Project Information

Building type Detached house

Reference	J5067-1		
Date	7 October 2019		
Client	DCM Architectural Consultants Ltd 25 Pigeon Lane Herne Bay Kent CT6 7EH	Project	Unit 1 66 Borstal Hill Whitstable Kent CT5 4NB

Code for Sustainable Homes

Assessor Name:	Mark Attlesey
Assessor No.:	ECMK300581
Ene 1:	Dwelling Emission Rating
TER:	18.07
DER:	17.75
% improvement:	1.8%
Credits:	0
Level:	n/a
Ene 2:	Fabric Energy Efficiency
Dwelling Type:	Detached house
FEE:	55.6
Target FEE:	46.0
Credits:	3
Ene 7:	Low and Zero Carbon Technologies

Energy is supplied by low or zero carbon technologies: No

Reduction in CO2 emissions as a result: n/a

	Standard case		Actual case		
	kWh/m²/year	kg/m²/year	kWh/m²/year	kg/m²/year	
DER		20.5301		17.7464	(ZC1)
CO2 emissions from appliances		15.1547		15.1547	(ZC2)
CO2 emissions from cooking		1.8375		1.8375	(ZC3)
Total CO2 emissions		37.5222		34.7385	(ZC4)
Residual CO2 emissions offset from biofuel CHP		0.0000		0.0000	(ZC5)
Additional allowable generation	0.0000		0.0000		(ZC6)
Resulting CO2 emissions offset		0.0000		0.0000	(ZC7)
Net CO2 emissions		37.5222		34.7385	(ZC8)

Reduction in emissions = 100 x (1 - (ZC8actual / ZC8standard))
= 100 x (1 - (34.7385 / 37.5222))
= 0%

Credits 0

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SAP 2012 worksheet for New dwelling as designed - calculation of energy ratings

1. Overall dwelling dimensions

	Area (m^2)	Av. Storey height (m)	Volume (m^3)	
Ground floor (1)	50.31	2.31	116.22	(3a)
First floor	50.31	2.50	125.78	(3b)
Total floor area	100.62			(4)
Dwelling volume (m^3)			241.99	(5)

2. Ventilation rate

	main + seondary + other heating		m^3 per hour	
Number of chimneys	0 + 0 + 0	x 40	0.00	(6a)
Number of open flues	0 + 0 + 0	x 20	0.00	(6b)
Number of intermittent fans	4	x 10	40.00	(7a)
Number of passive vents	0	x 10	0.00	(7b)
Number of flueless gas fires	0	x 40	0.00	(7c)

		Air changes per hour	
Infiltration due to chimneys, fans and flues		0.17	(8)
Pressure test, result q50	5.00		(17)
Air permeability		0.42	(18)
Number of sides on which sheltered		2.00	(19)
Shelter factor		0.85	(20)
Infiltration rate incorporating shelter factor		0.35	(21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
5.10	5.00	4.90	4.40	4.30	3.80	3.80	3.70	4.00	4.30	4.50	4.70	
												52.50 (22)

Wind Factor

1.27	1.25	1.23	1.10	1.07	0.95	0.95	0.93	1.00	1.07	1.13	1.18	
												13.13 (22a)

Adjusted infiltration rate (allowing for shelter and wind speed)

0.45	0.44	0.43	0.39	0.38	0.34	0.34	0.33	0.35	0.38	0.40	0.41	
												4.63 (22b)

Ventilation : natural ventilation, intermittent extract fans

Effective air change rate

0.60	0.60	0.59	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(25)

3. Heat losses and heat loss parameter

Element	Gross area, m²	Openings m²	Net area A, m²	U-value W/m²K	A x U W/K	kappa-value kJ/m²K	A x K kJ/K	
Window - Double-glazed, argon filled, low-E, En=0.2, hard coat (East)			**0.200**	**1.15 (1.20)**	0.23			(27)
Specified U-Value = 1.20								
Window - Double-glazed, argon filled, low-E, En=0.2, hard coat (West)			**2.880**	**1.15 (1.20)**	3.30			(27)
Specified U-Value = 1.20								
Window - Double-glazed, argon filled, low-E, En=0.2, hard coat (East)			**4.330**	**1.15 (1.20)**	4.96			(27)
Specified U-Value = 1.20								
Window - Double-glazed, argon filled, low-E, En=0.2, hard coat (South)			**0.550**	**1.15 (1.20)**	0.63			(27)
Specified U-Value = 1.20								
Full glazed door - Double-glazed, argon filled, low-E, En=0.2, hard coat (South)			**2.630**	**1.20**	3.16			(26)
Specified U-Value = 1.20								
Full glazed door - Double-glazed, argon filled, low-E, En=0.2, hard coat (East)			**3.780**	**1.20**	4.54			(26)
Specified U-Value = 1.20								
Full glazed door - Double-glazed, argon filled, low-E, En=0.2, hard coat (West)			**6.680**	**1.20**	8.02			(26)
Specified U-Value = 1.20								
Rooflight at 70° or less - Double-glazed, argon filled, low-E, En=0.2, hard coat (n/a)			**4.670**	**1.15 (1.20)**	5.35			(27)
Velux Specified U-Value = 1.20								
Walls			4.15	0.21	0.87	9.00	37.35	(29)
Dormer Cheeks - Weatherboard/Battens/9 OSB/51 Cavity/140 Timber Frame Insulated With 120 Celotex XR4000 Between Studs/12.5 P'bd								
Walls			102.19	0.20	20.44	9.00	919.71	(29)
Brick or (Weatherboard/Battens/100 Medium Dense Block)/51 Cavity/140 Timber Frame Insulated With 120 Celotex XR4000 Between Studs/12.5 P'bd								
Ground floors			50.31	0.12	6.04	75.00	3773.25	(28)
Beam/Medium Dense Block/150 Kingspan TF70/Screed								

3. Heat losses and heat loss parameter

Element	Gross area, m²	Openings m²	Net area A, m²	U-value W/m²K	A x U W/K	kappa-value kJ/m²K	A x K kJ/K	
Flat roofs			3.36	0.15	0.50	9.00	30.24	(30)
150 Kingspan TR27 Over Joists								
Pitched roofs insulated between rafters			56.37	0.12	6.76	9.00	507.33	(30)
150 Kingspan K7 Between Rafters/52.5 Kingspan K118 Under Rafters With Breather Membrane								

Total area of external elements Sigma A, m²	242.10	(31)
Fabric heat loss, W/K	64.78	(33)
Heat capacity	5267.88	(34)
Thermal mass parameter, kJ/m²K	52.35	(35)
Effect of thermal bridges	36.32	(36)
Total fabric heat loss	101.10	(37)

Ventilation heat loss calculated monthly

48.02	47.70	47.39	45.95	45.68	44.42	44.42	44.19	44.90	45.68	46.23	46.80	(38)

Heat transfer coefficient, W/K

149.12	148.80	148.49	147.05	146.78	145.52	145.52	145.29	146.00	146.78	147.33	147.90	
											147.05	(39)

Heat loss parameter (HLP), W/m²K

1.48	1.48	1.48	1.46	1.46	1.45	1.45	1.44	1.45	1.46	1.46	1.47	

HLP (average)	1.46	(40)

Number of days in month (Table 1a)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements **kWh/year**

Assumed occupancy, N 2.75 (42)

Annual average hot water usage in litres per day Vd,average 99.40 (43)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month												
109.34	105.36	101.39	97.41	93.43	89.46	89.46	93.43	97.41	101.39	105.36	109.34	(44)
Energy content of hot water used												
162.15	141.81	146.34	127.58	122.42	105.64	97.89	112.33	113.67	132.47	144.60	157.03	

Energy content (annual) 1563.92 (45)

Distribution loss												
24.32	21.27	21.95	19.14	18.36	15.85	14.68	16.85	17.05	19.87	21.69	23.55	(46)

store loss determined from EN 13203-2 tests, taken from boiler data record

Hot water storage volume (litres) 0.00 (50)

Hot water cylinder loss factor (kWh/day) 0.0000 (51)

Volume factor 0.0000 (52)

Temperature factor 0.0000 (53)

Energy lost from store (kWh/day) 0.00 (55)

Total storage loss												
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)
Net storage loss												
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 loss												
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 calculated for each month												
17.47	15.75	17.36	16.68	17.14	16.47	16.95	17.07	16.58	17.26	16.82	17.43	(61)
Total heat required for water heating calculated for each month												
179.61	157.56	163.70	144.26	139.55	122.11	114.84	129.40	130.25	149.73	161.42	174.46	(62)
Output from water heater for each month, kWh/month												
179.61	157.56	163.70	144.26	139.55	122.11	114.84	129.40	130.25	149.73	161.42	174.46	(64)
											1766.89	(64)
Heat gains from water heating, kWh/month												
58.28	51.09	53.00	46.59	44.99	39.24	36.78	41.62	41.94	48.36	52.29	56.57	(65)

5. Internal gains

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains, Watts												
164.71	164.71	164.71	164.71	164.71	164.71	164.71	164.71	164.71	164.71	164.71	164.71	(66)
Lighting gains												
62.02	55.08	44.80	33.91	25.35	21.40	23.13	30.06	40.35	51.23	59.79	63.74	(67)
Appliances gains												
384.07	388.05	378.01	356.63	329.64	304.28	287.33	283.34	293.39	314.77	341.76	367.12	(68)
Cooking gains												
54.22	54.22	54.22	54.22	54.22	54.22	54.22	54.22	54.22	54.22	54.22	54.22	(69)
Pumps and fans gains												
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 (negative values)												
-109.81	-109.81	-109.81	-109.81	-109.81	-109.81	-109.81	-109.81	-109.81	-109.81	-109.81	-109.81	(71)
Water heating gains												
78.33	76.03	71.23	64.71	60.47	54.50	49.44	55.94	58.25	65.00	72.62	76.04	(72)
Total internal gains												
636.54	631.28	606.16	567.37	527.58	492.30	472.02	481.46	504.10	543.12	586.29	619.02	(73)

6. Solar gains (calculation for January)

	Area & Flux	g & FF	Shading	Gains
Window - Double-glazed, argon filled, low-E, En=0.2, hard coat (East)	0.9 x 0.200	19.64	0.72 x 0.70	0.77	1.3720
Specified U-Value = 1.20					
Window - Double-glazed, argon filled, low-E, En=0.2, hard coat (West)	0.9 x 2.880	19.64	0.72 x 0.70	0.77	19.7562
Specified U-Value = 1.20					
Window - Double-glazed, argon filled, low-E, En=0.2, hard coat (East)	0.9 x 4.330	19.64	0.72 x 0.70	0.77	29.7029
Specified U-Value = 1.20					
Window - Double-glazed, argon filled, low-E, En=0.2, hard coat (South)	0.9 x 0.550	46.75	0.72 x 0.70	0.77	8.9811
Specified U-Value = 1.20					
Full glazed door - Double-glazed, argon filled, low-E, En=0.2, hard coat (South)	0.9 x 2.630	46.75	0.72 x 0.70	0.77	42.9458
Specified U-Value = 1.20					
Full glazed door - Double-glazed, argon filled, low-E, En=0.2, hard coat (East)	0.9 x 3.780	19.64	0.72 x 0.70	0.77	25.9300
Specified U-Value = 1.20					
Full glazed door - Double-glazed, argon filled, low-E, En=0.2, hard coat (West)	0.9 x 6.680	19.64	0.72 x 0.70	0.77	45.8234
Specified U-Value = 1.20					
Rooflight at 70° or less - Double-glazed, argon filled, low-E, En=0.2, hard coat (n/a)	0.9 x 4.670	26.00	0.72 x 0.70	1.00	55.0761
Velux Specified U-Value = 1.20					

7. Mean internal temperature

Temperature during heating periods in the living area, Th1 (°C) 21.00 (85)

Heating system responsiveness 1.00

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau												
9.81	9.83	9.85	9.95	9.97	10.06	10.06	10.07	10.02	9.97	9.93	9.89	
alpha												
1.65	1.66	1.66	1.66	1.66	1.67	1.67	1.67	1.67	1.66	1.66	1.66	
Utilisation factor for gains for living area												
0.88	0.83	0.76	0.66	0.54	0.42	0.33	0.37	0.54	0.73	0.85	0.89	(86)
Mean internal temperature in living area T1												
17.39	17.86	18.59	19.45	20.14	20.61	20.82	20.77	20.37	19.42	18.24	17.30	(87)
Temperature during heating periods in rest of dwelling Th2												
19.70	19.70	19.71	19.72	19.72	19.73	19.73	19.73	19.72	19.72	19.71	19.71	(88)
Utilisation factor for gains for rest of dwelling												
0.87	0.82	0.74	0.63	0.49	0.36	0.25	0.28	0.47	0.70	0.83	0.88	(89)
Mean internal temperature in the rest of dwelling T2												
15.14	15.78	16.78	17.93	18.82	19.39	19.61	19.58	19.14	17.92	16.33	15.01	(90)

Living area fraction (50.31 / 100.62) 0.50 (91)

Mean internal temperature (for the whole dwelling)

16.27	16.82	17.69	18.69	19.48	20.00	20.22	20.17	19.76	18.67	17.28	16.15	(92)
Apply adjustment to the mean internal temperature, where appropriate												
16.27	16.82	17.69	18.69	19.48	20.00	20.22	20.17	19.76	18.67	17.28	16.15	(93)

8. Space heating requirement

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains												
0.82	0.77	0.69	0.59	0.49	0.37	0.28	0.32	0.48	0.66	0.78	0.83	(94)
Useful gains												
708.11	821.43	911.92	941.55	858.01	657.62	471.68	480.25	627.77	698.14	677.31	672.09	(95)
Monthly average external temperature												
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												
1784.55	1774.10	1661.51	1439.97	1141.97	785.27	526.07	548.45	825.76	1184.39	1500.13	1768.00	(97)
Fraction of month for heating												
1.00	1.00	1.00	1.00	1.00	-	-	-	-	1.00	1.00	1.00	
Space heating requirement for each month, kWh/month												
800.87	640.19	557.69	358.86	211.27	-	-	-	-	361.77	592.43	815.36	

Total space heating requirement per year (kWh/year) (October to May) 4338.45 (98)

Space heating requirement per m² (kWh/m²/year) 43.12 (99)

8c. Space cooling requirement - not applicable

9a. Energy requirements

kWh/year

No secondary heating system selected

Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main heating system	92.80%	(206)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement												
800.87	640.19	557.69	358.86	211.27	-	-	-	-	361.77	592.43	815.36	(98)
Appendix Q - monthly energy saved (main heating system 1)												
0.00	0.00	0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(210)
Space heating fuel (main heating system 1)												
863.01	689.86	600.96	386.71	227.66	-	-	-	-	389.84	638.40	878.62	(211)
Appendix Q - monthly energy saved (main heating system 2)												
0.00	0.00	0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(212)
Space heating fuel (main heating system 2)												
0.00	0.00	0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(213)
Appendix Q - monthly energy saved (secondary heating system)												
0.00	0.00	0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(214)
Space heating fuel (secondary)												
0.00	0.00	0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(215)
Water heating												
Water heating requirement												
179.61	157.56	163.70	144.26	139.55	122.11	114.84	129.40	130.25	149.73	161.42	174.46	(64)

Efficiency of water heater	87.10	(216)

89.29	89.25	89.17	89.01	88.71	87.10	87.10	87.10	87.10	88.99	89.21	89.31	(217)
Water heating fuel												
201.15	176.53	183.57	162.07	157.32	140.19	131.84	148.56	149.54	168.25	180.95	195.34	(219)

Annual totals	kWh/year	
Space heating fuel used, main system 1	4675.06	(211)
Space heating fuel (secondary)	0.00	(215)
Water heating fuel	1995.33	(219)
Electricity for pumps, fans and electric keep-hot		
central heating pump	30.00	(230c)
boiler with a fan-assisted flue	45.00	(230e)
Total electricity for the above, kWh/year	75.00	(231)
Electricity for lighting (100.00% fixed LEL)	438.10	(232)
Energy saving/generation technologies		
Appendix Q -		
Energy saved or generated ():	0.000	(236a)
Energy used ():	0.000	(237a)
Total delivered energy for all uses	7183.49	(238)

10a. Fuel costs using Table 12 prices

	kWh/year	Fuel price p/kWh	£/year	
Space heating - main system 1	4675.057	3.480	162.69	(240)
Space heating - main system 2	0.000	0.000	0.00	(241)
Water heating				
Water heating cost	1995.33	3.480	69.44	(247)
Mech vent fans cost	0.000	13.190	0.00	(249)
Pump/fan energy cost	75.000	13.190	9.89	(249)
Energy for lighting	438.096	13.190	57.78	(250)
Additional standing charges			120.00	(251)
Electricity generated - PVs	0.000	0.000	0.00	(252)
Appendix Q -				
Energy saved or generated ():	0.000	0.000	0.00	(253)
Energy used ():	0.000	0.000	0.00	(254)
Total energy cost			419.81	(255)

11a. SAP rating

Energy cost deflator	0.42	(256)
Energy cost factor (ECF)	1.21	(257)
SAP value	83.11	
SAP rating	**83**	(258)
SAP band	**B**	

12a. Carbon dioxide emissions

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating, main system 1	4675.06	0.216	1009.81	(261)
Space heating, main system 2	0.00	0.000	0.00	(262)
Space heating, secondary	0.00	0.519	0.00	(263)
Water heating	1995.33	0.216	430.99	(264)
Space and water heating			1440.80	(265)
Electricity for pumps and fans	75.00	0.519	38.93	(267)
Electricity for lighting	438.10	0.519	227.37	(268)
Electricity generated - PVs	0.00	0.519	0.00	(269)
Electricity generated - µCHP	0.00	0.000	0.00	(269)
Appendix Q -				
Energy saved ():	0.00	0.000	0.00	(270)
Energy used ():	0.00	0.000	0.00	(271)
Total CO2, kg/year			1707.10	(272)

	kg/m²/year	
CO2 emissions per m²	**16.97**	(273)
EI value	84.29	(273a)
EI rating	**84**	(274)
EI band	**B**	

