Project Information

Building type Detached house

Reference	J5067-3		
Date	7 October 2019		
Client	DCM Architectural Consultants Ltd 25 Pigeon Lane Herne Bay Kent CT6 7EH	Project	Unit 3 66 Borstal Hill Whitstable Kent CT5 4NB

Code for Sustainable Homes

Assessor Name:	Mark Attlesey
Assessor No.:	ECMK300581
Ene 1:	Dwelling Emission Rating
TER:	18.80
DER:	18.50
% improvement:	1.6%
Credits:	0
Level:	n/a
Ene 2:	Fabric Energy Efficiency
Dwelling Type:	Detached house
FEE:	57.1
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		21.4644		18.4981	(ZC1)
CO2 emissions from appliances		15.6080		15.6080	(ZC2)
CO2 emissions from cooking		1.9770		1.9770	(ZC3)
Total CO2 emissions		39.0494		36.0830	(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		39.0494		36.0830	(ZC8)

Reduction in emissions = 100 x (1 - (ZC8actual / ZC8standard))
= 100 x (1 - (36.0830 / 39.0494))
= 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)	46.23	2.31	106.79	(3a)
First floor	46.23	2.50	115.57	(3b)
Total floor area	92.46			(4)
Dwelling volume (m^3)			222.37	(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			0.18	(8)
Pressure test, result q50		5.00		(17)
Air permeability			0.43	(18)
Number of sides on which sheltered			2.00	(19)
Shelter factor			0.85	(20)
Infiltration rate incorporating shelter factor			0.37	(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)

0.47	0.46	0.45	0.40	0.39	0.35	0.35	0.34	0.37	0.39	0.41	0.43	
												4.80 (22b)

Ventilation : natural ventilation, intermittent extract fans

Effective air change rate

0.61	0.60	0.60	0.58	0.58	0.56	0.56	0.56	0.57	0.58	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)			**2.520**	**1.15 (1.20)**	2.89			(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 (North)			**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 (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 (North)			**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			96.74	0.20	19.35	9.00	870.66	(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			46.23	0.12	5.55	75.00	3467.25	(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			51.06	0.12	6.13	9.00	459.54	(30)
150 Kingspan K7 Between Rafters/52.5 Kingspan K118 Under Rafters With Breather Membrane								

Total area of external elements Sigma A, m²	226.90	(31)
Fabric heat loss, W/K	62.16	(33)
Heat capacity	4865.04	(34)
Thermal mass parameter, kJ/m²K	52.62	(35)
Effect of thermal bridges	34.04	(36)
Total fabric heat loss	96.19	(37)

Ventilation heat loss calculated monthly

44.65	44.34	44.04	42.62	42.35	41.11	41.11	40.88	41.59	42.35	42.89	43.45	(38)

Heat transfer coefficient, W/K

140.85	140.54	140.23	138.81	138.54	137.30	137.30	137.07	137.78	138.54	139.08	139.64	
											138.81	(39)

Heat loss parameter (HLP), W/m²K

1.52	1.52	1.52	1.50	1.50	1.48	1.48	1.48	1.49	1.50	1.50	1.51	

HLP (average) 1.50 (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 2.66 (42)

Annual average hot water usage in litres per day Vd,average 97.33 (43)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month												
107.06	103.17	99.27	95.38	91.49	87.59	87.59	91.49	95.38	99.27	103.17	107.06	(44)
Energy content of hot water used												
158.76	138.86	143.29	124.92	119.86	103.43	95.85	109.99	111.30	129.71	141.59	153.75	

Energy content (annual) 1531.31 (45)

Distribution loss												
23.81	20.83	21.49	18.74	17.98	15.52	14.38	16.50	16.69	19.46	21.24	23.06	(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												
17.45	15.73	17.33	16.64	17.10	16.44	16.92	17.04	16.55	17.24	16.80	17.41	(61)
Total heat required for water heating calculated for each month												
176.21	154.58	160.62	141.56	136.97	119.88	112.77	127.02	127.85	146.94	158.39	171.17	(62)
Output from water heater for each month, kWh/month												
176.21	154.58	160.62	141.56	136.97	119.88	112.77	127.02	127.85	146.94	158.39	171.17	(64)

1733.95 (64)

Heat gains from water heating, kWh/month												
57.15	50.10	51.98	45.70	44.13	38.50	36.10	40.83	41.14	47.44	51.28	55.48	(65)

5. Internal gains

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains, Watts												
159.48	159.48	159.48	159.48	159.48	159.48	159.48	159.48	159.48	159.48	159.48	159.48	(66)
Lighting gains												
57.96	51.48	41.86	31.69	23.69	20.00	21.61	28.09	37.71	47.88	55.88	59.57	(67)
Appliances gains												
363.48	367.25	357.75	337.51	311.97	287.96	271.93	268.15	277.66	297.89	323.44	347.44	(68)
Cooking gains												
53.61	53.61	53.61	53.61	53.61	53.61	53.61	53.61	53.61	53.61	53.61	53.61	(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)												
-106.32	-106.32	-106.32	-106.32	-106.32	-106.32	-106.32	-106.32	-106.32	-106.32	-106.32	-106.32	(71)
Water heating gains												
76.82	74.56	69.86	63.47	59.32	53.48	48.52	54.88	57.15	63.76	71.22	74.56	(72)
Total internal gains												
608.02	603.05	579.23	542.44	504.74	471.20	451.82	460.89	482.27	519.29	560.30	591.34	(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 2.520 19.64	0.72 x 0.70	0.77	17.2867
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 (North)	0.9 x 0.550 10.63	0.72 x 0.70	0.77	2.0427
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 (North)	0.9 x 2.630 10.63	0.72 x 0.70	0.77	9.7677
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											
9.59	9.62	9.64	9.74	9.75	9.84	9.84	9.86	9.81	9.75	9.72	9.68
alpha											
1.64	1.64	1.64	1.65	1.65	1.66	1.66	1.66	1.65	1.65	1.65	1.65
Utilisation factor for gains for living area											
0.88	0.84	0.77	0.66	0.54	0.42	0.33	0.37	0.54	0.74	0.85	0.89 (86)
Mean internal temperature in living area T1											
17.33	17.78	18.54	19.43	20.14	20.61	20.82	20.77	20.35	19.36	18.18	17.24 (87)
Temperature during heating periods in rest of dwelling Th2											
19.67	19.67	19.68	19.69	19.69	19.70	19.70	19.70	19.69	19.69	19.68	19.68 (88)
Utilisation factor for gains for rest of dwelling											
0.87	0.82	0.74	0.62	0.49	0.35	0.24	0.28	0.48	0.70	0.83	0.88 (89)
Mean internal temperature in the rest of dwelling T2											
15.05	15.67	16.69	17.88	18.79	19.36	19.58	19.55	19.09	17.84	16.23	14.92 (90)

Living area fraction (46.23 / 92.46) 0.50 (91)

Mean internal temperature (for the whole dwelling)

16.19	16.73	17.61	18.66	19.47	19.99	20.20	20.16	19.72	18.60	17.20	16.08 (92)

