in dwelling (Appendix Q) (s1) or (s1*) of SAP worksheet		×	N/A	=	0.00	(s1a)
Energy consumed by the technology (Appendix Q) (s2) or (s2*) of SAP worksheet		×	N/A	=	0.00	(s2a)
Total CO_2 kg/year (107) + (108) + (109) - (110) + (111) - (s1a) + (s2a)				=	2214.83	(112)
Carbon dioxide emissions rate (112) ÷ (5)				=	28.92	(113)
EI rating					76	
EI band					C	

Space heating from CHP or recovered/geothermal heat, box (86*)	N/A	×	N/A	box (107*) =	N/A
Space heating from boilers (87*) × 100 ÷ (109*) =	N/A	×	N/A	Table 12 =	-1.00
Electricity for pumps and fans, box (88*)	N/A	×	N/A	Table 12 =	N/A
Total PE associated with boilers, CHP or recovered/geothermal heat *If negative, enter "0" in box (115*)*			[(108*) + (110*) + ... + (114*)] =		-1.00
Energy for lighting from Appendix L	581.05	×	2.80	Table 12 =	1626.93
Energy produced or saved in dwelling (Appendix M)					
PV energy produced or saved (95*) of SAP worksheet		×	N/A	Table 12 =	N/A
Wind energy produced or saved (95b1*) of SAP worksheet		×	N/A	Table 12 =	N/A

14. Target carbon dioxide Emission Rate (TER)

TER = (Ch X fuel factor + Cl) × (1- improvement factor)	23.14
Where	
Ch is carbon dioxide emissions for heating and hot water (including pumps and fans)	25.72
Fuel Factor is taken from Table 1	1.00
Cl is the carbon dioxide emission s for internal fixed lighting	3.20
Improvement Factor is 20 %	0.20