Calculation of stars for heating and DHW

Main heating energy efficiency	(3.48 / 0.8980) x (1 + (0.29 x 0.00)) = 3.8753, stars = 4
Main heating environmental impact	(0.2160 / 0.8980) x (1 + (0.29 x 0.00)) = 0.2405, stars = 4
Water heating energy efficiency	3.48 / 0.8845 = 3.9346, stars = 4
Water heating environmental impact	0.2160 / 0.8845 = 0.2442, stars = 4

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SAP 2012 worksheet for notional dwelling - calculation of target emissions

1. Overall dwelling dimensions

	Area (m^2)	Av. Storey height (m)	Volume (m^3)	
Ground floor (1)	50.31	2.31	116.22	(3a)
First floor	50.31	2.50	125.78	(3b)
Total floor area	100.62			(4)
Dwelling volume (m^3)			241.99	(5)

2. Ventilation rate

	main + seondary + other heating		m^3 per hour	
Number of chimneys	0 + 0 + 0	x 40	0.00	(6a)
Number of open flues	0 + 0 + 0	x 20	0.00	(6b)
Number of intermittent fans	4	x 10	40.00	(7a)
Number of passive vents	0	x 10	0.00	(7b)
Number of flueless gas fires	0	x 40	0.00	(7c)

		Air changes per hour	
Infiltration due to chimneys, fans and flues		0.17	(8)
Pressure test, result q50	5.00		(17)
Air permeability		0.42	(18)
Number of sides on which sheltered		2.00	(19)
Shelter factor		0.85	(20)
Infiltration rate incorporating shelter factor		0.35	(21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
5.10	5.00	4.90	4.40	4.30	3.80	3.80	3.70	4.00	4.30	4.50	4.70

52.50 (22)

Wind Factor

1.27	1.25	1.23	1.10	1.07	0.95	0.95	0.93	1.00	1.07	1.13	1.18

13.13 (22a)

Adjusted infiltration rate (allowing for shelter and wind speed)

0.45	0.44	0.43	0.39	0.38	0.34	0.34	0.33	0.35	0.38	0.40	0.41

4.63 (22b)

Ventilation : natural ventilation, intermittent extract fans

Effective air change rate

0.60	0.60	0.59	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(25)

3. Heat losses and heat loss parameter

Element	Gross area, m²	Openings m²	Net area A, m²	U-value W/m²K	A x U W/K	
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (East)			**0.200**	**1.33 (1.40)**	0.27	(27)
Specified U-Value = 1.20						
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (West)			**2.820**	**1.33 (1.40)**	3.74	(27)
Specified U-Value = 1.20						
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (East)			**4.230**	**1.33 (1.40)**	5.61	(27)
Specified U-Value = 1.20						
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (South)			**0.540**	**1.33 (1.40)**	0.72	(27)
Specified U-Value = 1.20						
Full glazed door - Double-glazed, air-filled, low-E, En=0.1, soft coat (South)			**2.570**	**1.40**	3.60	(26)
Specified U-Value = 1.20						
Full glazed door - Double-glazed, air-filled, low-E, En=0.1, soft coat (East)			**3.700**	**1.40**	5.18	(26)
Specified U-Value = 1.20						
Full glazed door - Double-glazed, air-filled, low-E, En=0.1, soft coat (West)			**6.530**	**1.40**	9.14	(26)
Specified U-Value = 1.20						
Rooflight at 70° or less - Double-glazed, air-filled, low-E, En=0.1, soft coat (n/a)			**4.570**	**1.59 (1.70)**	7.27	(27)
Velux Specified U-Value = 1.20						
Walls			4.15	0.18	0.75	(29)
Dormer Cheeks - Weatherboard/Battens/9 OSB/51 Cavity/140 Timber Frame Insulated With 120 Celotex XR4000 Between Studs/12.5 P'bd						
Walls			102.65	0.18	18.48	(29)
Brick or (Weatherboard/Battens/100 Medium Dense Block)/51 Cavity/140 Timber Frame Insulated With 120 Celotex XR4000 Between Studs/12.5 P'bd						
Ground floors			50.31	0.13	6.54	(28)
Beam/Medium Dense Block/150 Kingspan TF70/Screed						

3. Heat losses and heat loss parameter

Element	Gross area, m²	Openings m²	Net area A, m²	U-value W/m²K	A x U W/K	
Flat roofs			3.36	0.13	0.44	(30)
150 Kingspan TR27 Over Joists						
Pitched roofs insulated between rafters			56.47	0.13	7.34	(30)
150 Kingspan K7 Between Rafters/52.5 Kingspan K118 Under Rafters With Breather Membrane						

Total area of external elements Sigma A, m²	242.10	(31)
Fabric heat loss, W/K	69.06	(33)
Thermal mass parameter, kJ/m²K (user-specified TMP)	250.00	(35)
Effect of thermal bridges	12.11	(36)
Total fabric heat loss	81.17	(37)

Ventilation heat loss calculated monthly

48.02	47.70	47.39	45.95	45.68	44.42	44.42	44.19	44.90	45.68	46.23	46.80	(38)

Heat transfer coefficient, W/K

129.19	128.87	128.56	127.12	126.85	125.59	125.59	125.35	126.07	126.85	127.39	127.97	
											127.12	(39)

Heat loss parameter (HLP), W/m²K

1.28	1.28	1.28	1.26	1.26	1.25	1.25	1.25	1.25	1.26	1.27	1.27	

HLP (average) 1.26 (40)

Number of days in month (Table 1a)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements **kWh/year**

Assumed occupancy, N 2.75 (42)

Annual average hot water usage in litres per day Vd,average 99.40 (43)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hot water usage in litres per day for each month											
109.34	105.36	101.39	97.41	93.43	89.46	89.46	93.43	97.41	101.39	105.36	109.34 (44)
Energy content of hot water used											
162.15	141.81	146.34	127.58	122.42	105.64	97.89	112.33	113.67	132.47	144.60	157.03

Energy content (annual) 1563.92 (45)

Distribution loss											
24.32	21.27	21.95	19.14	18.36	15.85	14.68	16.85	17.05	19.87	21.69	23.55 (46)

Hot water storage volume (litres) 0.00 (50)

Hot water cylinder loss factor (kWh/day) 0.0000 (51)

Volume factor 0.0000 (52)

Temperature factor 0.0000 (53)

Energy lost from store (kWh/day) 0.00 (55)

Total storage loss											
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)
Net storage loss											
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 loss											
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 calculated for each month											
50.96	46.03	50.96	48.04	47.61	44.12	45.59	47.61	48.04	50.96	49.32	50.96 (61)
Total heat required for water heating calculated for each month											
213.10	187.84	197.30	175.62	170.03	149.75	143.48	159.94	161.71	183.43	193.92	207.99 (62)
Output from water heater for each month, kWh/month											
213.10	187.84	197.30	175.62	170.03	149.75	143.48	159.94	161.71	183.43	193.92	207.99 (64)

2144.11 (64)

Heat gains from water heating, kWh/month											
66.65	58.66	61.40	54.43	52.61	46.15	43.94	49.25	49.80	56.79	60.41	64.95 (65)

5. Internal gains

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains, Watts												
137.26	137.26	137.26	137.26	137.26	137.26	137.26	137.26	137.26	137.26	137.26	137.26	(66)
Lighting gains												
24.93	22.14	18.00	13.63	10.19	8.60	9.29	12.08	16.22	20.59	24.03	25.62	(67)
Appliances gains												
257.33	260.00	253.27	238.94	220.86	203.86	192.51	189.84	196.57	210.89	228.98	245.97	(68)
Cooking gains												
36.73	36.73	36.73	36.73	36.73	36.73	36.73	36.73	36.73	36.73	36.73	36.73	(69)
Pumps and fans gains												
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 (negative values)												
-109.81	-109.81	-109.81	-109.81	-109.81	-109.81	-109.81	-109.81	-109.81	-109.81	-109.81	-109.81	(71)
Water heating gains												
89.59	87.29	82.52	75.60	70.71	64.10	59.07	66.20	69.17	76.33	83.90	87.30	(72)
Total internal gains												
439.02	436.60	420.97	395.35	368.93	343.75	328.05	335.30	349.14	374.99	404.09	426.07	(73)

6. Solar gains (calculation for January)

	Area & Flux	g & FF	Shading	Gains
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (East)	0.9 x 0.200 19.64	0.63 x 0.70	0.77	1.2005
Specified U-Value = 1.20				
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (West)	0.9 x 2.820 19.64	0.63 x 0.70	0.77	16.9265
Specified U-Value = 1.20				
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (East)	0.9 x 4.230 19.64	0.63 x 0.70	0.77	25.3898
Specified U-Value = 1.20				
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (South)	0.9 x 0.540 46.75	0.63 x 0.70	0.77	7.7155
Specified U-Value = 1.20				
Full glazed door - Double-glazed, air-filled, low-E, En=0.1, soft coat (South)	0.9 x 2.570 46.75	0.63 x 0.70	0.77	36.7203
Specified U-Value = 1.20				
Full glazed door - Double-glazed, air-filled, low-E, En=0.1, soft coat (East)	0.9 x 3.700 19.64	0.63 x 0.70	0.77	22.2086
Specified U-Value = 1.20				
Full glazed door - Double-glazed, air-filled, low-E, En=0.1, soft coat (West)	0.9 x 6.530 19.64	0.63 x 0.70	0.77	39.1951
Specified U-Value = 1.20				
Rooflight at 70° or less - Double-glazed, air-filled, low-E, En=0.1, soft coat (n/a)	0.9 x 4.570 26.00	0.63 x 0.70	1.00	47.1597
Velux Specified U-Value = 1.20				

7. Mean internal temperature

Temperature during heating periods in the living area, Th1 (°C) 21.00 (85)

Heating system responsiveness 1.00

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau											
54.09	54.22	54.35	54.97	55.09	55.64	55.64	55.74	55.42	55.09	54.85	54.60
alpha											
4.61	4.61	4.62	4.66	4.67	4.71	4.71	4.72	4.69	4.67	4.66	4.64
Utilisation factor for gains for living area											
1.00	0.99	0.97	0.89	0.74	0.55	0.40	0.46	0.74	0.96	0.99	1.00 (86)
Mean internal temperature in living area T1											
19.61	19.84	20.21	20.63	20.88	20.98	21.00	20.99	20.91	20.51	19.97	19.57 (87)
Temperature during heating periods in rest of dwelling Th2											
19.85	19.86	19.86	19.87	19.87	19.88	19.88	19.88	19.88	19.87	19.87	19.86 (88)
Utilisation factor for gains for rest of dwelling											
1.00	0.99	0.96	0.86	0.67	0.46	0.30	0.35	0.65	0.94	0.99	1.00 (89)
Mean internal temperature in the rest of dwelling T2											
18.02	18.36	18.88	19.46	19.77	19.87	19.88	19.88	19.82	19.32	18.55	17.97 (90)

Living area fraction (50.31 / 100.62) 0.50 (91)

Mean internal temperature (for the whole dwelling)

18.81	19.10	19.54	20.04	20.33	20.42	20.44	20.44	20.36	19.91	19.26	18.77 (92)
Apply adjustment to the mean internal temperature, where appropriate											
18.81	19.10	19.54	20.04	20.33	20.42	20.44	20.44	20.36	19.91	19.26	18.77 (93)

8. Space heating requirement

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation factor for gains											
1.00	0.99	0.96	0.87	0.70	0.50	0.35	0.41	0.69	0.94	0.99	1.00 (94)
Useful gains											
632.65	801.80	982.00	1096.40	1000.20	715.80	479.66	501.35	725.32	765.51	640.91	586.92 (95)
Monthly average external temperature											
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											
1875.08	1829.91	1677.00	1416.61	1094.37	731.33	482.01	505.96	789.82	1181.48	1549.08	1864.59 (97)
Fraction of month for heating											
1.00	1.00	1.00	1.00	1.00	-	-	-	-	1.00	1.00	1.00
Space heating requirement for each month, kWh/month											
924.37	690.89	517.08	230.55	70.07	-	-	-	-	309.49	653.88	950.58

Total space heating requirement per year (kWh/year) (October to May) 4346.91 (98)

Space heating requirement per m² (kWh/m²/year) 43.20 (99)

9a. Energy requirements

kWh/year

No secondary heating system selected

Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main heating system	93.40%	(206)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement												
924.37	690.89	517.08	230.55	70.07	-	-	-	-	309.49	653.88	950.58	(98)
Appendix Q - monthly energy saved (main heating system 1)												
0.00	0.00	0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(210)
Space heating fuel (main heating system 1)												
989.69	739.71	553.62	246.84	75.02	-	-	-	-	331.36	700.09	1017.76	(211)
Appendix Q - monthly energy saved (main heating system 2)												
0.00	0.00	0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(212)
Space heating fuel (main heating system 2)												
0.00	0.00	0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(213)
Appendix Q - monthly energy saved (secondary heating system)												
0.00	0.00	0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(214)
Space heating fuel (secondary)												
0.00	0.00	0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(215)
Water heating												
Water heating requirement												
213.10	187.84	197.30	175.62	170.03	149.75	143.48	159.94	161.71	183.43	193.92	207.99	(64)

Efficiency of water heater	80.30	(216)

88.32	88.03	87.37	85.74	83.01	80.30	80.30	80.30	80.30	86.36	87.87	88.40	(217)
Water heating fuel												
241.29	213.38	225.83	204.83	204.84	186.49	178.67	199.18	201.38	212.41	220.68	235.27	(219)

Annual totals	kWh/year	
Space heating fuel used, main system 1	4654.08	(211)
Space heating fuel (secondary)	0.00	(215)
Water heating fuel	2524.26	(219)
Electricity for pumps, fans and electric keep-hot		
central heating pump	30.00	(230c)
boiler with a fan-assisted flue	45.00	(230e)
Total electricity for the above, kWh/year	75.00	(231)
Electricity for lighting (100.00% fixed LEL)	440.19	(232)
Energy saving/generation technologies		
Appendix Q -		
Energy saved or generated ():	0.000	(236a)
Energy used ():	0.000	(237a)
Total delivered energy for all uses	7693.52	(238)

10a. Does not apply

11a. Does not apply

SAP 2012 worksheet for notional dwelling - calculation of target emissions

12a. Carbon dioxide emissions

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating, main system 1	4654.08	0.216	1005.28	(261)
Space heating, main system 2	0.00	0.000	0.00	(262)
Space heating, secondary	0.00	0.519	0.00	(263)
Water heating	2524.26	0.216	545.24	(264)
Space and water heating			1550.52	(265)
Electricity for pumps and fans	75.00	0.519	38.93	(267)
Electricity for lighting	440.19	0.519	228.46	(268)
Electricity generated - PVs	0.00	0.519	0.00	(269)
Electricity generated - µCHP	0.00	0.000	0.00	(269)
Appendix Q -				
Energy saved ():	0.00	0.000	0.00	(270)
Energy used ():	0.00	0.000	0.00	(271)
Total CO2, kg/year			1817.90	(272)

	kg/m²/year	
Emissions per m² for space and water heating	**15.41**	(272a)
Emissions per m² for lighting	**2.27**	(272b)
Emissions per m² for pumps and fans	**0.39**	(272c)
Target Carbon Dioxide Emission Rate (TER)	**18.07**	(273)

= (15.4097 x 1.00) + 2.2705 + 0.3869

Project Information

Building type Detached house

Reference	J5067-1		
Date	7 October 2019		
Client	DCM Architectural Consultants Ltd 25 Pigeon Lane Herne Bay Kent CT6 7EH	Project	Unit 1 66 Borstal Hill Whitstable Kent CT5 4NB

SAP 2012 worksheet for New dwelling as designed - calculation of dwelling emissions

1. Overall dwelling dimensions

	Area (m^2)	Av. Storey height (m)	Volume (m^3)	
Ground floor (1)	50.31	2.31	116.22	(3a)
First floor	50.31	2.50	125.78	(3b)
Total floor area	100.62			(4)
Dwelling volume (m^3)			241.99	(5)

2. Ventilation rate

	main + seondary + other heating		m^3 per hour	
Number of chimneys	0 + 0 + 0	x 40	0.00	(6a)
Number of open flues	0 + 0 + 0	x 20	0.00	(6b)
Number of intermittent fans	4	x 10	40.00	(7a)
Number of passive vents	0	x 10	0.00	(7b)
Number of flueless gas fires	0	x 40	0.00	(7c)

		Air changes per hour	
Infiltration due to chimneys, fans and flues		0.17	(8)
Pressure test, result q50	5.00		(17)
Air permeability		0.42	(18)
Number of sides on which sheltered		2.00	(19)
Shelter factor		0.85	(20)
Infiltration rate incorporating shelter factor		0.35	(21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
5.10	5.00	4.90	4.40	4.30	3.80	3.80	3.70	4.00	4.30	4.50	4.70

52.50 (22)

Wind Factor

1.27	1.25	1.23	1.10	1.07	0.95	0.95	0.93	1.00	1.07	1.13	1.18

13.13 (22a)

Adjusted infiltration rate (allowing for shelter and wind speed)

0.45	0.44	0.43	0.39	0.38	0.34	0.34	0.33	0.35	0.38	0.40	0.41

4.63 (22b)

Ventilation : natural ventilation, intermittent extract fans

Effective air change rate

0.60	0.60	0.59	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(25)

3. Heat losses and heat loss parameter

Element	Gross area, m²	Openings m²	Net area A, m²	U-value W/m²K	A x U W/K	kappa-value kJ/m²K	A x K kJ/K	
Window - Double-glazed, argon filled, low-E, En=0.2, hard coat (East)			**0.200**	**1.15 (1.20)**	0.23			(27)
Specified U-Value = 1.20								
Window - Double-glazed, argon filled, low-E, En=0.2, hard coat (South)			**0.550**	**1.15 (1.20)**	0.63			(27)
Specified U-Value = 1.20								
Window - Double-glazed, argon filled, low-E, En=0.2, hard coat (East)			**4.330**	**1.15 (1.20)**	4.96			(27)
Specified U-Value = 1.20								
Window - Double-glazed, argon filled, low-E, En=0.2, hard coat (West)			**2.880**	**1.15 (1.20)**	3.30			(27)
Specified U-Value = 1.20								
Full glazed door - Double-glazed, argon filled, low-E, En=0.2, hard coat (West)			**6.680**	**1.20**	8.02			(26)
Specified U-Value = 1.20								
Full glazed door - Double-glazed, argon filled, low-E, En=0.2, hard coat (East)			**3.780**	**1.20**	4.54			(26)
Specified U-Value = 1.20								
Full glazed door - Double-glazed, argon filled, low-E, En=0.2, hard coat (South)			**2.630**	**1.20**	3.16			(26)
Specified U-Value = 1.20								
Rooflight at 70° or less - Double-glazed, argon filled, low-E, En=0.2, hard coat (n/a)			**4.670**	**1.15 (1.20)**	5.35			(27)
Velux Specified U-Value = 1.20								
Walls			4.15	0.21	0.87	9.00	37.35	(29)
Dormer Cheeks - Weatherboard/Battens/9 OSB/51 Cavity/140 Timber Frame Insulated With 120 Celotex XR4000 Between Studs/12.5 P'bd								
Walls			102.19	0.20	20.44	9.00	919.71	(29)
Brick or (Weatherboard/Battens/100 Medium Dense Block)/51 Cavity/140 Timber Frame Insulated With 120 Celotex XR4000 Between Studs/12.5 P'bd								
Ground floors			50.31	0.12	6.04	75.00	3773.25	(28)
Beam/Medium Dense Block/150 Kingspan TF70/Screed								