Apply adjustment to the mean internal temperature, where appropriate

16.19	16.73	17.61	18.66	19.47	19.99	20.20	20.16	19.72	18.60	17.20	16.08 (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	0.70	0.59	0.48	0.37	0.28	0.31	0.48	0.67	0.78	0.83 (94)
Useful gains											
651.85	752.69	843.06	881.78	809.34	620.50	443.74	450.66	584.59	641.78	621.33	619.63 (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											
1674.23	1662.13	1558.58	1354.29	1075.88	739.38	494.48	515.19	774.83	1108.71	1405.29	1658.86 (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											
760.65	611.14	532.35	340.21	198.30	-	-	-	-	347.40	564.45	773.18

Total space heating requirement per year (kWh/year) (October to May) 4127.68 (98)

Space heating requirement per m² (kWh/m²/year) 44.64 (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												
760.65	611.14	532.35	340.21	198.30	-	-	-	-	347.40	564.45	773.18	(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)												
819.67	658.56	573.66	366.60	213.69	-	-	-	-	374.35	608.24	833.17	(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												
176.21	154.58	160.62	141.56	136.97	119.88	112.77	127.02	127.85	146.94	158.39	171.17	(64)
Efficiency of water heater											87.10	(216)
89.28	89.24	89.16	88.99	88.68	87.10	87.10	87.10	87.10	88.98	89.19	89.30	(217)
Water heating fuel												
197.37	173.22	180.15	159.08	154.46	137.63	129.47	145.84	146.79	165.14	177.57	191.68	(219)

Annual totals	kWh/year	
Space heating fuel used, main system 1	4447.93	(211)
Space heating fuel (secondary)	0.00	(215)
Water heating fuel	1958.39	(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)	409.43	(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	6890.75	(238)

10a. Fuel costs using Table 12 prices

	kWh/year	Fuel price p/kWh	£/year	
Space heating - main system 1	4447.933	3.480	154.79	(240)
Space heating - main system 2	0.000	0.000	0.00	(241)
Water heating				
Water heating cost	1958.39	3.480	68.15	(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	409.426	13.190	54.00	(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			406.84	(255)

11a. SAP rating

Energy cost deflator	0.42	(256)
Energy cost factor (ECF)	1.24	(257)
SAP value	82.66	
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	4447.93	0.216	960.75	(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	1958.39	0.216	423.01	(264)
Space and water heating			1383.77	(265)
Electricity for pumps and fans	75.00	0.519	38.93	(267)
Electricity for lighting	409.43	0.519	212.49	(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			1635.18	(272)

	kg/m²/year	
CO2 emissions per m²	**17.69**	(273)
EI value	84.06	(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 / 0.8843 = 3.9351, stars = 4
Water heating environmental impact	0.2160 / 0.8843 = 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)	46.23	2.31	106.79	(3a)
First floor	46.23	2.50	115.57	(3b)
Total floor area	92.46			(4)
Dwelling volume (m^3)			222.37	(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	3	x 10	30.00	(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		0.13	(8)
Pressure test, result q50	5.00		(17)
Air permeability		0.38	(18)
Number of sides on which sheltered		2.00	(19)
Shelter factor		0.85	(20)
Infiltration rate incorporating shelter factor		0.33	(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)

0.42	0.41	0.40	0.36	0.35	0.31	0.31	0.30	0.33	0.35	0.37	0.38

4.29 (22b)

Ventilation : natural ventilation, intermittent extract fans

Effective air change rate

0.59	0.58	0.58	0.56	0.56	0.55	0.55	0.55	0.55	0.56	0.57	0.57	(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 (West)			**2.300**	**1.33 (1.40)**	3.05	(27)
Specified U-Value = 1.20						
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (East)			**3.950**	**1.33 (1.40)**	5.24	(27)
Specified U-Value = 1.20						
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North)			**0.500**	**1.33 (1.40)**	0.66	(27)
Specified U-Value = 1.20						
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (East)			**0.180**	**1.33 (1.40)**	0.24	(27)
Specified U-Value = 1.20						
Full glazed door - Double-glazed, air-filled, low-E, En=0.1, soft coat (West)			**6.090**	**1.40**	8.53	(26)
Specified U-Value = 1.20						
Full glazed door - Double-glazed, air-filled, low-E, En=0.1, soft coat (East)			**3.450**	**1.40**	4.83	(26)
Specified U-Value = 1.20						
Full glazed door - Double-glazed, air-filled, low-E, En=0.1, soft coat (North)			**2.400**	**1.40**	3.36	(26)
Specified U-Value = 1.20						
Rooflight at 70° or less - Double-glazed, air-filled, low-E, En=0.1, soft coat (n/a)			**4.260**	**1.59 (1.70)**	6.78	(27)
Velux Specified U-Value = 1.20						
Walls			98.54	0.18	17.74	(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						
Walls			4.17	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						
Ground floors			46.23	0.13	6.01	(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			51.47	0.13	6.69	(30)
150 Kingspan K7 Between Rafters/52.5 Kingspan K118 Under Rafters With Breather Membrane						

Total area of external elements Sigma A, m²	226.90	(31)
Fabric heat loss, W/K	64.31	(33)
Thermal mass parameter, kJ/m²K (user-specified TMP)	250.00	(35)
Effect of thermal bridges	11.34	(36)
Total fabric heat loss	75.65	(37)

Ventilation heat loss calculated monthly

43.08	42.83	42.58	41.44	41.23	40.23	40.23	40.05	40.62	41.23	41.66	42.11	(38)

Heat transfer coefficient, W/K

118.73	118.48	118.24	117.10	116.88	115.89	115.89	115.71	116.27	116.88	117.32	117.77	
											117.10	(39)

Heat loss parameter (HLP), W/m²K

1.28	1.28	1.28	1.27	1.26	1.25	1.25	1.25	1.26	1.26	1.27	1.27	
HLP (average)											1.27	(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 2.66 (42)

Annual average hot water usage in litres per day Vd,average 97.33 (43)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hot water usage in litres per day for each month											
107.06	103.17	99.27	95.38	91.49	87.59	87.59	91.49	95.38	99.27	103.17	107.06 (44)
Energy content of hot water used											
158.76	138.86	143.29	124.92	119.86	103.43	95.85	109.99	111.30	129.71	141.59	153.75

Energy content (annual) 1531.31 (45)

Distribution loss											
23.81	20.83	21.49	18.74	17.98	15.52	14.38	16.50	16.69	19.46	21.24	23.06 (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	50.59	47.04	46.62	43.20	44.64	46.62	47.04	50.59	49.32	50.96 (61)
Total heat required for water heating calculated for each month											
209.72	184.88	193.87	171.96	166.49	146.63	140.48	156.61	158.34	180.30	190.90	204.71 (62)
Output from water heater for each month, kWh/month											
209.72	184.88	193.87	171.96	166.49	146.63	140.48	156.61	158.34	180.30	190.90	204.71 (64)

2104.89 (64)

Heat gains from water heating, kWh/month											
65.53	57.68	60.29	53.30	51.51	45.19	43.03	48.23	48.77	55.78	59.41	63.86 (65)