3. Heat losses and heat loss parameter

Element	Gross area, m²	Openings m²	Net area A, m²	U-value W/m²K	A x U W/K	kappa-value kJ/m²K	A x K kJ/K	
Flat roofs			3.36	0.15	0.50	9.00	30.24	(30)
150 Kingspan TR27 Over Joists								
Pitched roofs insulated between rafters			56.37	0.12	6.76	9.00	507.33	(30)
150 Kingspan K7 Between Rafters/52.5 Kingspan K118 Under Rafters With Breather Membrane								

Total area of external elements Sigma A, m²	242.10	(31)
Fabric heat loss, W/K	64.78	(33)
Heat capacity	0.00	(34)
Thermal mass parameter, kJ/m²K	52.35	(35)
Effect of thermal bridges	36.32	(36)
Total fabric heat loss	101.10	(37)

Ventilation heat loss calculated monthly

48.02	47.70	47.39	45.95	45.68	44.42	44.42	44.19	44.90	45.68	46.23	46.80	(38)

Heat transfer coefficient, W/K

149.12	148.80	148.49	147.05	146.78	145.52	145.52	145.29	146.00	146.78	147.33	147.90	
											147.05	(39)

Heat loss parameter (HLP), W/m²K

1.48	1.48	1.48	1.46	1.46	1.45	1.45	1.44	1.45	1.46	1.46	1.47	

HLP (average)	1.46	(40)

Number of days in month (Table 1a)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements **kWh/year**

Assumed occupancy, N 2.75 (42)

Annual average hot water usage in litres per day Vd,average 99.40 (43)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month												
109.34	105.36	101.39	97.41	93.43	89.46	89.46	93.43	97.41	101.39	105.36	109.34	(44)
Energy content of hot water used												
162.15	141.81	146.34	127.58	122.42	105.64	97.89	112.33	113.67	132.47	144.60	157.03	

Energy content (annual) 1563.92 (45)

Distribution loss												
24.32	21.27	21.95	19.14	18.36	15.85	14.68	16.85	17.05	19.87	21.69	23.55	(46)

store loss determined from EN 13203-2 tests, taken from boiler data record

Hot water storage volume (litres) 0.00 (50)

Hot water cylinder loss factor (kWh/day) 0.0000 (51)

Volume factor 0.0000 (52)

Temperature factor 0.0000 (53)

Energy lost from store (kWh/day) 0.00 (55)

Total storage loss												
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)
Net storage loss												
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 loss												
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 calculated for each month												
17.47	15.75	17.36	16.68	17.14	16.47	16.95	17.07	16.58	17.26	16.82	17.43	(61)
Total heat required for water heating calculated for each month												
179.61	157.56	163.70	144.26	139.55	122.11	114.84	129.40	130.25	149.73	161.42	174.46	(62)
Output from water heater for each month, kWh/month												
179.61	157.56	163.70	144.26	139.55	122.11	114.84	129.40	130.25	149.73	161.42	174.46	(64)

1766.89 (64)

Heat gains from water heating, kWh/month												
58.28	51.09	53.00	46.59	44.99	39.24	36.78	41.62	41.94	48.36	52.29	56.57	(65)

5. Internal gains

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains, Watts												
137.26	137.26	137.26	137.26	137.26	137.26	137.26	137.26	137.26	137.26	137.26	137.26	(66)
Lighting gains												
24.81	22.03	17.92	13.57	10.14	8.56	9.25	12.02	16.14	20.49	23.92	25.50	(67)
Appliances gains												
257.33	260.00	253.27	238.94	220.86	203.86	192.51	189.84	196.57	210.89	228.98	245.97	(68)
Cooking gains												
36.73	36.73	36.73	36.73	36.73	36.73	36.73	36.73	36.73	36.73	36.73	36.73	(69)
Pumps and fans gains												
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 (negative values)												
-109.81	-109.81	-109.81	-109.81	-109.81	-109.81	-109.81	-109.81	-109.81	-109.81	-109.81	-109.81	(71)
Water heating gains												
78.33	76.03	71.23	64.71	60.47	54.50	49.44	55.94	58.25	65.00	72.62	76.04	(72)
Total internal gains												
427.65	425.23	409.60	384.39	358.65	334.11	318.38	324.98	338.14	363.57	392.69	414.68	(73)

6. Solar gains (calculation for January)

	Area & Flux	g & FF	Shading	Gains
Window - Double-glazed, argon filled, low-E, En=0.2, hard coat (East)	0.9 x 0.200 19.64	0.72 x 0.70	0.77	1.3720
Specified U-Value = 1.20				
Window - Double-glazed, argon filled, low-E, En=0.2, hard coat (South)	0.9 x 0.550 46.75	0.72 x 0.70	0.77	8.9811
Specified U-Value = 1.20				
Window - Double-glazed, argon filled, low-E, En=0.2, hard coat (East)	0.9 x 4.330 19.64	0.72 x 0.70	0.77	29.7029
Specified U-Value = 1.20				
Window - Double-glazed, argon filled, low-E, En=0.2, hard coat (West)	0.9 x 2.880 19.64	0.72 x 0.70	0.77	19.7562
Specified U-Value = 1.20				
Full glazed door - Double-glazed, argon filled, low-E, En=0.2, hard coat (West)	0.9 x 6.680 19.64	0.72 x 0.70	0.77	45.8234
Specified U-Value = 1.20				
Full glazed door - Double-glazed, argon filled, low-E, En=0.2, hard coat (East)	0.9 x 3.780 19.64	0.72 x 0.70	0.77	25.9300
Specified U-Value = 1.20				
Full glazed door - Double-glazed, argon filled, low-E, En=0.2, hard coat (South)	0.9 x 2.630 46.75	0.72 x 0.70	0.77	42.9458
Specified U-Value = 1.20				
Rooflight at 70° or less - Double-glazed, argon filled, low-E, En=0.2, hard coat (n/a)	0.9 x 4.670 26.00	0.72 x 0.70	1.00	55.0761
Velux Specified U-Value = 1.20				

7. Mean internal temperature

Temperature during heating periods in the living area, Th1 (°C) 21.00 (85)

Heating system responsiveness 1.00

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau											
9.81	9.83	9.85	9.95	9.97	10.06	10.06	10.07	10.02	9.97	9.93	9.89
alpha											
1.65	1.66	1.66	1.66	1.66	1.67	1.67	1.67	1.67	1.66	1.66	1.66
Utilisation factor for gains for living area											
0.92	0.87	0.80	0.70	0.57	0.45	0.36	0.40	0.58	0.78	0.89	0.93 (86)
Mean internal temperature in living area T1											
17.06	17.57	18.37	19.31	20.06	20.56	20.79	20.74	20.29	19.23	17.95	16.96 (87)
Temperature during heating periods in rest of dwelling Th2											
19.70	19.70	19.71	19.72	19.72	19.73	19.73	19.73	19.72	19.72	19.71	19.71 (88)
Utilisation factor for gains for rest of dwelling											
0.91	0.86	0.78	0.66	0.53	0.39	0.27	0.31	0.52	0.75	0.87	0.92 (89)
Mean internal temperature in the rest of dwelling T2											
14.69	15.39	16.49	17.75	18.72	19.34	19.60	19.55	19.05	17.69	15.94	14.55 (90)

Living area fraction (50.31 / 100.62) 0.50 (91)

Mean internal temperature (for the whole dwelling)

15.87	16.48	17.43	18.53	19.39	19.95	20.20	20.15	19.67	18.46	16.95	15.76 (92)

Apply adjustment to the mean internal temperature, where appropriate

15.87	16.48	17.43	18.53	19.39	19.95	20.20	20.15	19.67	18.46	16.95	15.76 (93)

8. Space heating requirement

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation factor for gains											
0.86	0.81	0.73	0.63	0.51	0.40	0.30	0.34	0.51	0.71	0.83	0.88 (94)
Useful gains											
567.95	700.79	818.72	879.37	821.23	638.65	462.21	467.41	592.58	620.96	559.91	530.44 (95)
Monthly average external temperature											
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											
1725.93	1723.45	1622.96	1415.61	1128.69	779.06	523.19	544.44	813.23	1153.11	1451.04	1709.09 (97)
Fraction of month for heating											
1.00	1.00	1.00	1.00	1.00	-	-	-	-	1.00	1.00	1.00
Space heating requirement for each month, kWh/month											
861.54	687.22	598.35	386.09	228.76	-	-	-	-	395.92	641.62	876.91

Total space heating requirement per year (kWh/year) (October to May) 4676.42 (98)

Space heating requirement per m² (kWh/m²/year) 46.48 (99)

8c. Space cooling requirement - not applicable

9a. Energy requirements

kWh/year

No secondary heating system selected

Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main heating system	92.80%	(206)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement												
861.54	687.22	598.35	386.09	228.76	-	-	-	-	395.92	641.62	876.91	(98)
Appendix Q - monthly energy saved (main heating system 1)												
0.00	0.00	0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(210)
Space heating fuel (main heating system 1)												
928.39	740.54	644.77	416.05	246.50	-	-	-	-	426.64	691.40	944.95	(211)
Appendix Q - monthly energy saved (main heating system 2)												
0.00	0.00	0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(212)
Space heating fuel (main heating system 2)												
0.00	0.00	0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(213)
Appendix Q - monthly energy saved (secondary heating system)												
0.00	0.00	0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(214)
Space heating fuel (secondary)												
0.00	0.00	0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(215)
Water heating												
Water heating requirement												
179.61	157.56	163.70	144.26	139.55	122.11	114.84	129.40	130.25	149.73	161.42	174.46	(64)

Efficiency of water heater	87.10	(216)

89.32	89.28	89.21	89.05	88.76	87.10	87.10	87.10	87.10	89.04	89.24	89.34	(217)
Water heating fuel												
201.09	176.47	183.51	162.00	157.23	140.19	131.84	148.56	149.54	168.16	180.88	195.28	(219)

Annual totals	kWh/year	
Space heating fuel used, main system 1	5039.24	(211)
Space heating fuel (secondary)	0.00	(215)
Water heating fuel	1994.75	(219)
Electricity for pumps, fans and electric keep-hot		
central heating pump	30.00	(230c)
boiler with a fan-assisted flue	45.00	(230e)
Total electricity for the above, kWh/year	75.00	(231)
Electricity for lighting (100.00% fixed LEL)	438.10	(232)
Energy saving/generation technologies		
Appendix Q -		
Energy saved or generated ():	0.000	(236a)
Energy used ():	0.000	(237a)
Total delivered energy for all uses	7547.08	(238)

10a. Does not apply

11a. Does not apply

12a. Carbon dioxide emissions

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating, main system 1	5039.24	0.216	1088.48	(261)
Space heating, main system 2	0.00	0.000	0.00	(262)
Space heating, secondary	0.00	0.519	0.00	(263)
Water heating	1994.75	0.216	430.87	(264)
Space and water heating			1519.34	(265)
Electricity for pumps and fans	75.00	0.519	38.93	(267)
Electricity for lighting	438.10	0.519	227.37	(268)
Electricity generated - PVs	0.00	0.519	0.00	(269)
Electricity generated - µCHP	0.00	0.000	0.00	(269)
Appendix Q -				
Energy saved ():	0.00	0.000	0.00	(270)
Energy used ():	0.00	0.000	0.00	(271)
Total CO2, kg/year			1785.64	(272)
			kg/m²/year	
Dwelling Carbon Dioxide Emission Rate (DER)			**17.75**	(273)

Project Information
Building type Detached house

Reference	J5067-1		
Date	7 October 2019		
Client	DCM Architectural Consultants Ltd	Project	Unit 1
	25 Pigeon Lane		66 Borstal Hill
	Herne Bay		Whitstable
	Kent		Kent
	CT6 7EH		CT5 4NB

REGULATION COMPLIANCE REPORT - Approved Document L1A, 2012 Edition, England
assessed by program JPA Designer version 6.04a1, printed on 7/10/2019 at 16:20:18

New dwelling as designed

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1 TER and DER
Fuel for main heating system: Gas (mains) (fuel factor = 1.00)

Target Carbon Dioxide Emission Rate	TER = 18.07	
Dwelling Carbon Dioxide Emission Rate	DER = 17.75	OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	TFEE = 56.9	
Dwelling Fabric Energy Efficiency (DFEE)	DFEE = 55.6	OK

2a Thermal bridging
Thermal bridging calculated using default y-value of 0.15

2b Fabric U-values

Element	Average	Highest	
Wall	0.20 (max. 0.30)	0.21 (max. 0.70)	OK
Floor	0.12 (max. 0.25)	0.12 (max. 0.70)	OK
Roof	0.12 (max. 0.20)	0.15 (max. 0.35)	OK
Openings	1.20 (max. 2.00)	1.20 (max. 3.30)	OK

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3 Air permeability

Air permeability at 50 pascals:	5.00	OK
Maximum :	10.00	

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4 Heating efficiency
Main heating system:
Boiler and radiators, mains gas
Alpha InTec 40GS
Source of efficiency: from boiler database
Alpha InTec 40GS
Efficiency: 88.9% SEDBUK2009
Minimum: 88.0% OK
Secondary heating system:
None -

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

(Also refer to "Domestic Building Services Compliance Guide" by the DCLG)

Space heating controls	Time and temperature zone control	OK
Hot water controls	No cylinder	
Boiler Interlock	Yes	OK
Hot water controls	No cylinder	

7 Low energy lights

Percentage of fixed lights with low-energy fittings: 100.0%

Minimum: 75.0% OK

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (South East England): OK

Slight OK

Based on:

Thermal mass parameter : 52.35

Overshading : Average or unknown (20-60 % sky blocked)

Orientation : East

Ventilation rate : 8.00

Blinds/curtains :

None with blinds/shutters closed 0.00% of daylight hours

10 Key features

Ground floors U-value 0.12 W/m²K

Pitched roofs insulated between rafters U-value 0.12 W/m²K

Project Information

Building type Detached house

Reference	J5067-1		
Date	7 October 2019		
Client	DCM Architectural Consultants Ltd 25 Pigeon Lane Herne Bay Kent CT6 7EH	Project	Unit 1 66 Borstal Hill Whitstable Kent CT5 4NB

SAP 2012 input data Printed on 7 Oct 2019 at 04:20 PM

Unit 1, 66 Borstal Hill, Whitstable, Kent, CT5 4NB

Unit 1
66 Borstal Hill
Whitstable
Kent
CT5 4NB

Located in:	England
Region:	South East England
Postcode:	CT5 4NB
UPRN:	
Date of assessment:	2019-10-07
Date of certificate:	2019-10-07
Assessment type:	New dwelling as designed
Tenure:	Unknown
Transaction type:	New dwelling
Related party disclosure:	No related party
PCDF revision number:	367

Property description

Dwelling type:	Detached house	
Ground floor (1)	area = 50.31m²	storey height = 2.31m
First floor	area = 50.31m²	storey height = 2.50m

Living area: 50.31 (fraction 0.500)

Front of dwelling faces: East

Doors

Full glazed door	area = 6.68	U = 1.20	- Double-glazed, argon filled, low-E, En=0.2, hard coat (West)
Full glazed door	area = 3.78	U = 1.20	- Double-glazed, argon filled, low-E, En=0.2, hard coat (East)
Full glazed door	area = 2.63	U = 1.20	- Double-glazed, argon filled, low-E, En=0.2, hard coat (South)

Windows

Window	area = 0.20	U = 1.20	- Double-glazed, argon filled, low-E, En=0.2, hard coat (East)
Overshading:	Average or unknown (20-60 % sky blocked)		
Window	area = 0.55	U = 1.20	- Double-glazed, argon filled, low-E, En=0.2, hard coat (South)

Project Information

Building type Detached house

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Client	DCM Architectural Consultants Ltd 25 Pigeon Lane Herne Bay Kent CT6 7EH	Project	Unit 1 66 Borstal Hill Whitstable Kent CT5 4NB

SAP 2012 input data Printed on 7 Oct 2019 at 04:20 PM

Unit 1, 66 Borstal Hill, Whitstable, Kent, CT5 4NB

Overshading:	Average or unknown (20-60 % sky blocked)		
Window	area = 4.33	U = 1.20	- Double-glazed, argon filled, low-E, En=0.2, hard coat (East)
Overshading:	Average or unknown (20-60 % sky blocked)		
Window	area = 2.88	U = 1.20	- Double-glazed, argon filled, low-E, En=0.2, hard coat (West)
Overshading:	Average or unknown (20-60 % sky blocked)		
Rooflights			
Rooflight at 70° or less	area = 4.67	U = 1.20	- Double-glazed, argon filled, low-E, En=0.2, hard coat (n/a)
Overshading:	Very little (<20 % sky blocked)		
Opaque Elements			
Walls	area = 4.15	U = 0.21, k = 9.0	Dormer Cheeks - Weatherboard/Battens/9 OSB/51 Cavity/140 Timber Frame Insulated With 120 Celotex XR4000 Between Studs/12.5 P'bd
Walls	area = 102.19	U = 0.20, k = 9.0	Brick or (Weatherboard/Battens/100 Medium Dense Block)/51 Cavity/140 Timber Frame Insulated With 120 Celotex XR4000 Between Studs/12.5 P'bd
Ground floors	area = 50.31	U = 0.12, k = 75.0	Beam/Medium Dense Block/150 Kingspan TF70/Screed
Roofs	area = 3.36	U = 0.15, k = 9.0	150 Kingspan TR27 Over Joists
Roofs	area = 56.37	U = 0.12, k = 9.0	150 Kingspan K7 Between Rafters/52.5 Kingspan K118 Under Rafters With Breather Membrane
Thermal bridges:	NOT Accredited Construction Details (y = 0.1500)		
Thermal mass:	Calculated from k values		
Pressure test:	Yes (q50 - 5.00) : measured in this dwelling : Yes		
Ventilation:	Natural ventilation with intermittent extract fans		
Number of chimneys:	0		
Number of open flues:	0		
Number of intermittent fans:	4		
Number of passive stacks:	0		
Number of sides sheltered:	2.00		