5. Internal gains

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains, Watts												
132.90	132.90	132.90	132.90	132.90	132.90	132.90	132.90	132.90	132.90	132.90	132.90	(66)
Lighting gains												
23.66	21.01	17.09	12.94	9.67	8.16	8.82	11.47	15.39	19.54	22.81	24.31	(67)
Appliances gains												
243.53	246.06	239.69	226.13	209.02	192.94	182.19	179.66	186.03	199.59	216.70	232.79	(68)
Cooking gains												
36.29	36.29	36.29	36.29	36.29	36.29	36.29	36.29	36.29	36.29	36.29	36.29	(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)												
-106.32	-106.32	-106.32	-106.32	-106.32	-106.32	-106.32	-106.32	-106.32	-106.32	-106.32	-106.32	(71)
Water heating gains												
88.08	85.83	81.03	74.02	69.23	62.77	57.83	64.82	67.73	74.97	82.51	85.84	(72)
Total internal gains												
421.13	418.77	403.68	378.96	353.79	329.73	314.71	321.82	335.02	359.96	387.89	408.81	(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 (West)	0.9 x 2.300	19.64	0.63 x 0.70	0.77	13.8053
Specified U-Value = 1.20					
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (East)	0.9 x 3.950	19.64	0.63 x 0.70	0.77	23.7092
Specified U-Value = 1.20					
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (North)	0.9 x 0.500	10.63	0.63 x 0.70	0.77	1.6249
Specified U-Value = 1.20					
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (East)	0.9 x 0.180	19.64	0.63 x 0.70	0.77	1.0804
Specified U-Value = 1.20					
Full glazed door - Double-glazed, air-filled, low-E, En=0.1, soft coat (West)	0.9 x 6.090	19.64	0.63 x 0.70	0.77	36.5541
Specified U-Value = 1.20					
Full glazed door - Double-glazed, air-filled, low-E, En=0.1, soft coat (East)	0.9 x 3.450	19.64	0.63 x 0.70	0.77	20.7080
Specified U-Value = 1.20					
Full glazed door - Double-glazed, air-filled, low-E, En=0.1, soft coat (North)	0.9 x 2.400	10.63	0.63 x 0.70	0.77	7.7993
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 4.260	26.00	0.63 x 0.70	1.00	43.9606
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											
54.08	54.19	54.30	54.83	54.93	55.40	55.40	55.49	55.22	54.93	54.73	54.52
alpha											
4.61	4.61	4.62	4.66	4.66	4.69	4.69	4.70	4.68	4.66	4.65	4.63
Utilisation factor for gains for living area											
1.00	0.99	0.97	0.90	0.74	0.55	0.41	0.47	0.76	0.96	0.99	1.00 (86)
Mean internal temperature in living area T1											
19.60	19.81	20.17	20.61	20.88	20.98	21.00	20.99	20.90	20.48	19.95	19.56 (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	19.87	19.87	19.87	19.86 (88)
Utilisation factor for gains for rest of dwelling											
1.00	0.99	0.97	0.87	0.68	0.46	0.31	0.36	0.67	0.95	0.99	1.00 (89)
Mean internal temperature in the rest of dwelling T2											
18.00	18.31	18.83	19.43	19.76	19.86	19.88	19.88	19.80	19.28	18.52	17.95 (90)

Living area fraction (46.23 / 92.46) 0.50 (91)

Mean internal temperature (for the whole dwelling)

18.80	19.06	19.50	20.02	20.32	20.42	20.44	20.43	20.35	19.88	19.23	18.76 (92)

Apply adjustment to the mean internal temperature, where appropriate

18.80	19.06	19.50	20.02	20.32	20.42	20.44	20.43	20.35	19.88	19.23	18.76 (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											
568.01	707.47	871.45	991.15	916.40	659.38	442.18	461.90	659.49	676.78	569.74	529.39 (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											
1721.32	1677.93	1537.53	1302.04	1007.56	674.49	444.52	466.68	726.98	1084.25	1423.22	1714.11 (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											
858.06	652.15	495.56	223.84	67.82	-	-	-	-	303.16	614.50	881.43

Total space heating requirement per year (kWh/year) (October to May) 4096.53 (98)

Space heating requirement per m² (kWh/m²/year) 44.31 (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												
858.06	652.15	495.56	223.84	67.82	-	-	-	-	303.16	614.50	881.43	(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)												
918.69	698.23	530.58	239.66	72.61	-	-	-	-	324.58	657.93	943.72	(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												
209.72	184.88	193.87	171.96	166.49	146.63	140.48	156.61	158.34	180.30	190.90	204.71	(64)

Efficiency of water heater	80.30	(216)

88.22	87.96	87.31	85.72	82.98	80.30	80.30	80.30	80.30	86.35	87.78	88.31	(217)
Water heating fuel												
237.73	210.20	222.05	200.61	200.62	182.60	174.95	195.03	197.18	208.80	217.47	231.82	(219)

Annual totals	kWh/year	
Space heating fuel used, main system 1	4386.01	(211)
Space heating fuel (secondary)	0.00	(215)
Water heating fuel	2479.06	(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)	417.77	(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	7357.84	(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	4386.01	0.216	947.38	(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	2479.06	0.216	535.48	(264)
Space and water heating			1482.85	(265)
Electricity for pumps and fans	75.00	0.519	38.93	(267)
Electricity for lighting	417.77	0.519	216.82	(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			1738.60	(272)

	kg/m²/year	
Emissions per m² for space and water heating	**16.04**	(272a)
Emissions per m² for lighting	**2.35**	(272b)
Emissions per m² for pumps and fans	**0.42**	(272c)
Target Carbon Dioxide Emission Rate (TER)	**18.80**	(273)

= (16.0378 x 1.00) + 2.3450 + 0.4210

Project Information

Building type Detached house

Reference	J5067-3		
Date	7 October 2019		
Client	DCM Architectural Consultants Ltd 25 Pigeon Lane Herne Bay Kent CT6 7EH	Project	Unit 3 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)	46.23	2.31	106.79	(3a)
First floor	46.23	2.50	115.57	(3b)
Total floor area	92.46			(4)
Dwelling volume (m^3)			222.37	(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		0.18	(8)
Pressure test, result q50	5.00		(17)
Air permeability		0.43	(18)
Number of sides on which sheltered		2.00	(19)
Shelter factor		0.85	(20)
Infiltration rate incorporating shelter factor		0.37	(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)

0.47	0.46	0.45	0.40	0.39	0.35	0.35	0.34	0.37	0.39	0.41	0.43

4.80 (22b)

Ventilation : natural ventilation, intermittent extract fans

Effective air change rate

0.61	0.60	0.60	0.58	0.58	0.56	0.56	0.56	0.57	0.58	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 (North)			**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)			**2.520**	**1.15 (1.20)**	2.89			(27)
Specified U-Value = 1.20								
Full glazed door - Double-glazed, argon filled, low-E, En=0.2, hard coat (North)			**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			96.74	0.20	19.35	9.00	870.66	(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			46.23	0.12	5.55	75.00	3467.25	(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			51.06	0.12	6.13	9.00	459.54	(30)
150 Kingspan K7 Between Rafters/52.5 Kingspan K118 Under Rafters With Breather Membrane								