Project Information

Building type Detached house

Reference	J5067-1		
Date	7 October 2019		
Client	DCM Architectural Consultants Ltd 25 Pigeon Lane Herne Bay Kent CT6 7EH	Project	Unit 1 66 Borstal Hill Whitstable Kent CT5 4NB

SAP 2012 input data Printed on 7 Oct 2019 at 04:20 PM

Unit 1, 66 Borstal Hill, Whitstable, Kent, CT5 4NB

Measured/design q50:	5.00
Main heating system:	Central heating systems with radiators or underfloor heating Gas boilers (including LPG) 1998 or later Condensing combi with automatic ignition Index : 16766 Eff 87.10% / 89.80% Alpha InTec 40GS Radiators Pump in heated space: Yes Boiler has load or weather compensator: Yes Boiler Interlock: Yes Design flow temperature : Unknown Central heating pump 2013 or later Gas (mains)
Main heating controls:	Time and temperature zone control
Boiler has load compensator:	No
Boiler has weather compensator:	Yes
Boiler has emhanced load compensator:	No
Boiler interlock:	Yes
Secondary heating system:	None
Water heating:	Combination boiler Combination boiler type : Instantaneous Solar panel: no
Water use <= 125 litres/person/day:	Yes
Low energy lights:	100.0% of fixed lighting outlets
Total fixed lighting outlets:	25
Electricity tariff:	Standard tariff
Photovoltaics 1:	Peak kW: 0.00
Photovoltaics 2:	Peak kW: 0.00

Project Information

Building type Detached house

Reference	J5067-1		
Date	7 October 2019		
Client	DCM Architectural Consultants Ltd 25 Pigeon Lane Herne Bay Kent CT6 7EH	Project	Unit 1 66 Borstal Hill Whitstable Kent CT5 4NB

SAP 2012 input data Printed on 7 Oct 2019 at 04:20 PM

Unit 1, 66 Borstal Hill, Whitstable, Kent, CT5 4NB

Photovoltaics 3: Peak kW: 0.00
Conservatory: No
Fixed air conditioning: No
Smoke Control Area: Not specified
Additional allowable electricity generation :
0.00kg/m²/year

SAP 2012 Overheating Assessment for New dwelling as designed

Dwelling type	Detached house
Number of storeys	2
Cross ventilation possible	Yes
Region	South East England
Front of dwelling faces	East
Overshading	Average or unknown (20-60 % sky blocked)
Overhangs	(as detailed below)
Thermal mass parameter	52.35 (calculated from construction elements)
Night ventilation	No
Ventilation rate during hot weather (ach)	8.00 (Windows fully open)

Summer ventilation heat loss coefficient	638.86	(P1)
Transmission heat loss coefficient	101.10	(37)
Summer heat loss coefficient	739.96	(P2)

Solar gains (calculation for July)

Orientation	Area	Flux	g & FF	Shading	Gains
East	0.9 x 0.20	110.22	0.72 x 0.70	0.90	9
West	0.9 x 2.88	110.22	0.72 x 0.70	0.90	130
East	0.9 x 4.33	110.22	0.72 x 0.70	0.90	195
South	0.9 x 0.55	108.01	0.72 x 0.70	0.90	24
n/a	0.9 x 4.67	189.00	0.72 x 0.70	1.00	400
Total					1345

	Jun	Jul	Aug	
Solar gains	1412	1345	1159	(P3)
Internal gains	489	469	478	
Total summer gains	1901	1814	1638	(P5)
Summer gain/loss ratio	2.57	2.45	2.21	(P6)
External temperature (South East England)	15.2	17.6	17.8	
Thermal mass temperature increment (TMP=52.4)	1.63	1.63	1.63	
Threshold temperature	19.40	21.68	21.65	(P7)
Likelihood of high internal temperature	Not sig.	Slight	Slight	

Assessment of likelihood of high internal temperature **Slight**

Predicted Energy Assessment

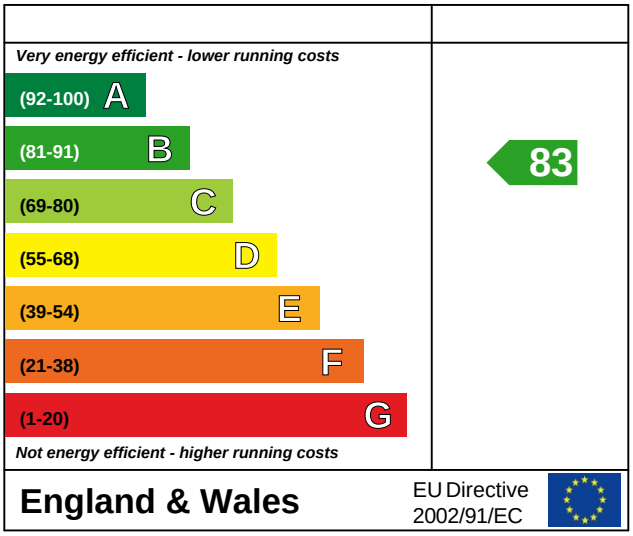
Unit 1
66 Borstal Hill
Whitstable
Kent
CT5 4NB
Ref: J5067-1

Dwelling type: Detached house
Date of assessment: 7 October 2019
Produced by Thermcalc Limited
Total floor area: 101 m²

This is a Predicted Energy Assessment for a property which is not yet complete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, an Energy Performance Certificate is required providing information about the energy performance of the completed property.

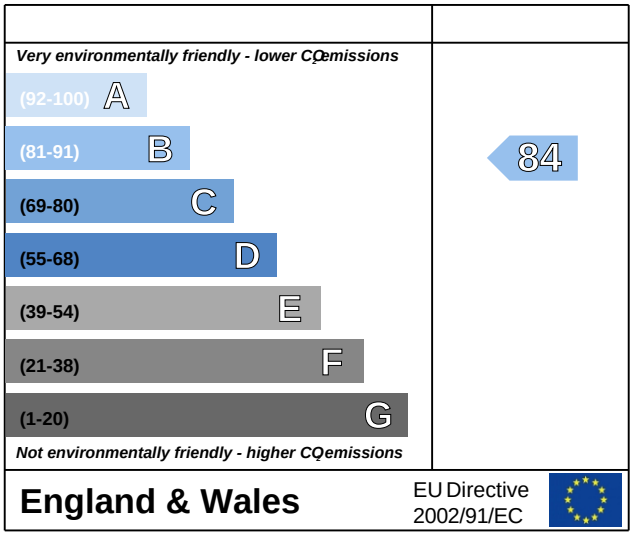
Energy performance has been assessed using the SAP 2012 methodology and is rated in terms of the energy use per square metre of floor area, energy efficiency based on fuel costs and environmental impact based on carbon dioxide (CO_2) emissions.

Energy Efficiency Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Environmental Impact (CO_2) Rating



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO_2) emissions. The higher the rating the less impact it has on the environment.

Project Information

Building type Detached house

Reference	J5067-1		
Date	7 October 2019		
Client	DCM Architectural Consultants Ltd 25 Pigeon Lane Herne Bay Kent CT6 7EH	Project	Unit 1 66 Borstal Hill Whitstable Kent CT5 4NB

SAP 2012 worksheet for - calculation of fabric energy efficiency

1. Overall dwelling dimensions

	Area (m^2)	Av. Storey height (m)	Volume (m^3)	
Ground floor (1)	50.31	2.31	116.22	(3a)
First floor	50.31	2.50	125.78	(3b)
Total floor area	100.62			(4)
Dwelling volume (m^3)			241.99	(5)

2. Ventilation rate

	main + seondary + other heating		m³ per hour	
Number of chimneys	0 + 0 + 0	x 40	0.00	(6a)
Number of open flues	0 + 0 + 0	x 20	0.00	(6b)
Number of intermittent fans	4	x 10	40.00	(7a)
Number of passive vents	0	x 10	0.00	(7b)
Number of flueless gas fires	0	x 40	0.00	(7c)

		Air changes per hour	
Infiltration due to chimneys, fans and flues		0.17	(8)
Pressure test, result q50	5.00		(17)
Air permeability		0.42	(18)
Number of sides on which sheltered		2.00	(19)
Shelter factor		0.85	(20)
Infiltration rate incorporating shelter factor		0.35	(21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
5.10	5.00	4.90	4.40	4.30	3.80	3.80	3.70	4.00	4.30	4.50	4.70

52.50 (22)

Wind Factor

1.27	1.25	1.23	1.10	1.07	0.95	0.95	0.93	1.00	1.07	1.13	1.18

13.13 (22a)

Adjusted infiltration rate (allowing for shelter and wind speed)

0.45	0.44	0.43	0.39	0.38	0.34	0.34	0.33	0.35	0.38	0.40	0.41

4.63 (22b)

Ventilation : natural ventilation, intermittent extract fans

Effective air change rate

0.60	0.60	0.59	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(25)

3. Heat losses and heat loss parameter

Element	Gross area, m²	Openings m²	Net area A, m²	U-value W/m²K	A x U W/K	kappa-value kJ/m²K	A x K kJ/K	
Window - Double-glazed, argon filled, low-E, En=0.2, hard coat (East)			**0.200**	**1.15 (1.20)**	0.23			(27)
Specified U-Value = 1.20								
Window - Double-glazed, argon filled, low-E, En=0.2, hard coat (West)			**2.880**	**1.15 (1.20)**	3.30			(27)
Specified U-Value = 1.20								
Window - Double-glazed, argon filled, low-E, En=0.2, hard coat (East)			**4.330**	**1.15 (1.20)**	4.96			(27)
Specified U-Value = 1.20								
Window - Double-glazed, argon filled, low-E, En=0.2, hard coat (South)			**0.550**	**1.15 (1.20)**	0.63			(27)
Specified U-Value = 1.20								
Full glazed door - Double-glazed, argon filled, low-E, En=0.2, hard coat (South)			**2.630**	**1.20**	3.16			(26)
Specified U-Value = 1.20								
Full glazed door - Double-glazed, argon filled, low-E, En=0.2, hard coat (East)			**3.780**	**1.20**	4.54			(26)
Specified U-Value = 1.20								
Full glazed door - Double-glazed, argon filled, low-E, En=0.2, hard coat (West)			**6.680**	**1.20**	8.02			(26)
Specified U-Value = 1.20								
Rooflight at 70° or less - Double-glazed, argon filled, low-E, En=0.2, hard coat (n/a)			**4.670**	**1.15 (1.20)**	5.35			(27)
Velux Specified U-Value = 1.20								
Walls			4.15	0.21	0.87	9.00	37.35	(29)
Dormer Cheeks - Weatherboard/Battens/9 OSB/51 Cavity/140 Timber Frame Insulated With 120 Celotex XR4000 Between Studs/12.5 P'bd								
Walls			102.19	0.20	20.44	9.00	919.71	(29)
Brick or (Weatherboard/Battens/100 Medium Dense Block)/51 Cavity/140 Timber Frame Insulated With 120 Celotex XR4000 Between Studs/12.5 P'bd								
Ground floors			50.31	0.12	6.04	75.00	3773.25	(28)
Beam/Medium Dense Block/150 Kingspan TF70/Screed								

3. Heat losses and heat loss parameter

Element	Gross area, m²	Openings m²	Net area A, m²	U-value W/m²K	A x U W/K	kappa-value kJ/m²K	A x K kJ/K	
Flat roofs			3.36	0.15	0.50	9.00	30.24	(30)
150 Kingspan TR27 Over Joists								
Pitched roofs insulated between rafters			56.37	0.12	6.76	9.00	507.33	(30)
150 Kingspan K7 Between Rafters/52.5 Kingspan K118 Under Rafters With Breather Membrane								

Total area of external elements Sigma A, m²	242.10	(31)
Fabric heat loss, W/K	64.78	(33)
Heat capacity	5267.88	(34)
Thermal mass parameter, kJ/m²K	52.35	(35)
Effect of thermal bridges	36.32	(36)
Total fabric heat loss	101.10	(37)

Ventilation heat loss calculated monthly

48.02	47.70	47.39	45.95	45.68	44.42	44.42	44.19	44.90	45.68	46.23	46.80	(38)

Heat transfer coefficient, W/K

149.12	148.80	148.49	147.05	146.78	145.52	145.52	145.29	146.00	146.78	147.33	147.90	
											147.05	(39)

Heat loss parameter (HLP), W/m²K

1.48	1.48	1.48	1.46	1.46	1.45	1.45	1.44	1.45	1.46	1.46	1.47	

HLP (average)	1.46	(40)

Number of days in month (Table 1a)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements **kWh/year**

Assumed occupancy, N 2.75 (42)

Annual average hot water usage in litres per day Vd,average 99.40 (43)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hot water usage in litres per day for each month											
109.34	105.36	101.39	97.41	93.43	89.46	89.46	93.43	97.41	101.39	105.36	109.34 (44)
Energy content of hot water used											
162.15	141.81	146.34	127.58	122.42	105.64	97.89	112.33	113.67	132.47	144.60	157.03

Energy content (annual) 1563.92 (45)

Distribution loss											
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 (46)

store loss determined from EN 13203-2 tests, taken from boiler data record

Hot water storage volume (litres) 0.00 (50)

Hot water cylinder loss factor (kWh/day) 0.0000 (51)

Volume factor 0.0000 (52)

Temperature factor 0.0000 (53)

Energy lost from store (kWh/day) 0.00 (55)

Total storage loss											
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)
Net storage loss											
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 loss											
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 calculated for each month											
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)
Total heat required for water heating calculated for each month											
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 (62)
Output from water heater for each month, kWh/month											
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 (64)

0.00 (64)

Heat gains from water heating, kWh/month											
34.46	30.14	31.10	27.11	26.01	22.45	20.80	23.87	24.15	28.15	30.73	33.37 (65)

5. Internal gains

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains, Watts												
137.26	137.26	137.26	137.26	137.26	137.26	137.26	137.26	137.26	137.26	137.26	137.26	(66)
Lighting gains												
24.81	22.03	17.92	13.57	10.14	8.56	9.25	12.02	16.14	20.49	23.92	25.50	(67)
Appliances gains												
257.33	260.00	253.27	238.94	220.86	203.86	192.51	189.84	196.57	210.89	228.98	245.97	(68)
Cooking gains												
36.73	36.73	36.73	36.73	36.73	36.73	36.73	36.73	36.73	36.73	36.73	36.73	(69)
Pumps and fans gains												
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(70)
Losses e.g. evaporation (negative values)												
-109.81	-109.81	-109.81	-109.81	-109.81	-109.81	-109.81	-109.81	-109.81	-109.81	-109.81	-109.81	(71)
Water heating gains												
46.31	44.84	41.80	37.65	34.96	31.18	27.96	32.08	33.55	37.84	42.68	44.85	(72)
Total internal gains												
392.62	391.05	377.16	354.34	330.14	307.78	293.90	298.13	310.43	333.40	359.75	380.50	(73)

6. Solar gains (calculation for January)

	Area & Flux	g & FF	Shading	Gains
Window - Double-glazed, argon filled, low-E, En=0.2, hard coat (East)	0.9 x 0.200 19.64	0.72 x 0.70	0.77	1.3720
Specified U-Value = 1.20				
Window - Double-glazed, argon filled, low-E, En=0.2, hard coat (West)	0.9 x 2.880 19.64	0.72 x 0.70	0.77	19.7562
Specified U-Value = 1.20				
Window - Double-glazed, argon filled, low-E, En=0.2, hard coat (East)	0.9 x 4.330 19.64	0.72 x 0.70	0.77	29.7029
Specified U-Value = 1.20				
Window - Double-glazed, argon filled, low-E, En=0.2, hard coat (South)	0.9 x 0.550 46.75	0.72 x 0.70	0.77	8.9811
Specified U-Value = 1.20				
Full glazed door - Double-glazed, argon filled, low-E, En=0.2, hard coat (South)	0.9 x 2.630 46.75	0.72 x 0.70	0.77	42.9458
Specified U-Value = 1.20				
Full glazed door - Double-glazed, argon filled, low-E, En=0.2, hard coat (East)	0.9 x 3.780 19.64	0.72 x 0.70	0.77	25.9300
Specified U-Value = 1.20				
Full glazed door - Double-glazed, argon filled, low-E, En=0.2, hard coat (West)	0.9 x 6.680 19.64	0.72 x 0.70	0.77	45.8234
Specified U-Value = 1.20				
Rooflight at 70° or less - Double-glazed, argon filled, low-E, En=0.2, hard coat (n/a)	0.9 x 4.670 26.00	0.72 x 0.70	1.00	55.0761
Velux Specified U-Value = 1.20				

7. Mean internal temperature

Temperature during heating periods in the living area, Th1 (°C) 21.00 (85)

Heating system responsiveness 1.00

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau											
9.81	9.83	9.85	9.95	9.97	10.06	10.06	10.07	10.02	9.97	9.93	9.89
alpha											
1.65	1.66	1.66	1.66	1.66	1.67	1.67	1.67	1.67	1.66	1.66	1.66
Utilisation factor for gains for living area											
0.92	0.88	0.81	0.70	0.58	0.46	0.36	0.41	0.59	0.79	0.89	0.93 (86)
Mean internal temperature in living area T1											
17.00	17.52	18.33	19.28	20.04	20.55	20.79	20.74	20.27	19.19	17.90	16.90 (87)
Temperature during heating periods in rest of dwelling Th2											
19.70	19.70	19.71	19.72	19.72	19.73	19.73	19.73	19.72	19.72	19.71	19.71 (88)
Utilisation factor for gains for rest of dwelling											
0.91	0.87	0.79	0.67	0.53	0.39	0.27	0.32	0.52	0.76	0.88	0.92 (89)
Mean internal temperature in the rest of dwelling T2											
16.09	16.60	17.39	18.30	19.00	19.45	19.63	19.60	19.24	18.25	17.00	16.00 (90)

Living area fraction (50.31 / 100.62) 0.50 (91)

Mean internal temperature (for the whole dwelling)

16.55	17.06	17.86	18.79	19.52	20.00	20.21	20.17	19.75	18.72	17.45	16.45 (92)

Apply adjustment to the mean internal temperature, where appropriate

16.55	17.06	17.86	18.79	19.52	20.00	20.21	20.17	19.75	18.72	17.45	16.45 (93)

8. Space heating requirement

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation factor for gains											
0.88	0.83	0.75	0.64	0.52	0.41	0.31	0.35	0.53	0.72	0.85	0.89 (94)
Useful gains											
548.91	688.69	814.53	881.15	824.19	640.20	462.62	467.54	592.61	615.85	545.29	510.40 (95)
Monthly average external temperature											
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											
1826.31	1809.58	1687.00	1454.31	1148.03	786.26	525.56	547.53	825.62	1191.90	1524.74	1811.83 (97)
Fraction of month for heating											
1.00	1.00	1.00	1.00	1.00	-	-	-	-	1.00	1.00	1.00
Space heating requirement for each month, kWh/month											
950.38	753.23	649.12	412.67	240.94	-	-	-	-	428.58	705.20	968.26

Total space heating requirement per year (kWh/year) (October to May) 5108.39 (98)

Space heating requirement per m² (kWh/m²/year) 50.77 (99)

8c. Space cooling requirement

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
External temperaturers												
-	-	-	-	-	14.60	16.60	16.40	-	-	-	-	
Heat loss rate W												
-	-	-	-	-	1367.88	1076.84	1104.17	-	-	-	-	(100)
Utilisation factor for loss												
-	-	-	-	-	0.72	0.77	0.74	-	-	-	-	(101)
Useful loss W												
-	-	-	-	-	984.61	829.95	814.01	-	-	-	-	(102)
Internal gains W												
0.00	0.00	0.00	0.00	0.00	465.98	447.53	454.61	0.00	0.00	0.00	0.00	
Solar gains W												
0.00	0.00	0.00	0.00	0.00	1411.75	1344.65	1159.43	0.00	0.00	0.00	0.00	
Gains W												
-	-	-	-	-	1877.73	1792.19	1614.04	-	-	-	-	(103)
Fraction of month for cooling												
0.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	(103a)
Space heating kWh												
-	-	-	-	-	78.55	-4.95	-16.88	-	-	-	-	(98)
Space cooling kWh												
-	-	-	-	-	643.04	715.91	595.22	-	-	-	-	(104)
Total											1954.18	(104)
Cooled fraction											1.00	(105)
Intermittency factor												
-	-	-	-	-	0.25	0.25	0.25	-	-	-	-	(106)
Space cooling requirement for month												
-	-	-	-	-	160.76	178.98	148.81	-	-	-	-	
Space cooling (June to August)											488.54	(107)
Space cooling requirement per m² (kWh/m²/year)											4.86	(108)

8f. Fabric Energy Efficiency

	kWh/year	
Energy for space heating	50.77	(99)
Energy for space cooling	4.86	(108)
Total	55.62	(109)
Dwelling Fabric Energy Efficiency	**55.6**	(109)

Project Information

Building type Detached house

Reference	J5067-1		
Date	7 October 2019		
Client	DCM Architectural Consultants Ltd 25 Pigeon Lane Herne Bay Kent CT6 7EH	Project	Unit 1 66 Borstal Hill Whitstable Kent CT5 4NB

SAP 2012 worksheet for - CSH Ene 7 standard case

1. Overall dwelling dimensions

	Area (m^2)	Av. Storey height (m)	Volume (m^3)	
Ground floor (1)	50.31	2.31	116.22	(3a)
First floor	50.31	2.50	125.78	(3b)
Total floor area	100.62			(4)
Dwelling volume (m^3)			241.99	(5)

2. Ventilation rate

	main + seondary + other heating		m³ per hour	
Number of chimneys	0 + 0 + 0	x 40	0.00	(6a)
Number of open flues	0 + 0 + 0	x 20	0.00	(6b)
Number of intermittent fans	4	x 10	40.00	(7a)
Number of passive vents	0	x 10	0.00	(7b)
Number of flueless gas fires	0	x 40	0.00	(7c)

			Air changes per hour	
Infiltration due to chimneys, fans and flues			0.17	(8)
Pressure test, result q50		5.00		(17)
Air permeability			0.42	(18)
Number of sides on which sheltered			2.00	(19)
Shelter factor			0.85	(20)
Infiltration rate incorporating shelter factor			0.35	(21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
5.10	5.00	4.90	4.40	4.30	3.80	3.80	3.70	4.00	4.30	4.50	4.70	
												52.50 (22)

Wind Factor

1.27	1.25	1.23	1.10	1.07	0.95	0.95	0.93	1.00	1.07	1.13	1.18	
												13.13 (22a)

Adjusted infiltration rate (allowing for shelter and wind speed)

0.45	0.44	0.43	0.39	0.38	0.34	0.34	0.33	0.35	0.38	0.40	0.41	
												4.63 (22b)

Ventilation : natural ventilation, intermittent extract fans

Effective air change rate

0.60	0.60	0.59	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(25)

3. Heat losses and heat loss parameter

Element	Gross area, m²	Openings m²	Net area A, m²	U-value W/m²K	A x U W/K	kappa-value kJ/m²K	A x K kJ/K	
Window - Double-glazed, argon filled, low-E, En=0.2, hard coat (East)			**0.200**	**1.15 (1.20)**	0.23			(27)
Specified U-Value = 1.20								
Window - Double-glazed, argon filled, low-E, En=0.2, hard coat (West)			**2.880**	**1.15 (1.20)**	3.30			(27)
Specified U-Value = 1.20								
Window - Double-glazed, argon filled, low-E, En=0.2, hard coat (East)			**4.330**	**1.15 (1.20)**	4.96			(27)
Specified U-Value = 1.20								
Window - Double-glazed, argon filled, low-E, En=0.2, hard coat (South)			**0.550**	**1.15 (1.20)**	0.63			(27)
Specified U-Value = 1.20								
Full glazed door - Double-glazed, argon filled, low-E, En=0.2, hard coat (South)			**2.630**	**1.20**	3.16			(26)
Specified U-Value = 1.20								
Full glazed door - Double-glazed, argon filled, low-E, En=0.2, hard coat (East)			**3.780**	**1.20**	4.54			(26)
Specified U-Value = 1.20								
Full glazed door - Double-glazed, argon filled, low-E, En=0.2, hard coat (West)			**6.680**	**1.20**	8.02			(26)
Specified U-Value = 1.20								
Rooflight at 70° or less - Double-glazed, argon filled, low-E, En=0.2, hard coat (n/a)			**4.670**	**1.15 (1.20)**	5.35			(27)
Velux Specified U-Value = 1.20								
Walls			4.15	0.21	0.87	9.00	37.35	(29)
Dormer Cheeks - Weatherboard/Battens/9 OSB/51 Cavity/140 Timber Frame Insulated With 120 Celotex XR4000 Between Studs/12.5 P'bd								
Walls			102.19	0.20	20.44	9.00	919.71	(29)
Brick or (Weatherboard/Battens/100 Medium Dense Block)/51 Cavity/140 Timber Frame Insulated With 120 Celotex XR4000 Between Studs/12.5 P'bd								
Ground floors			50.31	0.12	6.04	75.00	3773.25	(28)
Beam/Medium Dense Block/150 Kingspan TF70/Screed								

3. Heat losses and heat loss parameter

Element	Gross area, m²	Openings m²	Net area A, m²	U-value W/m²K	A x U W/K	kappa-value kJ/m²K	A x K kJ/K	
Flat roofs			3.36	0.15	0.50	9.00	30.24	(30)
150 Kingspan TR27 Over Joists								
Pitched roofs insulated between rafters			56.37	0.12	6.76	9.00	507.33	(30)
150 Kingspan K7 Between Rafters/52.5 Kingspan K118 Under Rafters With Breather Membrane								

Total area of external elements Sigma A, m²	242.10	(31)
Fabric heat loss, W/K	64.78	(33)
Heat capacity	5267.88	(34)
Thermal mass parameter, kJ/m²K	52.35	(35)
Effect of thermal bridges	36.32	(36)
Total fabric heat loss	101.10	(37)

Ventilation heat loss calculated monthly

48.02	47.70	47.39	45.95	45.68	44.42	44.42	44.19	44.90	45.68	46.23	46.80	(38)

Heat transfer coefficient, W/K

149.12	148.80	148.49	147.05	146.78	145.52	145.52	145.29	146.00	146.78	147.33	147.90	
											147.05	(39)

Heat loss parameter (HLP), W/m²K

1.48	1.48	1.48	1.46	1.46	1.45	1.45	1.44	1.45	1.46	1.46	1.47	

HLP (average)	1.46	(40)

Number of days in month (Table 1a)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements **kWh/year**

Assumed occupancy, N 2.75 (42)

Annual average hot water usage in litres per day Vd,average 99.40 (43)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month												
109.34	105.36	101.39	97.41	93.43	89.46	89.46	93.43	97.41	101.39	105.36	109.34	(44)
Energy content of hot water used												
162.15	141.81	146.34	127.58	122.42	105.64	97.89	112.33	113.67	132.47	144.60	157.03	

Energy content (annual) 1563.92 (45)

Distribution loss												
24.32	21.27	21.95	19.14	18.36	15.85	14.68	16.85	17.05	19.87	21.69	23.55	(46)

Hot water storage volume (litres) 150.00 (50)

Hot water cylinder loss factor (kWh/day) 0.0191 (51)

Volume factor 0.9283 (52)

Temperature factor 0.5400 (53)

Energy lost from hot water cylinder (kWh/day) 1.44 (55)

Total storage loss												
44.53	40.22	44.53	43.09	44.53	43.09	44.53	44.53	43.09	44.53	43.09	44.53	(56)
Net storage loss												
44.53	40.22	44.53	43.09	44.53	43.09	44.53	44.53	43.09	44.53	43.09	44.53	(57)
Primary loss												
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)
Total heat required for water heating calculated for each month												
229.94	203.04	214.13	193.19	190.21	171.24	165.68	180.12	179.27	200.26	210.21	224.82	(62)
Output from water heater for each month, kWh/month												
229.94	203.04	214.13	193.19	190.21	171.24	165.68	180.12	179.27	200.26	210.21	224.82	(64)

2362.10 (64)

Heat gains from water heating, kWh/month												
108.15	96.14	102.89	94.90	94.94	87.61	86.78	91.58	90.28	98.28	100.56	106.44	(65)

5. Internal gains

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains, Watts												
137.26	137.26	137.26	137.26	137.26	137.26	137.26	137.26	137.26	137.26	137.26	137.26	(66)
Lighting gains												
24.81	22.03	17.92	13.57	10.14	8.56	9.25	12.02	16.14	20.49	23.92	25.50	(67)
Appliances gains												
257.33	260.00	253.27	238.94	220.86	203.86	192.51	189.84	196.57	210.89	228.98	245.97	(68)
Cooking gains												
36.73	36.73	36.73	36.73	36.73	36.73	36.73	36.73	36.73	36.73	36.73	36.73	(69)
Pumps and fans gains												
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 (negative values)												
-109.81	-109.81	-109.81	-109.81	-109.81	-109.81	-109.81	-109.81	-109.81	-109.81	-109.81	-109.81	(71)
Water heating gains												
145.36	143.06	138.29	131.81	127.60	121.68	116.64	123.09	125.39	132.10	139.67	143.07	(72)
Total internal gains												
494.67	492.27	476.66	451.50	425.78	401.28	385.58	392.14	405.27	430.66	459.74	481.72	(73)

6. Solar gains (calculation for January)

	Area & Flux	g & FF	Shading	Gains
Window - Double-glazed, argon filled, low-E, En=0.2, hard coat (East)	0.9 x 0.200 19.64	0.72 x 0.70	0.77	1.3720
Specified U-Value = 1.20				
Window - Double-glazed, argon filled, low-E, En=0.2, hard coat (West)	0.9 x 2.880 19.64	0.72 x 0.70	0.77	19.7562
Specified U-Value = 1.20				
Window - Double-glazed, argon filled, low-E, En=0.2, hard coat (East)	0.9 x 4.330 19.64	0.72 x 0.70	0.77	29.7029
Specified U-Value = 1.20				
Window - Double-glazed, argon filled, low-E, En=0.2, hard coat (South)	0.9 x 0.550 46.75	0.72 x 0.70	0.77	8.9811
Specified U-Value = 1.20				
Full glazed door - Double-glazed, argon filled, low-E, En=0.2, hard coat (South)	0.9 x 2.630 46.75	0.72 x 0.70	0.77	42.9458
Specified U-Value = 1.20				
Full glazed door - Double-glazed, argon filled, low-E, En=0.2, hard coat (East)	0.9 x 3.780 19.64	0.72 x 0.70	0.77	25.9300
Specified U-Value = 1.20				
Full glazed door - Double-glazed, argon filled, low-E, En=0.2, hard coat (West)	0.9 x 6.680 19.64	0.72 x 0.70	0.77	45.8234
Specified U-Value = 1.20				
Rooflight at 70° or less - Double-glazed, argon filled, low-E, En=0.2, hard coat (n/a)	0.9 x 4.670 26.00	0.72 x 0.70	1.00	55.0761
Velux Specified U-Value = 1.20				

7. Mean internal temperature

Temperature during heating periods in the living area, Th1 (°C) 21.00 (85)

Heating system responsiveness 1.00

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau											
9.81	9.83	9.85	9.95	9.97	10.06	10.06	10.07	10.02	9.97	9.93	9.89
alpha											
1.65	1.66	1.66	1.66	1.66	1.67	1.67	1.67	1.67	1.66	1.66	1.66
Utilisation factor for gains for living area											
0.90	0.86	0.79	0.68	0.56	0.44	0.34	0.39	0.56	0.76	0.87	0.91 (86)
Mean internal temperature in living area T1											
17.17	17.67	18.45	19.36	20.09	20.58	20.81	20.76	20.33	19.30	18.06	17.07 (87)
Temperature during heating periods in rest of dwelling Th2											
19.70	19.70	19.71	19.72	19.72	19.73	19.73	19.73	19.72	19.72	19.71	19.71 (88)
Utilisation factor for gains for rest of dwelling											
0.89	0.85	0.77	0.65	0.51	0.37	0.26	0.30	0.50	0.73	0.86	0.90 (89)
Mean internal temperature in the rest of dwelling T2											
16.26	16.75	17.50	18.37	19.04	19.47	19.64	19.61	19.27	18.35	17.14	16.17 (90)

Living area fraction (50.31 / 100.62) 0.50 (91)

Mean internal temperature (for the whole dwelling)

16.71	17.21	17.98	18.87	19.57	20.03	20.22	20.18	19.80	18.82	17.60	16.62 (92)
Apply adjustment to the mean internal temperature, where appropriate											
16.71	17.21	17.98	18.87	19.57	20.03	20.22	20.18	19.80	18.82	17.60	16.62 (93)

8. Space heating requirement

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation factor for gains											
0.86	0.81	0.73	0.62	0.51	0.39	0.29	0.33	0.50	0.70	0.82	0.87 (94)
Useful gains											
622.47	752.27	864.85	916.01	845.95	651.88	468.54	475.68	613.97	660.78	610.64	585.67 (95)
Monthly average external temperature											
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											
1851.21	1831.32	1704.14	1465.75	1154.74	789.61	527.18	549.80	832.19	1207.03	1546.96	1837.14 (97)
Fraction of month for heating											
1.00	1.00	1.00	1.00	1.00	-	-	-	-	1.00	1.00	1.00
Space heating requirement for each month, kWh/month											
914.19	725.12	624.43	395.81	229.74	-	-	-	-	406.41	674.15	931.10

Total space heating requirement per year (kWh/year) (October to May) 4900.95 (98)

Space heating requirement per m² (kWh/m²/year) 48.71 (99)

8c. Space cooling requirement - not applicable

9a. Energy requirements

kWh/year

No secondary heating system selected

Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main heating system	88.80%	(206)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement												
914.19	725.12	624.43	395.81	229.74	-	-	-	-	406.41	674.15	931.10	(98)
Appendix Q - monthly energy saved (main heating system 1)												
0.00	0.00	0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(210)
Space heating fuel (main heating system 1)												
1029.49	816.58	703.19	445.73	258.72	-	-	-	-	457.67	759.18	1048.53	(211)
Appendix Q - monthly energy saved (main heating system 2)												
0.00	0.00	0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(212)
Space heating fuel (main heating system 2)												
0.00	0.00	0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(213)
Appendix Q - monthly energy saved (secondary heating system)												
0.00	0.00	0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(214)
Space heating fuel (secondary)												
0.00	0.00	0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(215)
Water heating												
Water heating requirement												
229.94	203.04	214.13	193.19	190.21	171.24	165.68	180.12	179.27	200.26	210.21	224.82	(64)

Efficiency of water heater	79.50	(216)

86.76	86.58	86.22	85.52	84.33	79.50	79.50	79.50	79.50	85.50	86.40	86.82	(217)
Water heating fuel												
265.02	234.50	248.34	225.90	225.55	215.40	208.40	226.56	225.50	234.23	243.30	258.94	(219)

Annual totals	kWh/year	
Space heating fuel used, main system 1	5519.09	(211)
Space heating fuel (secondary)	0.00	(215)
Water heating fuel	2811.64	(219)
Electricity for pumps, fans and electric keep-hot		
central heating pump	30.00	(230c)
boiler with a fan-assisted flue	45.00	(230e)
Total electricity for the above, kWh/year	75.00	(231)
Electricity for lighting (100.00% fixed LEL)	438.10	(232)
Energy saving/generation technologies		
Appendix Q -		
Energy saved or generated ():	0.000	(236a)
Energy used ():	0.000	(237a)
Total delivered energy for all uses	8843.83	(238)