Total area of external elements Sigma A, m²	226.90	(31)
Fabric heat loss, W/K	62.16	(33)
Heat capacity	0.00	(34)
Thermal mass parameter, kJ/m²K	52.62	(35)
Effect of thermal bridges	34.04	(36)
Total fabric heat loss	96.19	(37)

Ventilation heat loss calculated monthly

44.65	44.34	44.04	42.62	42.35	41.11	41.11	40.88	41.59	42.35	42.89	43.45	(38)

Heat transfer coefficient, W/K

140.85	140.54	140.23	138.81	138.54	137.30	137.30	137.07	137.78	138.54	139.08	139.64	
											138.81	(39)

Heat loss parameter (HLP), W/m²K

1.52	1.52	1.52	1.50	1.50	1.48	1.48	1.48	1.49	1.50	1.50	1.51	

HLP (average) 1.50 (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 2.66 (42)

Annual average hot water usage in litres per day Vd,average 97.33 (43)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hot water usage in litres per day for each month											
107.06	103.17	99.27	95.38	91.49	87.59	87.59	91.49	95.38	99.27	103.17	107.06 (44)
Energy content of hot water used											
158.76	138.86	143.29	124.92	119.86	103.43	95.85	109.99	111.30	129.71	141.59	153.75

Energy content (annual) 1531.31 (45)

Distribution loss											
23.81	20.83	21.49	18.74	17.98	15.52	14.38	16.50	16.69	19.46	21.24	23.06 (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											
17.45	15.73	17.33	16.64	17.10	16.44	16.92	17.04	16.55	17.24	16.80	17.41 (61)
Total heat required for water heating calculated for each month											
176.21	154.58	160.62	141.56	136.97	119.88	112.77	127.02	127.85	146.94	158.39	171.17 (62)
Output from water heater for each month, kWh/month											
176.21	154.58	160.62	141.56	136.97	119.88	112.77	127.02	127.85	146.94	158.39	171.17 (64)

1733.95 (64)

Heat gains from water heating, kWh/month											
57.15	50.10	51.98	45.70	44.13	38.50	36.10	40.83	41.14	47.44	51.28	55.48 (65)

5. Internal gains

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains, Watts												
132.90	132.90	132.90	132.90	132.90	132.90	132.90	132.90	132.90	132.90	132.90	132.90	(66)
Lighting gains												
23.18	20.59	16.75	12.68	9.48	8.00	8.65	11.24	15.08	19.15	22.35	23.83	(67)
Appliances gains												
243.53	246.06	239.69	226.13	209.02	192.94	182.19	179.66	186.03	199.59	216.70	232.79	(68)
Cooking gains												
36.29	36.29	36.29	36.29	36.29	36.29	36.29	36.29	36.29	36.29	36.29	36.29	(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)												
-106.32	-106.32	-106.32	-106.32	-106.32	-106.32	-106.32	-106.32	-106.32	-106.32	-106.32	-106.32	(71)
Water heating gains												
76.82	74.56	69.86	63.47	59.32	53.48	48.52	54.88	57.15	63.76	71.22	74.56	(72)
Total internal gains												
409.40	407.07	392.16	368.15	343.68	320.28	305.23	311.65	324.13	348.37	376.14	397.05	(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 (North)	0.9 x 0.550 10.63	0.72 x 0.70	0.77	2.0427
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 2.520 19.64	0.72 x 0.70	0.77	17.2867
Specified U-Value = 1.20				
Full glazed door - Double-glazed, argon filled, low-E, En=0.2, hard coat (North)	0.9 x 2.630 10.63	0.72 x 0.70	0.77	9.7677
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												
9.59	9.62	9.64	9.74	9.75	9.84	9.84	9.86	9.81	9.75	9.72	9.68	
alpha												
1.64	1.64	1.64	1.65	1.65	1.66	1.66	1.66	1.65	1.65	1.65	1.65	
Utilisation factor for gains for living area												
0.92	0.88	0.81	0.70	0.57	0.45	0.35	0.40	0.59	0.79	0.89	0.93	(86)
Mean internal temperature in living area T1												
16.99	17.49	18.31	19.28	20.05	20.56	20.79	20.74	20.27	19.17	17.88	16.89	(87)
Temperature during heating periods in rest of dwelling Th2												
19.67	19.67	19.68	19.69	19.69	19.70	19.70	19.70	19.69	19.69	19.68	19.68	(88)
Utilisation factor for gains for rest of dwelling												
0.91	0.86	0.79	0.66	0.52	0.38	0.26	0.31	0.52	0.76	0.88	0.92	(89)
Mean internal temperature in the rest of dwelling T2												
14.58	15.27	16.39	17.70	18.70	19.32	19.57	19.52	19.00	17.59	15.84	14.45	(90)

Living area fraction (46.23 / 92.46) 0.50 (91)

Mean internal temperature (for the whole dwelling)

15.79	16.38	17.35	18.49	19.38	19.94	20.18	20.13	19.63	18.38	16.86	15.67	(92)
Apply adjustment to the mean internal temperature, where appropriate												
15.79	16.38	17.35	18.49	19.38	19.94	20.18	20.13	19.63	18.38	16.86	15.67	(93)

8. Space heating requirement

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains												
0.87	0.82	0.74	0.63	0.51	0.39	0.30	0.34	0.52	0.71	0.83	0.88	(94)
Useful gains												
517.41	636.09	753.12	822.52	774.90	602.98	434.97	438.47	550.33	566.50	508.07	484.00	(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												
1617.69	1612.84	1521.07	1330.91	1063.40	733.63	491.80	511.37	762.50	1077.89	1357.64	1602.14	(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												
818.61	656.38	571.35	366.04	214.65	-	-	-	-	380.47	611.69	831.90	

Total space heating requirement per year (kWh/year) (October to May) 4451.09 (98)

Space heating requirement per m² (kWh/m²/year) 48.14 (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												
818.61	656.38	571.35	366.04	214.65	-	-	-	-	380.47	611.69	831.90	(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)												
882.13	707.30	615.68	394.44	231.30	-	-	-	-	409.99	659.15	896.44	(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												
176.21	154.58	160.62	141.56	136.97	119.88	112.77	127.02	127.85	146.94	158.39	171.17	(64)

Efficiency of water heater	87.10	(216)

89.31	89.27	89.19	89.03	88.73	87.10	87.10	87.10	87.10	89.03	89.23	89.33	(217)
Water heating fuel												
197.30	173.16	180.08	159.01	154.37	137.63	129.47	145.84	146.79	165.05	177.50	191.62	(219)

Annual totals	kWh/year	
Space heating fuel used, main system 1	4796.44	(211)
Space heating fuel (secondary)	0.00	(215)
Water heating fuel	1957.80	(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)	409.43	(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	7238.66	(238)

10a. Does not apply

11a. Does not apply

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

12a. Carbon dioxide emissions

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating, main system 1	4796.44	0.216	1036.03	(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	1957.80	0.216	422.88	(264)
Space and water heating			1458.91	(265)
Electricity for pumps and fans	75.00	0.519	38.93	(267)
Electricity for lighting	409.43	0.519	212.49	(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			1710.33	(272)
			kg/m²/year	
Dwelling Carbon Dioxide Emission Rate (DER)			**18.50**	(273)

Project Information
Building type Detached house

Reference	J5067-3		
Date	7 October 2019		
Client	DCM Architectural Consultants Ltd 25 Pigeon Lane Herne Bay Kent CT6 7EH	Project	Unit 3 66 Borstal Hill Whitstable Kent 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 16:24:08

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 = 18.80	
Dwelling Carbon Dioxide Emission Rate	DER = 18.50	OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	TFEE = 58.3	
Dwelling Fabric Energy Efficiency (DFEE)	DFEE = 57.1	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 : 52.62

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	J5067-3		
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SAP 2012 input data Printed on 7 Oct 2019 at 04:24 PM

Unit 3, 66 Borstal Hill, Whitstable, Kent, CT5 4NB

Unit 3
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 = 46.23m²	storey height = 2.31m
First floor	area = 46.23m²	storey height = 2.50m

Living area: 46.23 (fraction 0.500)

Front of dwelling faces: East

Doors

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

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 (North)

Project Information

Building type Detached house

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SAP 2012 input data Printed on 7 Oct 2019 at 04:24 PM

Unit 3, 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 = 2.52	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 = 96.74	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 = 46.23	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 = 51.06	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	J5067-3		
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SAP 2012 input data Printed on 7 Oct 2019 at 04:24 PM

Unit 3, 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

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SAP 2012 input data Printed on 7 Oct 2019 at 04:24 PM

Unit 3, 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	52.62 (calculated from construction elements)
Night ventilation	No
Ventilation rate during hot weather (ach)	8.00 (Windows fully open)

Summer ventilation heat loss coefficient	587.05	(P1)
Transmission heat loss coefficient	96.19	(37)
Summer heat loss coefficient	683.24	(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 2.52	110.22	0.72 x 0.70	0.90	113
East	0.9 x 4.33	110.22	0.72 x 0.70	0.90	195
North	0.9 x 0.55	74.68	0.72 x 0.70	0.90	17
n/a	0.9 x 4.67	189.00	0.72 x 0.70	1.00	400
Total					1285

	Jun	Jul	Aug	
Solar gains	1355	1285	1086	(P3)
Internal gains	468	449	458	
Total summer gains	1823	1734	1544	(P5)
Summer gain/loss ratio	2.67	2.54	2.26	(P6)
External temperature (South East England)	15.2	17.6	17.8	
Thermal mass temperature increment (TMP=52.6)	1.63	1.63	1.63	
Threshold temperature	19.50	21.77	21.69	(P7)
Likelihood of high internal temperature	Not sig.	Slight	Slight	

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

Predicted Energy Assessment

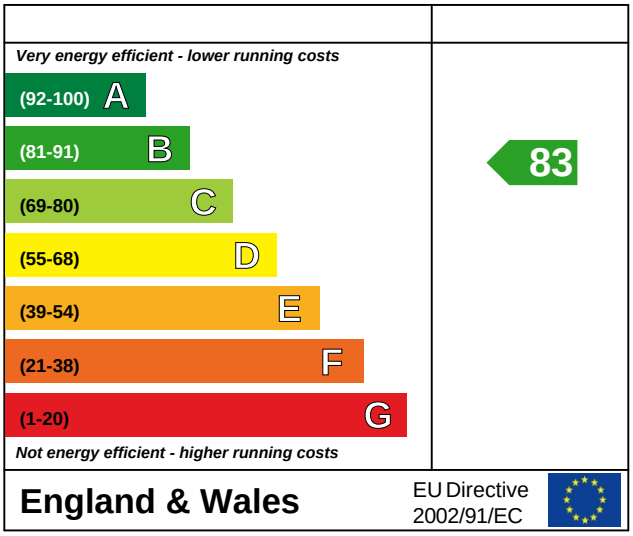
Unit 3
66 Borstal Hill
Whitstable
Kent
CT5 4NB
Ref: J5067-3

Dwelling type: Detached house
Date of assessment: 7 October 2019
Produced by Thermcalc Limited
Total floor area: 92 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.

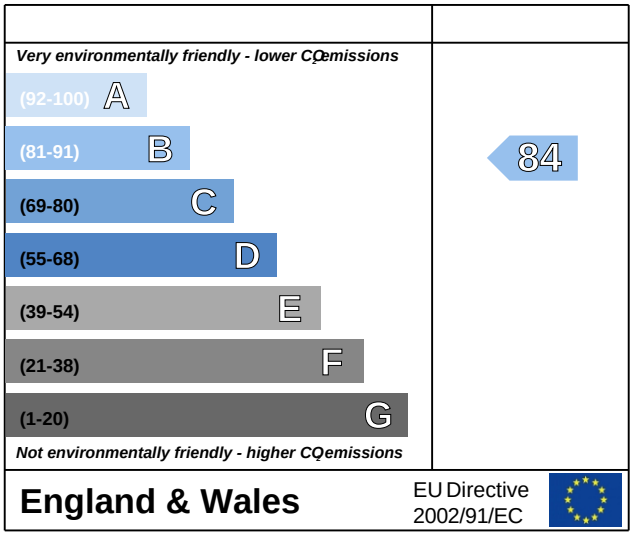
Energy performance has been assessed using the SAP 2012 methodology and is rated in terms of the energy use per square metre of floor area, energy efficiency based on fuel costs and environmental impact based on carbon dioxide (CO_2) emissions.

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	J5067-3		
Date	7 October 2019		
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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)	46.23	2.31	106.79	(3a)
First floor	46.23	2.50	115.57	(3b)
Total floor area	92.46			(4)
Dwelling volume (m^3)			222.37	(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	3	x 10	30.00	(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			0.13	(8)
Pressure test, result q50		5.00		(17)
Air permeability			0.38	(18)
Number of sides on which sheltered			2.00	(19)
Shelter factor			0.85	(20)
Infiltration rate incorporating shelter factor			0.33	(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)

0.42	0.41	0.40	0.36	0.35	0.31	0.31	0.30	0.33	0.35	0.37	0.38

4.29 (22b)

Ventilation : natural ventilation, intermittent extract fans

Effective air change rate

0.59	0.58	0.58	0.56	0.56	0.55	0.55	0.55	0.55	0.56	0.57	0.57	(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)			**2.520**	**1.15 (1.20)**	2.89			(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 (North)			**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 (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 (North)			**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 Dormer Cheeks - Weatherboard/Battens/9 OSB/51 Cavity/140 Timber Frame Insulated With 120 Celotex XR4000 Between Studs/12.5 P'bd			4.15	0.21	0.87	9.00	37.35	(29)
Walls Brick or (Weatherboard/Battens/100 Medium Dense Block)/51 Cavity/140 Timber Frame Insulated With 120 Celotex XR4000 Between Studs/12.5 P'bd			96.74	0.20	19.35	9.00	870.66	(29)
Ground floors Beam/Medium Dense Block/150 Kingspan TF70/Screed			46.23	0.12	5.55	75.00	3467.25	(28)