10a. Does not apply

11a. Does not apply

12a. Carbon dioxide emissions

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating, main system 1	5519.09	0.216	1192.12	(261)
Space heating, main system 2	0.00	0.000	0.00	(262)
Space heating, secondary	0.00	0.519	0.00	(263)
Water heating	2811.64	0.216	607.31	(264)
Space and water heating			1799.44	(265)
Electricity for pumps and fans	75.00	0.519	38.93	(267)
Electricity for lighting	438.10	0.519	227.37	(268)
Electricity generated - PVs	0.00	0.519	0.00	(269)
Electricity generated - µCHP	0.00	0.000	0.00	(269)
Appendix Q -				
Energy saved ():	0.00	0.000	0.00	(270)
Energy used ():	0.00	0.000	0.00	(271)
Total CO2, kg/year			2065.73	(272)
			kg/m²/year	
Dwelling Carbon Dioxide Emission Rate (DER)			**20.53**	(273)

Project Information

Building type Detached house

Reference	J5067-1		
Date	7 October 2019		
Client	DCM Architectural Consultants Ltd 25 Pigeon Lane Herne Bay Kent CT6 7EH	Project	Unit 1 66 Borstal Hill Whitstable Kent CT5 4NB

1. Overall dwelling dimensions

	Area (m^2)	Av. Storey height (m)	Volume (m^3)	
Ground floor (1)	50.31	2.31	116.22	(3a)
First floor	50.31	2.50	125.78	(3b)
Total floor area	100.62			(4)
Dwelling volume (m^3)			241.99	(5)

2. Ventilation rate

	main + seondary + other heating		m^3 per hour	
Number of chimneys	0 + 0 + 0	x 40	0.00	(6a)
Number of open flues	0 + 0 + 0	x 20	0.00	(6b)
Number of intermittent fans	4	x 10	40.00	(7a)
Number of passive vents	0	x 10	0.00	(7b)
Number of flueless gas fires	0	x 40	0.00	(7c)

			Air changes per hour	
Infiltration due to chimneys, fans and flues			0.17	(8)
Pressure test, result q50		5.00		(17)
Air permeability			0.42	(18)
Number of sides on which sheltered			2.00	(19)
Shelter factor			0.85	(20)
Infiltration rate incorporating shelter factor			0.35	(21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
5.10	5.00	4.90	4.40	4.30	3.80	3.80	3.70	4.00	4.30	4.50	4.70

52.50 (22)

Wind Factor

1.27	1.25	1.23	1.10	1.07	0.95	0.95	0.93	1.00	1.07	1.13	1.18

13.13 (22a)

Adjusted infiltration rate (allowing for shelter and wind speed)

0.45	0.44	0.43	0.39	0.38	0.34	0.34	0.33	0.35	0.38	0.40	0.41

4.63 (22b)

Ventilation : natural ventilation, intermittent extract fans

Effective air change rate

0.60	0.60	0.59	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(25)

3. Heat losses and heat loss parameter

Element	Gross area, m²	Openings m²	Net area A, m²	U-value W/m²K	A x U W/K	kappa-value kJ/m²K	A x K kJ/K	
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (East)			**0.200**	**1.33 (1.40)**	0.27			(27)
Specified U-Value = 1.20								
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (South)			**0.540**	**1.33 (1.40)**	0.72			(27)
Specified U-Value = 1.20								
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (East)			**4.230**	**1.33 (1.40)**	5.61			(27)
Specified U-Value = 1.20								
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (West)			**2.820**	**1.33 (1.40)**	3.74			(27)
Specified U-Value = 1.20								
Full glazed door - Double-glazed, air-filled, low-E, En=0.1, soft coat (West)			**6.530**	**1.40**	9.14			(26)
Specified U-Value = 1.20								
Full glazed door - Double-glazed, air-filled, low-E, En=0.1, soft coat (East)			**3.700**	**1.40**	5.18			(26)
Specified U-Value = 1.20								
Full glazed door - Double-glazed, air-filled, low-E, En=0.1, soft coat (South)			**2.570**	**1.40**	3.60			(26)
Specified U-Value = 1.20								
Rooflight at 70° or less - Double-glazed, air-filled, low-E, En=0.1, soft coat (n/a)			**4.570**	**1.59 (1.70)**	7.27			(27)
Velux Specified U-Value = 1.20								
Walls			4.15	0.18	0.75	9.00	37.35	(29)
Dormer Cheeks - Weatherboard/Battens/9 OSB/51 Cavity/140 Timber Frame Insulated With 120 Celotex XR4000 Between Studs/12.5 P'bd								
Walls			102.65	0.18	18.48	9.00	923.85	(29)
Brick or (Weatherboard/Battens/100 Medium Dense Block)/51 Cavity/140 Timber Frame Insulated With 120 Celotex XR4000 Between Studs/12.5 P'bd								
Ground floors			50.31	0.13	6.54	75.00	3773.25	(28)
Beam/Medium Dense Block/150 Kingspan TF70/Screed								

3. Heat losses and heat loss parameter

Element	Gross area, m²	Openings m²	Net area A, m²	U-value W/m²K	A x U W/K	kappa-value kJ/m²K	A x K kJ/K	
Flat roofs			3.36	0.13	0.44	9.00	30.24	(30)
150 Kingspan TR27 Over Joists								
Pitched roofs insulated between rafters			56.47	0.13	7.34	9.00	508.23	(30)
150 Kingspan K7 Between Rafters/52.5 Kingspan K118 Under Rafters With Breather Membrane								

Total area of external elements Sigma A, m²	242.10	(31)
Fabric heat loss, W/K	69.06	(33)
Thermal mass parameter, kJ/m²K (user-specified TMP)	250.00	(35)
Effect of thermal bridges	12.11	(36)
Total fabric heat loss	81.17	(37)

Ventilation heat loss calculated monthly

48.02	47.70	47.39	45.95	45.68	44.42	44.42	44.19	44.90	45.68	46.23	46.80	(38)

Heat transfer coefficient, W/K

129.19	128.87	128.56	127.12	126.85	125.59	125.59	125.35	126.07	126.85	127.39	127.97	
											127.12	(39)

Heat loss parameter (HLP), W/m²K

1.28	1.28	1.28	1.26	1.26	1.25	1.25	1.25	1.25	1.26	1.27	1.27	

HLP (average) 1.26 (40)

Number of days in month (Table 1a)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements **kWh/year**

Assumed occupancy, N 2.75 (42)

Annual average hot water usage in litres per day Vd,average 99.40 (43)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hot water usage in litres per day for each month											
109.34	105.36	101.39	97.41	93.43	89.46	89.46	93.43	97.41	101.39	105.36	109.34 (44)
Energy content of hot water used											
162.15	141.81	146.34	127.58	122.42	105.64	97.89	112.33	113.67	132.47	144.60	157.03

Energy content (annual) 1563.92 (45)

Distribution loss											
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 (46)

Hot water storage volume (litres) 0.00 (50)

Hot water cylinder loss factor (kWh/day) 0.0000 (51)

Volume factor 0.0000 (52)

Temperature factor 0.0000 (53)

Energy lost from store (kWh/day) 0.00 (55)

Total storage loss											
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)
Net storage loss											
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 loss											
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 calculated for each month											
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)
Total heat required for water heating calculated for each month											
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 (62)
Output from water heater for each month, kWh/month											
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 (64)

0.00 (64)

Heat gains from water heating, kWh/month											
34.46	30.14	31.10	27.11	26.01	22.45	20.80	23.87	24.15	28.15	30.73	33.37 (65)

5. Internal gains

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains, Watts												
137.26	137.26	137.26	137.26	137.26	137.26	137.26	137.26	137.26	137.26	137.26	137.26	(66)
Lighting gains												
24.93	22.14	18.00	13.63	10.19	8.60	9.29	12.08	16.22	20.59	24.03	25.62	(67)
Appliances gains												
257.33	260.00	253.27	238.94	220.86	203.86	192.51	189.84	196.57	210.89	228.98	245.97	(68)
Cooking gains												
36.73	36.73	36.73	36.73	36.73	36.73	36.73	36.73	36.73	36.73	36.73	36.73	(69)
Pumps and fans gains												
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(70)
Losses e.g. evaporation (negative values)												
-109.81	-109.81	-109.81	-109.81	-109.81	-109.81	-109.81	-109.81	-109.81	-109.81	-109.81	-109.81	(71)
Water heating gains												
46.31	44.84	41.80	37.65	34.96	31.18	27.96	32.08	33.55	37.84	42.68	44.85	(72)
Total internal gains												
392.74	391.16	377.25	354.40	330.19	307.82	293.94	298.18	310.51	333.50	359.86	380.62	(73)

6. Solar gains (calculation for January)

	Area & Flux	g & FF	Shading	Gains
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (East)	0.9 x 0.200 19.64	0.63 x 0.70	0.77	1.2005
Specified U-Value = 1.20				
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (South)	0.9 x 0.540 46.75	0.63 x 0.70	0.77	7.7155
Specified U-Value = 1.20				
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (East)	0.9 x 4.230 19.64	0.63 x 0.70	0.77	25.3898
Specified U-Value = 1.20				
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (West)	0.9 x 2.820 19.64	0.63 x 0.70	0.77	16.9265
Specified U-Value = 1.20				
Full glazed door - Double-glazed, air-filled, low-E, En=0.1, soft coat (West)	0.9 x 6.530 19.64	0.63 x 0.70	0.77	39.1951
Specified U-Value = 1.20				
Full glazed door - Double-glazed, air-filled, low-E, En=0.1, soft coat (East)	0.9 x 3.700 19.64	0.63 x 0.70	0.77	22.2086
Specified U-Value = 1.20				
Full glazed door - Double-glazed, air-filled, low-E, En=0.1, soft coat (South)	0.9 x 2.570 46.75	0.63 x 0.70	0.77	36.7203
Specified U-Value = 1.20				
Rooflight at 70° or less - Double-glazed, air-filled, low-E, En=0.1, soft coat (n/a)	0.9 x 4.570 26.00	0.63 x 0.70	1.00	47.1597
Velux Specified U-Value = 1.20				

7. Mean internal temperature

Temperature during heating periods in the living area, Th1 (°C) 21.00 (85)

Heating system responsiveness 1.00

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau											
54.09	54.22	54.35	54.97	55.09	55.64	55.64	55.74	55.42	55.09	54.85	54.60
alpha											
4.61	4.61	4.62	4.66	4.67	4.71	4.71	4.72	4.69	4.67	4.66	4.64
Utilisation factor for gains for living area											
1.00	0.99	0.97	0.90	0.75	0.56	0.41	0.48	0.76	0.96	1.00	1.00 (86)
Mean internal temperature in living area T1											
19.57	19.80	20.17	20.60	20.88	20.98	21.00	20.99	20.90	20.48	19.93	19.53 (87)
Temperature during heating periods in rest of dwelling Th2											
19.85	19.86	19.86	19.87	19.87	19.88	19.88	19.88	19.88	19.87	19.87	19.86 (88)
Utilisation factor for gains for rest of dwelling											
1.00	0.99	0.97	0.87	0.69	0.47	0.31	0.37	0.67	0.95	0.99	1.00 (89)
Mean internal temperature in the rest of dwelling T2											
18.56	18.79	19.16	19.57	19.80	19.87	19.88	19.88	19.83	19.47	18.93	18.53 (90)

Living area fraction (50.31 / 100.62) 0.50 (91)

Mean internal temperature (for the whole dwelling)

19.06	19.30	19.67	20.09	20.34	20.42	20.44	20.44	20.37	19.97	19.43	19.03 (92)

Apply adjustment to the mean internal temperature, where appropriate

19.06	19.30	19.67	20.09	20.34	20.42	20.44	20.44	20.37	19.97	19.43	19.03 (93)

8. Space heating requirement

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation factor for gains											
1.00	0.99	0.96	0.88	0.71	0.51	0.36	0.42	0.71	0.95	0.99	1.00 (94)
Useful gains											
587.43	759.43	947.17	1076.20	992.86	714.30	479.39	500.72	717.78	735.11	598.88	542.22 (95)
Monthly average external temperature											
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											
1907.33	1855.46	1692.56	1422.17	1095.44	731.39	482.00	505.94	790.12	1188.79	1570.72	1897.79 (97)
Fraction of month for heating											
1.00	1.00	1.00	1.00	1.00	-	-	-	-	1.00	1.00	1.00
Space heating requirement for each month, kWh/month											
982.00	736.53	554.57	249.10	76.32	-	-	-	-	337.54	699.72	1008.55

Total space heating requirement per year (kWh/year) (October to May) 4644.33 (98)

Space heating requirement per m² (kWh/m²/year) 46.16 (99)

8c. Space cooling requirement

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
External temperaturers												
-	-	-	-	-	14.60	16.60	16.40	-	-	-	-	
Heat loss rate W												
-	-	-	-	-	1180.53	929.35	952.70	-	-	-	-	(100)
Utilisation factor for loss												
-	-	-	-	-	0.93	0.97	0.95	-	-	-	-	(101)
Useful loss W												
-	-	-	-	-	1102.83	897.67	902.81	-	-	-	-	(102)
Internal gains W												
0.00	0.00	0.00	0.00	0.00	466.08	447.64	454.75	0.00	0.00	0.00	0.00	
Solar gains W												
0.00	0.00	0.00	0.00	0.00	1208.45	1151.01	992.46	0.00	0.00	0.00	0.00	
Gains W												
-	-	-	-	-	1674.53	1598.66	1447.21	-	-	-	-	(103)
Fraction of month for cooling												
0.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	(103a)
Space heating kWh												
-	-	-	-	-	1331.58	1553.90	1534.01	-	-	-	-	(98)
Space cooling kWh												
-	-	-	-	-	411.62	521.53	405.04	-	-	-	-	(104)
Total											1338.19	(104)
Cooled fraction											1.00	(105)
Intermittency factor												
-	-	-	-	-	0.25	0.25	0.25	-	-	-	-	(106)
Space cooling requirement for month												
-	-	-	-	-	102.91	130.38	101.26	-	-	-	-	
Space cooling (June to August)											334.55	(107)
Space cooling requirement per m² (kWh/m²/year)											3.32	(108)

8f. Fabric Energy Efficiency

	kWh/year	
Energy for space heating	46.16	(99)
Energy for space cooling	3.32	(108)
Total	49.48	(109)
Target Fabric Energy Efficiency	**56.9**	(109)

= 49.4820 x 1.15, rounded to 1 d.p.

Project Information

Building type Detached house

Reference	J5067-1		
Date	7 October 2019		
Client	DCM Architectural Consultants Ltd 25 Pigeon Lane Herne Bay Kent CT6 7EH	Project	Unit 1 66 Borstal Hill Whitstable Kent CT5 4NB

SAP 2012 worksheet for - calculation of Heat Demand

1. Overall dwelling dimensions

	Area (m^2)	Av. Storey height (m)	Volume (m^3)	
Ground floor (1)	50.31	2.31	116.22	(3a)
First floor	50.31	2.50	125.78	(3b)
Total floor area	100.62			(4)
Dwelling volume (m^3)			241.99	(5)

2. Ventilation rate

	main + seondary + other heating		m³ per hour	
Number of chimneys	0 + 0 + 0	x 40	0.00	(6a)
Number of open flues	0 + 0 + 0	x 20	0.00	(6b)
Number of intermittent fans	4	x 10	40.00	(7a)
Number of passive vents	0	x 10	0.00	(7b)
Number of flueless gas fires	0	x 40	0.00	(7c)

		Air changes per hour	
Infiltration due to chimneys, fans and flues		0.17	(8)
Pressure test, result q50	5.00		(17)
Air permeability		0.42	(18)
Number of sides on which sheltered		2.00	(19)
Shelter factor		0.85	(20)
Infiltration rate incorporating shelter factor		0.35	(21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
5.70	5.40	5.10	4.50	4.60	4.10	4.20	4.30	4.50	4.90	5.00	5.30

57.60 (22)

Wind Factor

1.43	1.35	1.27	1.13	1.15	1.02	1.05	1.07	1.13	1.23	1.25	1.32

14.40 (22a)

Adjusted infiltration rate (allowing for shelter and wind speed)

0.50	0.48	0.45	0.40	0.41	0.36	0.37	0.38	0.40	0.43	0.44	0.47

5.08 (22b)

Ventilation : natural ventilation, intermittent extract fans

Effective air change rate

0.63	0.61	0.60	0.58	0.58	0.57	0.57	0.57	0.58	0.59	0.60	0.61	(25)

3. Heat losses and heat loss parameter

Element	Gross area, m²	Openings m²	Net area A, m²	U-value W/m²K	A x U W/K	kappa-value kJ/m²K	A x K kJ/K	
Window - Double-glazed, argon filled, low-E, En=0.2, hard coat (East)			**0.200**	**1.15 (1.20)**	0.23			(27)
Specified U-Value = 1.20								
Window - Double-glazed, argon filled, low-E, En=0.2, hard coat (West)			**2.880**	**1.15 (1.20)**	3.30			(27)
Specified U-Value = 1.20								
Window - Double-glazed, argon filled, low-E, En=0.2, hard coat (East)			**4.330**	**1.15 (1.20)**	4.96			(27)
Specified U-Value = 1.20								
Window - Double-glazed, argon filled, low-E, En=0.2, hard coat (South)			**0.550**	**1.15 (1.20)**	0.63			(27)
Specified U-Value = 1.20								
Full glazed door - Double-glazed, argon filled, low-E, En=0.2, hard coat (South)			**2.630**	**1.20**	3.16			(26)
Specified U-Value = 1.20								
Full glazed door - Double-glazed, argon filled, low-E, En=0.2, hard coat (East)			**3.780**	**1.20**	4.54			(26)
Specified U-Value = 1.20								
Full glazed door - Double-glazed, argon filled, low-E, En=0.2, hard coat (West)			**6.680**	**1.20**	8.02			(26)
Specified U-Value = 1.20								
Rooflight at 70° or less - Double-glazed, argon filled, low-E, En=0.2, hard coat (n/a)			**4.670**	**1.15 (1.20)**	5.35			(27)
Velux Specified U-Value = 1.20								
Walls			4.15	0.21	0.87	9.00	37.35	(29)
Dormer Cheeks - Weatherboard/Battens/9 OSB/51 Cavity/140 Timber Frame Insulated With 120 Celotex XR4000 Between Studs/12.5 P'bd								
Walls			102.19	0.20	20.44	9.00	919.71	(29)
Brick or (Weatherboard/Battens/100 Medium Dense Block)/51 Cavity/140 Timber Frame Insulated With 120 Celotex XR4000 Between Studs/12.5 P'bd								
Ground floors			50.31	0.12	6.04	75.00	3773.25	(28)
Beam/Medium Dense Block/150 Kingspan TF70/Screed								