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			51.06	0.12	6.13	9.00	459.54	(30)
150 Kingspan K7 Between Rafters/52.5 Kingspan K118 Under Rafters With Breather Membrane								

Total area of external elements Sigma A, m²	226.90	(31)
Fabric heat loss, W/K	62.16	(33)
Heat capacity	4865.04	(34)
Thermal mass parameter, kJ/m²K	52.62	(35)
Effect of thermal bridges	34.04	(36)
Total fabric heat loss	96.19	(37)

Ventilation heat loss calculated monthly

43.08	42.83	42.58	41.44	41.23	40.23	40.23	40.05	40.62	41.23	41.66	42.11	(38)

Heat transfer coefficient, W/K

139.27	139.02	138.78	137.63	137.42	136.43	136.43	136.24	136.81	137.42	137.85	138.30	
											137.63	(39)

Heat loss parameter (HLP), W/m²K

1.51	1.50	1.50	1.49	1.49	1.48	1.48	1.47	1.48	1.49	1.49	1.50	
HLP (average)											1.49	(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 2.66 (42)

Annual average hot water usage in litres per day Vd,average 97.33 (43)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hot water usage in litres per day for each month											
107.06	103.17	99.27	95.38	91.49	87.59	87.59	91.49	95.38	99.27	103.17	107.06 (44)
Energy content of hot water used											
158.76	138.86	143.29	124.92	119.86	103.43	95.85	109.99	111.30	129.71	141.59	153.75

Energy content (annual) 1531.31 (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												
33.74	29.51	30.45	26.55	25.47	21.98	20.37	23.37	23.65	27.56	30.09	32.67	(65)

5. Internal gains

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains, Watts												
132.90	132.90	132.90	132.90	132.90	132.90	132.90	132.90	132.90	132.90	132.90	132.90	(66)
Lighting gains												
23.18	20.59	16.75	12.68	9.48	8.00	8.65	11.24	15.08	19.15	22.35	23.83	(67)
Appliances gains												
243.53	246.06	239.69	226.13	209.02	192.94	182.19	179.66	186.03	199.59	216.70	232.79	(68)
Cooking gains												
36.29	36.29	36.29	36.29	36.29	36.29	36.29	36.29	36.29	36.29	36.29	36.29	(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)												
-106.32	-106.32	-106.32	-106.32	-106.32	-106.32	-106.32	-106.32	-106.32	-106.32	-106.32	-106.32	(71)
Water heating gains												
45.35	43.91	40.93	36.87	34.24	30.53	27.38	31.41	32.85	37.05	41.79	43.92	(72)
Total internal gains												
374.93	373.43	360.23	338.55	315.60	294.33	281.08	285.18	296.83	318.66	343.71	363.40	(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 2.520	19.64	0.72 x 0.70	0.77	17.2867
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 (North)	0.9 x 0.550	10.63	0.72 x 0.70	0.77	2.0427
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 (North)	0.9 x 2.630	10.63	0.72 x 0.70	0.77	9.7677
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											
9.70	9.72	9.74	9.82	9.83	9.91	9.91	9.92	9.88	9.83	9.80	9.77
alpha											
1.65	1.65	1.65	1.65	1.66	1.66	1.66	1.66	1.66	1.66	1.65	1.65
Utilisation factor for gains for living area											
0.93	0.88	0.81	0.70	0.57	0.45	0.35	0.40	0.59	0.80	0.90	0.93 (86)
Mean internal temperature in living area T1											
16.95	17.46	18.29	19.27	20.05	20.56	20.79	20.73	20.26	19.14	17.85	16.85 (87)
Temperature during heating periods in rest of dwelling Th2											
19.68	19.68	19.69	19.70	19.70	19.71	19.71	19.71	19.70	19.70	19.69	19.69 (88)
Utilisation factor for gains for rest of dwelling											
0.92	0.87	0.79	0.67	0.53	0.38	0.27	0.31	0.53	0.76	0.89	0.93 (89)
Mean internal temperature in the rest of dwelling T2											
16.03	16.53	17.34	18.27	18.99	19.44	19.61	19.58	19.20	18.19	16.93	15.94 (90)

Living area fraction (46.23 / 92.46) 0.50 (91)

Mean internal temperature (for the whole dwelling)

16.49	16.99	17.81	18.77	19.52	20.00	20.20	20.16	19.73	18.67	17.39	16.40 (92)

Apply adjustment to the mean internal temperature, where appropriate

16.49	16.99	17.81	18.77	19.52	20.00	20.20	20.16	19.73	18.67	17.39	16.40 (93)

8. Space heating requirement

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation factor for gains											
0.89	0.84	0.76	0.64	0.52	0.40	0.30	0.35	0.53	0.73	0.85	0.90 (94)
Useful gains											
497.65	622.52	747.01	822.21	775.41	602.59	433.83	437.20	548.74	559.84	492.45	463.45 (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											
1698.13	1681.17	1569.79	1358.69	1074.64	736.55	491.56	511.88	770.26	1108.47	1418.29	1686.88 (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											
893.16	711.41	612.15	386.27	222.62	-	-	-	-	408.17	666.60	910.23

Total space heating requirement per year (kWh/year) (October to May) 4810.62 (98)

Space heating requirement per m² (kWh/m²/year) 52.03 (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												
-	-	-	-	-	1282.40	1009.55	1035.44	-	-	-	-	(100)
Utilisation factor for loss												
-	-	-	-	-	0.72	0.77	0.74	-	-	-	-	(101)
Useful loss W												
-	-	-	-	-	929.05	781.31	762.99	-	-	-	-	(102)
Internal gains W												
0.00	0.00	0.00	0.00	0.00	445.26	427.68	434.42	0.00	0.00	0.00	0.00	
Solar gains W												
0.00	0.00	0.00	0.00	0.00	1355.06	1285.18	1086.26	0.00	0.00	0.00	0.00	
Gains W												
-	-	-	-	-	1800.32	1712.86	1520.68	-	-	-	-	(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												
-	-	-	-	-	72.47	-4.99	-15.90	-	-	-	-	(98)
Space cooling kWh												
-	-	-	-	-	627.31	693.07	563.73	-	-	-	-	(104)
Total											1884.11	(104)
Cooled fraction											1.00	(105)
Intermittency factor												
-	-	-	-	-	0.25	0.25	0.25	-	-	-	-	(106)
Space cooling requirement for month												
-	-	-	-	-	156.83	173.27	140.93	-	-	-	-	
Space cooling (June to August)											471.03	(107)
Space cooling requirement per m² (kWh/m²/year)											5.09	(108)

8f. Fabric Energy Efficiency

	kWh/year	
Energy for space heating	52.03	(99)
Energy for space cooling	5.09	(108)
Total	57.12	(109)
Dwelling Fabric Energy Efficiency	**57.1**	(109)