3. Heat losses and heat loss parameter

Element	Gross area, m²	Openings m²	Net area A, m²	U-value W/m²K	A x U W/K	kappa-value kJ/m²K	A x K kJ/K	
Flat roofs			3.36	0.15	0.50	9.00	30.24	(30)
150 Kingspan TR27 Over Joists								
Pitched roofs insulated between rafters			56.37	0.12	6.76	9.00	507.33	(30)
150 Kingspan K7 Between Rafters/52.5 Kingspan K118 Under Rafters With Breather Membrane								

Total area of external elements Sigma A, m²	242.10	(31)
Fabric heat loss, W/K	64.78	(33)
Heat capacity	5267.88	(34)
Thermal mass parameter, kJ/m²K	52.35	(35)
Effect of thermal bridges	36.32	(36)
Total fabric heat loss	101.10	(37)

Ventilation heat loss calculated monthly

50.03	49.00	48.02	46.23	46.51	45.16	45.41	45.68	46.23	47.39	47.70	48.66	(38)

Heat transfer coefficient, W/K

151.13	150.10	149.12	147.33	147.61	146.26	146.51	146.78	147.33	148.49	148.80	149.76	
											148.27	(39)

Heat loss parameter (HLP), W/m²K

1.50	1.49	1.48	1.46	1.47	1.45	1.46	1.46	1.46	1.48	1.48	1.49	

HLP (average) 1.47 (40)

Number of days in month (Table 1a)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements **kWh/year**

Assumed occupancy, N 2.75 (42)

Annual average hot water usage in litres per day Vd,average 99.40 (43)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hot water usage in litres per day for each month											
109.34	105.36	101.39	97.41	93.43	89.46	89.46	93.43	97.41	101.39	105.36	109.34 (44)
Energy content of hot water used											
162.15	141.81	146.34	127.58	122.42	105.64	97.89	112.33	113.67	132.47	144.60	157.03

Energy content (annual) 1563.92 (45)

Distribution loss

24.32	21.27	21.95	19.14	18.36	15.85	14.68	16.85	17.05	19.87	21.69	23.55 (46)

store loss determined from EN 13203-2 tests, taken from boiler data record

Hot water storage volume (litres) 0.00 (50)

Hot water cylinder loss factor (kWh/day) 0.0000 (51)

Volume factor 0.0000 (52)

Temperature factor 0.0000 (53)

Energy lost from store (kWh/day) 0.00 (55)

Total storage loss

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)

Net storage loss

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 loss

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 calculated for each month

17.47	15.75	17.36	16.68	17.14	16.47	16.95	17.07	16.58	17.26	16.82	17.43 (61)

Total heat required for water heating calculated for each month

179.61	157.56	163.70	144.26	139.55	122.11	114.84	129.40	130.25	149.73	161.42	174.46 (62)

Output from water heater for each month, kWh/month

179.61	157.56	163.70	144.26	139.55	122.11	114.84	129.40	130.25	149.73	161.42	174.46 (64)

1766.89 (64)

Water heating demand **1767** (64)

Heat gains from water heating, kWh/month

58.28	51.09	53.00	46.59	44.99	39.24	36.78	41.62	41.94	48.36	52.29	56.57 (65)

5. Internal gains

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains, Watts												
164.71	164.71	164.71	164.71	164.71	164.71	164.71	164.71	164.71	164.71	164.71	164.71	(66)
Lighting gains												
62.02	55.08	44.80	33.91	25.35	21.40	23.13	30.06	40.35	51.23	59.79	63.74	(67)
Appliances gains												
384.07	388.05	378.01	356.63	329.64	304.28	287.33	283.34	293.39	314.77	341.76	367.12	(68)
Cooking gains												
54.22	54.22	54.22	54.22	54.22	54.22	54.22	54.22	54.22	54.22	54.22	54.22	(69)
Pumps and fans gains												
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 (negative values)												
-109.81	-109.81	-109.81	-109.81	-109.81	-109.81	-109.81	-109.81	-109.81	-109.81	-109.81	-109.81	(71)
Water heating gains												
78.33	76.03	71.23	64.71	60.47	54.50	49.44	55.94	58.25	65.00	72.62	76.04	(72)
Total internal gains												
636.54	631.28	606.16	567.37	527.58	492.30	472.02	481.46	504.10	543.12	586.29	619.02	(73)

6. Solar gains (calculation for January)

	Area & Flux	g & FF	Shading	Gains
Window - Double-glazed, argon filled, low-E, En=0.2, hard coat (East)	0.9 x 0.200 23.77	0.72 x 0.70	0.77	1.6601
Specified U-Value = 1.20				
Window - Double-glazed, argon filled, low-E, En=0.2, hard coat (West)	0.9 x 2.880 23.77	0.72 x 0.70	0.77	23.9055
Specified U-Value = 1.20				
Window - Double-glazed, argon filled, low-E, En=0.2, hard coat (East)	0.9 x 4.330 23.77	0.72 x 0.70	0.77	35.9413
Specified U-Value = 1.20				
Window - Double-glazed, argon filled, low-E, En=0.2, hard coat (South)	0.9 x 0.550 53.90	0.72 x 0.70	0.77	10.3539
Specified U-Value = 1.20				
Full glazed door - Double-glazed, argon filled, low-E, En=0.2, hard coat (South)	0.9 x 2.630 53.90	0.72 x 0.70	0.77	49.5106
Specified U-Value = 1.20				
Full glazed door - Double-glazed, argon filled, low-E, En=0.2, hard coat (East)	0.9 x 3.780 23.77	0.72 x 0.70	0.77	31.3760
Specified U-Value = 1.20				
Full glazed door - Double-glazed, argon filled, low-E, En=0.2, hard coat (West)	0.9 x 6.680 23.77	0.72 x 0.70	0.77	55.4475
Specified U-Value = 1.20				
Rooflight at 70° or less - Double-glazed, argon filled, low-E, En=0.2, hard coat (n/a)	0.9 x 4.670 32.00	0.72 x 0.70	1.00	67.7860
Velux Specified U-Value = 1.20				

7. Mean internal temperature

Temperature during heating periods in the living area, Th1 (°C) 21.00 (85)

Heating system responsiveness 1.00

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau												
9.68	9.75	9.81	9.93	9.91	10.01	9.99	9.97	9.93	9.85	9.83	9.77	
alpha												
1.65	1.65	1.65	1.66	1.66	1.67	1.67	1.66	1.66	1.66	1.66	1.65	
Utilisation factor for gains for living area												
0.86	0.82	0.74	0.60	0.47	0.33	0.21	0.22	0.41	0.66	0.81	0.87	(86)
Mean internal temperature in living area T1												
17.78	18.12	18.92	19.80	20.41	20.78	20.95	20.94	20.69	19.87	18.75	17.77	(87)
Temperature during heating periods in rest of dwelling Th2												
19.69	19.69	19.70	19.71	19.71	19.72	19.72	19.72	19.71	19.71	19.70	19.70	(88)
Utilisation factor for gains for rest of dwelling												
0.84	0.80	0.71	0.56	0.42	0.26	0.12	0.12	0.33	0.61	0.78	0.86	(89)
Mean internal temperature in the rest of dwelling T2												
15.68	16.14	17.22	18.37	19.14	19.57	19.70	19.70	19.49	18.51	17.02	15.67	(90)

Living area fraction (50.31 / 100.62) 0.50 (91)

Mean internal temperature (for the whole dwelling)

16.73	17.13	18.07	19.08	19.78	20.18	20.32	20.32	20.09	19.19	17.88	16.72	(92)

Apply adjustment to the mean internal temperature, where appropriate

16.73	17.13	18.07	19.08	19.78	20.18	20.32	20.32	20.09	19.19	17.88	16.72	(93)

8. Space heating requirement

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains												
0.79	0.75	0.67	0.54	0.42	0.29	0.16	0.17	0.36	0.59	0.74	0.81	(94)
Useful gains												
723.99	820.19	904.33	942.01	789.94	557.58	298.08	282.71	522.60	670.32	685.26	670.87	(95)
Monthly average external temperature												
5.50	5.80	7.60	10.00	13.10	15.90	18.20	18.30	15.90	12.30	8.70	5.80	(96)
Heat loss rate for mean internal temperature												
1696.76	1700.96	1560.85	1338.26	985.79	625.36	311.25	296.63	617.28	1023.33	1366.49	1635.54	(97)
Fraction of month for heating												
1.00	1.00	1.00	1.00	1.00	-	-	-	-	1.00	1.00	1.00	
Space heating requirement for each month, kWh/month												
723.74	591.88	488.44	285.30	145.71	-	-	-	-	262.64	490.48	717.72	

Total space heating requirement per year (kWh/year) (October to May) 3705.92 (98)

Space heating requirement per m² (kWh/m²/year) 36.83 (99)

Space heating demand **3706** (98)

Water heating demand **1767** (64)

8c. Space cooling requirement - not applicable

Project Information

Building type Detached house

Reference	J5067-1		
Date	7 October 2019		
Client	DCM Architectural Consultants Ltd 25 Pigeon Lane Herne Bay Kent CT6 7EH	Project	Unit 1 66 Borstal Hill Whitstable Kent CT5 4NB

SAP 2012 worksheet for - calculation of EPC Costs, Emissions And Primary Energy

1. Overall dwelling dimensions

	Area (m^2)	Av. Storey height (m)	Volume (m^3)	
Ground floor (1)	50.31	2.31	116.22	(3a)
First floor	50.31	2.50	125.78	(3b)
Total floor area	100.62			(4)
Dwelling volume (m^3)			241.99	(5)

2. Ventilation rate

	main + seondary + other heating		m^3 per hour	
Number of chimneys	0 + 0 + 0	x 40	0.00	(6a)
Number of open flues	0 + 0 + 0	x 20	0.00	(6b)
Number of intermittent fans	4	x 10	40.00	(7a)
Number of passive vents	0	x 10	0.00	(7b)
Number of flueless gas fires	0	x 40	0.00	(7c)

			Air changes per hour	
Infiltration due to chimneys, fans and flues			0.17	(8)
Pressure test, result q50		5.00		(17)
Air permeability			0.42	(18)
Number of sides on which sheltered			2.00	(19)
Shelter factor			0.85	(20)
Infiltration rate incorporating shelter factor			0.35	(21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
5.70	5.40	5.10	4.50	4.60	4.10	4.20	4.30	4.50	4.90	5.00	5.30	
												57.60 (22)

Wind Factor

1.43	1.35	1.27	1.13	1.15	1.02	1.05	1.07	1.13	1.23	1.25	1.32	
												14.40 (22a)

Adjusted infiltration rate (allowing for shelter and wind speed)

0.50	0.48	0.45	0.40	0.41	0.36	0.37	0.38	0.40	0.43	0.44	0.47	
												5.08 (22b)

Ventilation : natural ventilation, intermittent extract fans

Effective air change rate

0.63	0.61	0.60	0.58	0.58	0.57	0.57	0.57	0.58	0.59	0.60	0.61	(25)

3. Heat losses and heat loss parameter

Element	Gross area, m²	Openings m²	Net area A, m²	U-value W/m²K	A x U W/K	kappa-value kJ/m²K	A x K kJ/K	
Window - Double-glazed, argon filled, low-E, En=0.2, hard coat (East)			**0.200**	**1.15 (1.20)**	0.23			(27)
Specified U-Value = 1.20								
Window - Double-glazed, argon filled, low-E, En=0.2, hard coat (West)			**2.880**	**1.15 (1.20)**	3.30			(27)
Specified U-Value = 1.20								
Window - Double-glazed, argon filled, low-E, En=0.2, hard coat (East)			**4.330**	**1.15 (1.20)**	4.96			(27)
Specified U-Value = 1.20								
Window - Double-glazed, argon filled, low-E, En=0.2, hard coat (South)			**0.550**	**1.15 (1.20)**	0.63			(27)
Specified U-Value = 1.20								
Full glazed door - Double-glazed, argon filled, low-E, En=0.2, hard coat (South)			**2.630**	**1.20**	3.16			(26)
Specified U-Value = 1.20								
Full glazed door - Double-glazed, argon filled, low-E, En=0.2, hard coat (East)			**3.780**	**1.20**	4.54			(26)
Specified U-Value = 1.20								
Full glazed door - Double-glazed, argon filled, low-E, En=0.2, hard coat (West)			**6.680**	**1.20**	8.02			(26)
Specified U-Value = 1.20								
Rooflight at 70° or less - Double-glazed, argon filled, low-E, En=0.2, hard coat (n/a)			**4.670**	**1.15 (1.20)**	5.35			(27)
Velux Specified U-Value = 1.20								
Walls			4.15	0.21	0.87	9.00	37.35	(29)
Dormer Cheeks - Weatherboard/Battens/9 OSB/51 Cavity/140 Timber Frame Insulated With 120 Celotex XR4000 Between Studs/12.5 P'bd								
Walls			102.19	0.20	20.44	9.00	919.71	(29)
Brick or (Weatherboard/Battens/100 Medium Dense Block)/51 Cavity/140 Timber Frame Insulated With 120 Celotex XR4000 Between Studs/12.5 P'bd								
Ground floors			50.31	0.12	6.04	75.00	3773.25	(28)
Beam/Medium Dense Block/150 Kingspan TF70/Screed								

3. Heat losses and heat loss parameter

Element	Gross area, m²	Openings m²	Net area A, m²	U-value W/m²K	A x U W/K	kappa-value kJ/m²K	A x K kJ/K	
Flat roofs			3.36	0.15	0.50	9.00	30.24	(30)
150 Kingspan TR27 Over Joists								
Pitched roofs insulated between rafters			56.37	0.12	6.76	9.00	507.33	(30)
150 Kingspan K7 Between Rafters/52.5 Kingspan K118 Under Rafters With Breather Membrane								

Total area of external elements Sigma A, m²	242.10	(31)
Fabric heat loss, W/K	64.78	(33)
Heat capacity	5267.88	(34)
Thermal mass parameter, kJ/m²K	52.35	(35)
Effect of thermal bridges	36.32	(36)
Total fabric heat loss	101.10	(37)

Ventilation heat loss calculated monthly

50.03	49.00	48.02	46.23	46.51	45.16	45.41	45.68	46.23	47.39	47.70	48.66	(38)

Heat transfer coefficient, W/K

151.13	150.10	149.12	147.33	147.61	146.26	146.51	146.78	147.33	148.49	148.80	149.76	
											148.27	(39)

Heat loss parameter (HLP), W/m²K

1.50	1.49	1.48	1.46	1.47	1.45	1.46	1.46	1.46	1.48	1.48	1.49	
HLP (average)											1.47	(40)

Number of days in month (Table 1a)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements **kWh/year**

Assumed occupancy, N 2.75 (42)

Annual average hot water usage in litres per day Vd,average 99.40 (43)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hot water usage in litres per day for each month											
109.34	105.36	101.39	97.41	93.43	89.46	89.46	93.43	97.41	101.39	105.36	109.34 (44)
Energy content of hot water used											
162.15	141.81	146.34	127.58	122.42	105.64	97.89	112.33	113.67	132.47	144.60	157.03

Energy content (annual) 1563.92 (45)

Distribution loss											
24.32	21.27	21.95	19.14	18.36	15.85	14.68	16.85	17.05	19.87	21.69	23.55 (46)

store loss determined from EN 13203-2 tests, taken from boiler data record

Hot water storage volume (litres) 0.00 (50)

Hot water cylinder loss factor (kWh/day) 0.0000 (51)

Volume factor 0.0000 (52)

Temperature factor 0.0000 (53)

Energy lost from store (kWh/day) 0.00 (55)

Total storage loss											
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)
Net storage loss											
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 loss											
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 calculated for each month											
17.47	15.75	17.36	16.68	17.14	16.47	16.95	17.07	16.58	17.26	16.82	17.43 (61)
Total heat required for water heating calculated for each month											
179.61	157.56	163.70	144.26	139.55	122.11	114.84	129.40	130.25	149.73	161.42	174.46 (62)
Output from water heater for each month, kWh/month											
179.61	157.56	163.70	144.26	139.55	122.11	114.84	129.40	130.25	149.73	161.42	174.46 (64)

1766.89 (64)

Heat gains from water heating, kWh/month											
58.28	51.09	53.00	46.59	44.99	39.24	36.78	41.62	41.94	48.36	52.29	56.57 (65)

5. Internal gains

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains, Watts												
164.71	164.71	164.71	164.71	164.71	164.71	164.71	164.71	164.71	164.71	164.71	164.71	(66)
Lighting gains												
62.02	55.08	44.80	33.91	25.35	21.40	23.13	30.06	40.35	51.23	59.79	63.74	(67)
Appliances gains												
384.07	388.05	378.01	356.63	329.64	304.28	287.33	283.34	293.39	314.77	341.76	367.12	(68)
Cooking gains												
54.22	54.22	54.22	54.22	54.22	54.22	54.22	54.22	54.22	54.22	54.22	54.22	(69)
Pumps and fans gains												
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 (negative values)												
-109.81	-109.81	-109.81	-109.81	-109.81	-109.81	-109.81	-109.81	-109.81	-109.81	-109.81	-109.81	(71)
Water heating gains												
78.33	76.03	71.23	64.71	60.47	54.50	49.44	55.94	58.25	65.00	72.62	76.04	(72)
Total internal gains												
636.54	631.28	606.16	567.37	527.58	492.30	472.02	481.46	504.10	543.12	586.29	619.02	(73)