Project Information

Building type Detached house

Reference	J5067-3		
Date	7 October 2019		
Client	DCM Architectural Consultants Ltd 25 Pigeon Lane Herne Bay Kent CT6 7EH	Project	Unit 3 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)	46.23	2.31	106.79	(3a)
First floor	46.23	2.50	115.57	(3b)
Total floor area	92.46			(4)
Dwelling volume (m^3)			222.37	(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			0.18	(8)
Pressure test, result q50		5.00		(17)
Air permeability			0.43	(18)
Number of sides on which sheltered			2.00	(19)
Shelter factor			0.85	(20)
Infiltration rate incorporating shelter factor			0.37	(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)

0.47	0.46	0.45	0.40	0.39	0.35	0.35	0.34	0.37	0.39	0.41	0.43

4.80 (22b)

Ventilation : natural ventilation, intermittent extract fans

Effective air change rate

0.61	0.60	0.60	0.58	0.58	0.56	0.56	0.56	0.57	0.58	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)			**2.520**	**1.15 (1.20)**	2.89			(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 (North)			**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 (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 (North)			**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			96.74	0.20	19.35	9.00	870.66	(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			46.23	0.12	5.55	75.00	3467.25	(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			51.06	0.12	6.13	9.00	459.54	(30)
150 Kingspan K7 Between Rafters/52.5 Kingspan K118 Under Rafters With Breather Membrane								

Total area of external elements Sigma A, m²	226.90	(31)
Fabric heat loss, W/K	62.16	(33)
Heat capacity	4865.04	(34)
Thermal mass parameter, kJ/m²K	52.62	(35)
Effect of thermal bridges	34.04	(36)
Total fabric heat loss	96.19	(37)

Ventilation heat loss calculated monthly

44.65	44.34	44.04	42.62	42.35	41.11	41.11	40.88	41.59	42.35	42.89	43.45	(38)

Heat transfer coefficient, W/K

140.85	140.54	140.23	138.81	138.54	137.30	137.30	137.07	137.78	138.54	139.08	139.64	
											138.81	(39)

Heat loss parameter (HLP), W/m²K

1.52	1.52	1.52	1.50	1.50	1.48	1.48	1.48	1.49	1.50	1.50	1.51	
HLP (average)											1.50	(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 2.66 (42)

Annual average hot water usage in litres per day Vd,average 97.33 (43)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month												
107.06	103.17	99.27	95.38	91.49	87.59	87.59	91.49	95.38	99.27	103.17	107.06	(44)
Energy content of hot water used												
158.76	138.86	143.29	124.92	119.86	103.43	95.85	109.99	111.30	129.71	141.59	153.75	

Energy content (annual) 1531.31 (45)

Distribution loss												
23.81	20.83	21.49	18.74	17.98	15.52	14.38	16.50	16.69	19.46	21.24	23.06	(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												
226.55	200.09	211.08	190.52	187.66	169.04	163.64	177.78	176.90	197.50	207.19	221.55	(62)
Output from water heater for each month, kWh/month												
226.55	200.09	211.08	190.52	187.66	169.04	163.64	177.78	176.90	197.50	207.19	221.55	(64)

2329.49 (64)

Heat gains from water heating, kWh/month												
107.02	95.15	101.88	94.02	94.09	86.87	86.10	90.80	89.49	97.36	99.56	105.36	(65)

5. Internal gains

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains, Watts												
132.90	132.90	132.90	132.90	132.90	132.90	132.90	132.90	132.90	132.90	132.90	132.90	(66)
Lighting gains												
23.18	20.59	16.75	12.68	9.48	8.00	8.65	11.24	15.08	19.15	22.35	23.83	(67)
Appliances gains												
243.53	246.06	239.69	226.13	209.02	192.94	182.19	179.66	186.03	199.59	216.70	232.79	(68)
Cooking gains												
36.29	36.29	36.29	36.29	36.29	36.29	36.29	36.29	36.29	36.29	36.29	36.29	(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)												
-106.32	-106.32	-106.32	-106.32	-106.32	-106.32	-106.32	-106.32	-106.32	-106.32	-106.32	-106.32	(71)
Water heating gains												
143.85	141.60	136.93	130.58	126.46	120.66	115.73	122.05	124.29	130.86	138.28	141.61	(72)
Total internal gains												
476.43	474.12	459.23	435.26	410.83	387.46	372.43	378.82	391.27	415.47	443.20	464.09	(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 2.520 19.64	0.72 x 0.70	0.77	17.2867
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 (North)	0.9 x 0.550 10.63	0.72 x 0.70	0.77	2.0427
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 (North)	0.9 x 2.630 10.63	0.72 x 0.70	0.77	9.7677
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											
9.59	9.62	9.64	9.74	9.75	9.84	9.84	9.86	9.81	9.75	9.72	9.68
alpha											
1.64	1.64	1.64	1.65	1.65	1.66	1.66	1.66	1.65	1.65	1.65	1.65
Utilisation factor for gains for living area											
0.91	0.87	0.79	0.68	0.56	0.43	0.34	0.38	0.57	0.77	0.88	0.92 (86)
Mean internal temperature in living area T1											
17.11	17.59	18.39	19.34	20.09	20.58	20.81	20.75	20.30	19.25	18.00	17.02 (87)
Temperature during heating periods in rest of dwelling Th2											
19.67	19.67	19.68	19.69	19.69	19.70	19.70	19.70	19.69	19.69	19.68	19.68 (88)
Utilisation factor for gains for rest of dwelling											
0.90	0.85	0.77	0.65	0.51	0.37	0.25	0.30	0.50	0.73	0.86	0.91 (89)
Mean internal temperature in the rest of dwelling T2											
16.18	16.65	17.43	18.33	19.02	19.45	19.61	19.58	19.23	18.28	17.07	16.09 (90)

Living area fraction (46.23 / 92.46) 0.50 (91)

Mean internal temperature (for the whole dwelling)

16.64	17.12	17.91	18.83	19.55	20.01	20.21	20.17	19.77	18.76	17.53	16.56 (92)
Apply adjustment to the mean internal temperature, where appropriate											
16.64	17.12	17.91	18.83	19.55	20.01	20.21	20.17	19.77	18.76	17.53	16.56 (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	0.50	0.38	0.29	0.33	0.51	0.70	0.82	0.87 (94)
Useful gains											
571.67	687.27	798.78	858.44	798.79	615.60	441.01	446.55	571.69	606.33	558.66	538.98 (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											
1738.44	1717.57	1599.88	1379.05	1088.04	743.49	495.54	516.50	781.12	1130.86	1450.65	1725.33 (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											
868.08	692.36	596.02	374.84	215.20	-	-	-	-	390.25	642.24	882.64

Total space heating requirement per year (kWh/year) (October to May) 4661.62 (98)

Space heating requirement per m² (kWh/m²/year) 50.42 (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												
868.08	692.36	596.02	374.84	215.20	-	-	-	-	390.25	642.24	882.64	(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)												
977.56	779.68	671.19	422.12	242.34	-	-	-	-	439.47	723.24	993.96	(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												
226.55	200.09	211.08	190.52	187.66	169.04	163.64	177.78	176.90	197.50	207.19	221.55	(64)