6. Solar gains (calculation for January)

	Area & Flux	g & FF	Shading	Gains
Window - Double-glazed, argon filled, low-E, En=0.2, hard coat (East)	0.9 x 0.200 23.77	0.72 x 0.70	0.77	1.6601
Specified U-Value = 1.20				
Window - Double-glazed, argon filled, low-E, En=0.2, hard coat (West)	0.9 x 2.880 23.77	0.72 x 0.70	0.77	23.9055
Specified U-Value = 1.20				
Window - Double-glazed, argon filled, low-E, En=0.2, hard coat (East)	0.9 x 4.330 23.77	0.72 x 0.70	0.77	35.9413
Specified U-Value = 1.20				
Window - Double-glazed, argon filled, low-E, En=0.2, hard coat (South)	0.9 x 0.550 53.90	0.72 x 0.70	0.77	10.3539
Specified U-Value = 1.20				
Full glazed door - Double-glazed, argon filled, low-E, En=0.2, hard coat (South)	0.9 x 2.630 53.90	0.72 x 0.70	0.77	49.5106
Specified U-Value = 1.20				
Full glazed door - Double-glazed, argon filled, low-E, En=0.2, hard coat (East)	0.9 x 3.780 23.77	0.72 x 0.70	0.77	31.3760
Specified U-Value = 1.20				
Full glazed door - Double-glazed, argon filled, low-E, En=0.2, hard coat (West)	0.9 x 6.680 23.77	0.72 x 0.70	0.77	55.4475
Specified U-Value = 1.20				
Rooflight at 70° or less - Double-glazed, argon filled, low-E, En=0.2, hard coat (n/a)	0.9 x 4.670 32.00	0.72 x 0.70	1.00	67.7860
Velux Specified U-Value = 1.20				

7. Mean internal temperature

Temperature during heating periods in the living area, Th1 (°C) 21.00 (85)

Heating system responsiveness 1.00

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau											
9.68	9.75	9.81	9.93	9.91	10.01	9.99	9.97	9.93	9.85	9.83	9.77
alpha											
1.65	1.65	1.65	1.66	1.66	1.67	1.67	1.66	1.66	1.66	1.66	1.65
Utilisation factor for gains for living area											
0.86	0.82	0.74	0.60	0.47	0.33	0.21	0.22	0.41	0.66	0.81	0.87 (86)
Mean internal temperature in living area T1											
17.78	18.12	18.92	19.80	20.41	20.78	20.95	20.94	20.69	19.87	18.75	17.77 (87)
Temperature during heating periods in rest of dwelling Th2											
19.69	19.69	19.70	19.71	19.71	19.72	19.72	19.72	19.71	19.71	19.70	19.70 (88)
Utilisation factor for gains for rest of dwelling											
0.84	0.80	0.71	0.56	0.42	0.26	0.12	0.12	0.33	0.61	0.78	0.86 (89)
Mean internal temperature in the rest of dwelling T2											
15.68	16.14	17.22	18.37	19.14	19.57	19.70	19.70	19.49	18.51	17.02	15.67 (90)

Living area fraction (50.31 / 100.62) 0.50 (91)

Mean internal temperature (for the whole dwelling)

16.73	17.13	18.07	19.08	19.78	20.18	20.32	20.32	20.09	19.19	17.88	16.72 (92)

Apply adjustment to the mean internal temperature, where appropriate

16.73	17.13	18.07	19.08	19.78	20.18	20.32	20.32	20.09	19.19	17.88	16.72 (93)

8. Space heating requirement

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation factor for gains											
0.79	0.75	0.67	0.54	0.42	0.29	0.16	0.17	0.36	0.59	0.74	0.81 (94)
Useful gains											
723.99	820.19	904.33	942.01	789.94	557.58	298.08	282.71	522.60	670.32	685.26	670.87 (95)
Monthly average external temperature											
5.50	5.80	7.60	10.00	13.10	15.90	18.20	18.30	15.90	12.30	8.70	5.80 (96)
Heat loss rate for mean internal temperature											
1696.76	1700.96	1560.85	1338.26	985.79	625.36	311.25	296.63	617.28	1023.33	1366.49	1635.54 (97)
Fraction of month for heating											
1.00	1.00	1.00	1.00	1.00	-	-	-	-	1.00	1.00	1.00
Space heating requirement for each month, kWh/month											
723.74	591.88	488.44	285.30	145.71	-	-	-	-	262.64	490.48	717.72

Total space heating requirement per year (kWh/year) (October to May) 3705.92 (98)

Space heating requirement per m² (kWh/m²/year) 36.83 (99)

8c. Space cooling requirement - not applicable

9a. Energy requirements

kWh/year

No secondary heating system selected

Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main heating system	92.80%	(206)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement												
723.74	591.88	488.44	285.30	145.71	-	-	-	-	262.64	490.48	717.72	(98)
Appendix Q - monthly energy saved (main heating system 1)												
0.00	0.00	0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(210)
Space heating fuel (main heating system 1)												
779.89	637.80	526.34	307.44	157.02	-	-	-	-	283.02	528.54	773.40	(211)
Appendix Q - monthly energy saved (main heating system 2)												
0.00	0.00	0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(212)
Space heating fuel (main heating system 2)												
0.00	0.00	0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(213)
Appendix Q - monthly energy saved (secondary heating system)												
0.00	0.00	0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(214)
Space heating fuel (secondary)												
0.00	0.00	0.00	0.00	0.00	-	-	-	-	0.00	0.00	0.00	(215)
Water heating												
Water heating requirement												
179.61	157.56	163.70	144.26	139.55	122.11	114.84	129.40	130.25	149.73	161.42	174.46	(64)
Efficiency of water heater												87.10 (216)
89.25	89.22	89.11	88.87	88.46	87.10	87.10	87.10	87.10	88.80	89.12	89.26	(217)
Water heating fuel												
201.25	176.60	183.71	162.32	157.76	140.19	131.84	148.56	149.54	168.62	181.14	195.46	(219)

Annual totals	kWh/year	
Space heating fuel used, main system 1	3993.45	(211)
Space heating fuel (secondary)	0.00	(215)
Water heating fuel	1996.99	(219)
Electricity for pumps, fans and electric keep-hot		
central heating pump	30.00	(230c)
boiler with a fan-assisted flue	45.00	(230e)
Total electricity for the above, kWh/year	75.00	(231)
Electricity for lighting (100.00% fixed LEL)	438.10	(232)
Energy saving/generation technologies		
Appendix Q -		
Energy saved or generated ():	0.000	(236a)
Energy used ():	0.000	(237a)
Total delivered energy for all uses	6503.54	(238)

10a. Fuel costs using PCDF prices (rev 367)

	kWh/year	Fuel price p/kWh	£/year	
Space heating - main system 1	3993.452	4.040	161.34	(240)
Space heating - main system 2	0.000	0.000	0.00	(241)
Water heating				
Water heating cost	1996.99	4.040	80.68	(247)
Mech vent fans cost	0.000	14.460	0.00	(249)
Pump/fan energy cost	75.000	14.460	10.85	(249)
Energy for lighting	438.096	14.460	63.35	(250)
Additional standing charges			113.00	(251)
Electricity generated - PVs	0.000	0.000	0.00	(252)
Appendix Q -				
Energy saved or generated ():	0.000	-1.000	0.00	(253)
Energy used ():	0.000	-1.000	0.00	(254)
Total energy cost			429.21	(255)

12a. Carbon dioxide emissions

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating, main system 1	3993.45	0.216	862.59	(261)
Space heating, main system 2	0.00	0.000	0.00	(262)
Space heating, secondary	0.00	0.519	0.00	(263)
Water heating	1996.99	0.216	431.35	(264)
Space and water heating			1293.94	(265)
Electricity for pumps and fans	75.00	0.519	38.93	(267)
Electricity for lighting	438.10	0.519	227.37	(268)
Electricity generated - PVs	0.00	0.519	0.00	(269)
Electricity generated - µCHP	0.00	0.000	0.00	(269)
Appendix Q -				
Energy saved ():	0.00	0.000	0.00	(270)
Energy used ():	0.00	0.000	0.00	(271)
Total CO2, kg/year			1560.23	(272)

13a. Primary energy

	Energy kWh/year	Primary factor	P. Energy (kWh/year)	
Space heating, main	3993.45	1.220	4872.01	(261)
Space heating, main system 2	0.00	0.000	0.00	(262)
Space heating, secondary	0.00	3.070	0.00	(263)
Water heating	1996.99	1.220	2436.33	(264)
Space and water heating			7308.34	(265)
Electricity for pumps/fans	75.00	3.070	230.25	(267)
Electricity for lighting	438.10	3.070	1344.96	(268)
Electricity generated - PV	0.00	3.070	0.00	(269)
Electricity generated - µCHP	0.00	0.000	0.00	(269)
Electricity generated - wind	0.00	3.070	0.00	(269)
New energy-saving technology :				
Energy saved ():	0.00	0.000	0.00	(270)
Energy used ():	0.00	0.000	0.00	(271)
Primary energy kWh/year			**8883.54**	(272)
Primary energy kWh/m²/year			**88.29**	(273)

Project Information

Building type Detached house

Reference	J5067-1		
Date	7 October 2019		
Client	DCM Architectural Consultants Ltd 25 Pigeon Lane Herne Bay Kent CT6 7EH	Project	Unit 1 66 Borstal Hill Whitstable Kent CT5 4NB

SAP 2012 worksheet for New dwelling as designed - calculation of energy ratings for improved dwelling

1. Overall dwelling dimensions

	Area (m^2)	Av. Storey height (m)	Volume (m^3)	
Ground floor (1)	50.31	2.31	116.22	(3a)
First floor	50.31	2.50	125.78	(3b)
Total floor area	100.62			(4)
Dwelling volume (m^3)			241.99	(5)

2. Ventilation rate

	main + seondary + other heating		m^3 per hour	
Number of chimneys	0 + 0 + 0	x 40	0.00	(6a)
Number of open flues	0 + 0 + 0	x 20	0.00	(6b)
Number of intermittent fans	4	x 10	40.00	(7a)
Number of passive vents	0	x 10	0.00	(7b)
Number of flueless gas fires	0	x 40	0.00	(7c)

		Air changes per hour	
Infiltration due to chimneys, fans and flues		0.17	(8)
Pressure test, result q50	5.00		(17)
Air permeability		0.42	(18)
Number of sides on which sheltered		2.00	(19)
Shelter factor		0.85	(20)
Infiltration rate incorporating shelter factor		0.35	(21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
5.10	5.00	4.90	4.40	4.30	3.80	3.80	3.70	4.00	4.30	4.50	4.70	
												52.50 (22)

Wind Factor

1.27	1.25	1.23	1.10	1.07	0.95	0.95	0.93	1.00	1.07	1.13	1.18	
												13.13 (22a)

Adjusted infiltration rate (allowing for shelter and wind speed)

0.45	0.44	0.43	0.39	0.38	0.34	0.34	0.33	0.35	0.38	0.40	0.41	
												4.63 (22b)

Ventilation : natural ventilation, intermittent extract fans

Effective air change rate

0.60	0.60	0.59	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(25)

3. Heat losses and heat loss parameter

Element	Gross area, m²	Openings m²	Net area A, m²	U-value W/m²K	A x U W/K	kappa-value kJ/m²K	A x K kJ/K	
Window - Double-glazed, argon filled, low-E, En=0.2, hard coat (East)			**0.200**	**1.15 (1.20)**	0.23			(27)
Specified U-Value = 1.20								
Window - Double-glazed, argon filled, low-E, En=0.2, hard coat (West)			**2.880**	**1.15 (1.20)**	3.30			(27)
Specified U-Value = 1.20								
Window - Double-glazed, argon filled, low-E, En=0.2, hard coat (East)			**4.330**	**1.15 (1.20)**	4.96			(27)
Specified U-Value = 1.20								
Window - Double-glazed, argon filled, low-E, En=0.2, hard coat (South)			**0.550**	**1.15 (1.20)**	0.63			(27)
Specified U-Value = 1.20								
Full glazed door - Double-glazed, argon filled, low-E, En=0.2, hard coat (South)			**2.630**	**1.20**	3.16			(26)
Specified U-Value = 1.20								
Full glazed door - Double-glazed, argon filled, low-E, En=0.2, hard coat (East)			**3.780**	**1.20**	4.54			(26)
Specified U-Value = 1.20								
Full glazed door - Double-glazed, argon filled, low-E, En=0.2, hard coat (West)			**6.680**	**1.20**	8.02			(26)
Specified U-Value = 1.20								
Rooflight at 70° or less - Double-glazed, argon filled, low-E, En=0.2, hard coat (n/a)			**4.670**	**1.15 (1.20)**	5.35			(27)
Velux Specified U-Value = 1.20								
Walls			4.15	0.21	0.87	9.00	37.35	(29)
Dormer Cheeks - Weatherboard/Battens/9 OSB/51 Cavity/140 Timber Frame Insulated With 120 Celotex XR4000 Between Studs/12.5 P'bd								
Walls			102.19	0.20	20.44	9.00	919.71	(29)
Brick or (Weatherboard/Battens/100 Medium Dense Block)/51 Cavity/140 Timber Frame Insulated With 120 Celotex XR4000 Between Studs/12.5 P'bd								
Ground floors			50.31	0.12	6.04	75.00	3773.25	(28)
Beam/Medium Dense Block/150 Kingspan TF70/Screed								

3. Heat losses and heat loss parameter

Element	Gross area, m²	Openings m²	Net area A, m²	U-value W/m²K	A x U W/K	kappa-value kJ/m²K	A x K kJ/K	
Flat roofs			3.36	0.15	0.50	9.00	30.24	(30)
150 Kingspan TR27 Over Joists								
Pitched roofs insulated between rafters			56.37	0.12	6.76	9.00	507.33	(30)
150 Kingspan K7 Between Rafters/52.5 Kingspan K118 Under Rafters With Breather Membrane								

Total area of external elements Sigma A, m²	242.10	(31)
Fabric heat loss, W/K	64.78	(33)
Heat capacity	5267.88	(34)
Thermal mass parameter, kJ/m²K	52.35	(35)
Effect of thermal bridges	36.32	(36)
Total fabric heat loss	101.10	(37)

Ventilation heat loss calculated monthly

48.02	47.70	47.39	45.95	45.68	44.42	44.42	44.19	44.90	45.68	46.23	46.80	(38)

Heat transfer coefficient, W/K

149.12	148.80	148.49	147.05	146.78	145.52	145.52	145.29	146.00	146.78	147.33	147.90	
											147.05	(39)

Heat loss parameter (HLP), W/m²K

1.48	1.48	1.48	1.46	1.46	1.45	1.45	1.44	1.45	1.46	1.46	1.47	
HLP (average)											1.46	(40)

Number of days in month (Table 1a)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements **kWh/year**

Assumed occupancy, N 2.75 (42)

Annual average hot water usage in litres per day Vd,average 99.40 (43)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month												
109.34	105.36	101.39	97.41	93.43	89.46	89.46	93.43	97.41	101.39	105.36	109.34	(44)
Energy content of hot water used												
162.15	141.81	146.34	127.58	122.42	105.64	97.89	112.33	113.67	132.47	144.60	157.03	

Energy content (annual) 1563.92 (45)

Distribution loss												
24.32	21.27	21.95	19.14	18.36	15.85	14.68	16.85	17.05	19.87	21.69	23.55	(46)

store loss determined from EN 13203-2 tests, taken from boiler data record

Hot water storage volume (litres) 0.00 (50)

Hot water cylinder loss factor (kWh/day) 0.0000 (51)

Volume factor 0.0000 (52)

Temperature factor 0.0000 (53)

Energy lost from store (kWh/day) 0.00 (55)

Total storage loss												
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)
Net storage loss												
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 loss factor												
1.00	1.00	0.94	0.70	0.45	0.44	0.44	0.48	0.76	0.94	1.00	1.00	
Primary loss												
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 calculated for each month												
17.47	15.75	17.36	16.68	17.14	16.47	16.95	17.07	16.58	17.26	16.82	17.43	(61)
Total heat required for water heating calculated for each month												
179.61	157.56	163.70	144.26	139.55	122.11	114.84	129.40	130.25	149.73	161.42	174.46	(62)

Aperture area of solar panel	3.0000	(H1)
Collector zero-loss efficiency	0.7000	(H2)
Collector heat loss coefficient	1.8000	(H3)
Collector 2nd order heat loss coefficient	0.0050	(H3a)
Collector effective heat loss coefficient	1.8063	(H3b)
Collector performance ratio	2.5804	(H4)
Annual solar radiation per m²	1079.5246	(H5)
Overshading factor	0.8000	(H6)
Solar energy available	1813.6014	(H7)
Adjustment factor for showers	1.0000	(H7a)
Solar/load ratio	1.1596	(H8)
Solar utilisation factor	0.5778	(H9)
Collector performance factor	0.8793	(H10)
Dedicated solar storage volume	75.0000	(H11)
Effective solar volume	75.0000	(H13)
Daily hot water demand	99.3983	(H14)
Volume ratio Veff/V	0.7545	(H15)
Veff/V factor	0.9437	(H16)
Solar input	-869.5421	(H17)

Solar DHW input												
-25.21	-42.08	-71.66	-96.04	-118.65	-116.65	-115.11	-100.57	-78.77	-53.79	-29.91	-21.10	(63)
Output from water heater for each month, kWh/month												
154.40	115.48	92.04	48.22	20.90	5.45	0.00	28.83	51.48	95.94	131.51	153.36	(64)

897.63 (64)

Heat gains from water heating, kWh/month												
58.28	51.09	53.00	46.99	44.99	39.24	36.78	41.62	41.94	48.36	52.29	56.57	(65)

5. Internal gains

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains, Watts												
164.71	164.71	164.71	164.71	164.71	164.71	164.71	164.71	164.71	164.71	164.71	164.71	(66)
Lighting gains												
62.02	55.08	44.80	33.91	25.35	21.40	23.13	30.06	40.35	51.23	59.79	63.74	(67)
Appliances gains												
384.07	388.05	378.01	356.63	329.64	304.28	287.33	283.34	293.39	314.77	341.76	367.12	(68)
Cooking gains												
54.22	54.22	54.22	54.22	54.22	54.22	54.22	54.22	54.22	54.22	54.22	54.22	(69)
Pumps and fans gains												
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 (negative values)												
-109.81	-109.81	-109.81	-109.81	-109.81	-109.81	-109.81	-109.81	-109.81	-109.81	-109.81	-109.81	(71)
Water heating gains												
78.33	76.03	71.23	64.71	60.47	54.50	49.44	55.94	58.25	65.00	72.62	76.04	(72)
Total internal gains												
636.54	631.28	606.16	567.37	527.58	492.30	472.02	481.46	504.10	543.12	586.29	619.02	(73)