Efficiency of water heater	79.50	(216)

86.70	86.53	86.16	85.43	84.21	79.50	79.50	79.50	79.50	85.44	86.34	86.76	(217)
Water heating fuel												
261.31	231.23	244.97	223.01	222.84	212.63	205.83	223.62	222.52	231.15	239.98	255.34	(219)

Annual totals	kWh/year	
Space heating fuel used, main system 1	5249.57	(211)
Space heating fuel (secondary)	0.00	(215)
Water heating fuel	2774.44	(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)	409.43	(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	8508.43	(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	5249.57	0.216	1133.91	(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	2774.44	0.216	599.28	(264)
Space and water heating			1733.18	(265)
Electricity for pumps and fans	75.00	0.519	38.93	(267)
Electricity for lighting	409.43	0.519	212.49	(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			1984.60	(272)
			kg/m²/year	
Dwelling Carbon Dioxide Emission Rate (DER)			**21.46**	(273)

Project Information

Building type Detached house

Reference	J5067-3		
Date	7 October 2019		
Client	DCM Architectural Consultants Ltd 25 Pigeon Lane Herne Bay Kent CT6 7EH	Project	Unit 3 66 Borstal Hill Whitstable Kent CT5 4NB

1. Overall dwelling dimensions

	Area (m^2)	Av. Storey height (m)	Volume (m^3)	
Ground floor (1)	46.23	2.31	106.79	(3a)
First floor	46.23	2.50	115.57	(3b)
Total floor area	92.46			(4)
Dwelling volume (m^3)			222.37	(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	3	x 10	30.00	(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		0.13	(8)
Pressure test, result q50	5.00		(17)
Air permeability		0.38	(18)
Number of sides on which sheltered		2.00	(19)
Shelter factor		0.85	(20)
Infiltration rate incorporating shelter factor		0.33	(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)

0.42	0.41	0.40	0.36	0.35	0.31	0.31	0.30	0.33	0.35	0.37	0.38

4.29 (22b)

Ventilation : natural ventilation, intermittent extract fans

Effective air change rate

0.59	0.58	0.58	0.56	0.56	0.55	0.55	0.55	0.55	0.56	0.57	0.57	(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 (North)			**0.500**	**1.33 (1.40)**	0.66			(27)
Specified U-Value = 1.20								
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (East)			**3.950**	**1.33 (1.40)**	5.24			(27)
Specified U-Value = 1.20								
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (West)			**2.300**	**1.33 (1.40)**	3.05			(27)
Specified U-Value = 1.20								
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (East)			**0.180**	**1.33 (1.40)**	0.24			(27)
Specified U-Value = 1.20								
Full glazed door - Double-glazed, air-filled, low-E, En=0.1, soft coat (North)			**2.400**	**1.40**	3.36			(26)
Specified U-Value = 1.20								
Full glazed door - Double-glazed, air-filled, low-E, En=0.1, soft coat (East)			**3.450**	**1.40**	4.83			(26)
Specified U-Value = 1.20								
Full glazed door - Double-glazed, air-filled, low-E, En=0.1, soft coat (West)			**6.090**	**1.40**	8.53			(26)
Specified U-Value = 1.20								
Rooflight at 70° or less - Double-glazed, air-filled, low-E, En=0.1, soft coat (n/a)			**4.260**	**1.59 (1.70)**	6.78			(27)
Velux Specified U-Value = 1.20								
Walls			98.54	0.18	17.74	9.00	886.86	(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								
Walls			4.17	0.18	0.75	9.00	37.53	(29)
Dormer Cheeks - Weatherboard/Battens/9 OSB/51 Cavity/140 Timber Frame Insulated With 120 Celotex XR4000 Between Studs/12.5 P'bd								
Ground floors			46.23	0.13	6.01	75.00	3467.25	(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			51.47	0.13	6.69	9.00	463.23	(30)
150 Kingspan K7 Between Rafters/52.5 Kingspan K118 Under Rafters With Breather Membrane								

Total area of external elements Sigma A, m²	226.90	(31)
Fabric heat loss, W/K	64.31	(33)
Thermal mass parameter, kJ/m²K (user-specified TMP)	250.00	(35)
Effect of thermal bridges	11.34	(36)
Total fabric heat loss	75.65	(37)

Ventilation heat loss calculated monthly

43.08	42.83	42.58	41.44	41.23	40.23	40.23	40.05	40.62	41.23	41.66	42.11	(38)

Heat transfer coefficient, W/K

118.73	118.48	118.24	117.10	116.88	115.89	115.89	115.71	116.27	116.88	117.32	117.77	
											117.10	(39)

Heat loss parameter (HLP), W/m²K

1.28	1.28	1.28	1.27	1.26	1.25	1.25	1.25	1.26	1.26	1.27	1.27	
HLP (average)											1.27	(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 2.66 (42)

Annual average hot water usage in litres per day Vd,average 97.33 (43)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month												
107.06	103.17	99.27	95.38	91.49	87.59	87.59	91.49	95.38	99.27	103.17	107.06	(44)
Energy content of hot water used												
158.76	138.86	143.29	124.92	119.86	103.43	95.85	109.99	111.30	129.71	141.59	153.75	

Energy content (annual) 1531.31 (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												
33.74	29.51	30.45	26.55	25.47	21.98	20.37	23.37	23.65	27.56	30.09	32.67	(65)

5. Internal gains

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains, Watts												
132.90	132.90	132.90	132.90	132.90	132.90	132.90	132.90	132.90	132.90	132.90	132.90	(66)
Lighting gains												
23.66	21.01	17.09	12.94	9.67	8.16	8.82	11.47	15.39	19.54	22.81	24.31	(67)
Appliances gains												
243.53	246.06	239.69	226.13	209.02	192.94	182.19	179.66	186.03	199.59	216.70	232.79	(68)
Cooking gains												
36.29	36.29	36.29	36.29	36.29	36.29	36.29	36.29	36.29	36.29	36.29	36.29	(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)												
-106.32	-106.32	-106.32	-106.32	-106.32	-106.32	-106.32	-106.32	-106.32	-106.32	-106.32	-106.32	(71)
Water heating gains												
45.35	43.91	40.93	36.87	34.24	30.53	27.38	31.41	32.85	37.05	41.79	43.92	(72)
Total internal gains												
375.40	373.85	360.57	338.81	315.79	294.50	281.26	285.41	297.14	319.05	344.17	363.88	(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 (North)	0.9 x 0.500 10.63	0.63 x 0.70	0.77	1.6249
Specified U-Value = 1.20				
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (East)	0.9 x 3.950 19.64	0.63 x 0.70	0.77	23.7092
Specified U-Value = 1.20				
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (West)	0.9 x 2.300 19.64	0.63 x 0.70	0.77	13.8053
Specified U-Value = 1.20				
Window - Double-glazed, air-filled, low-E, En=0.1, soft coat (East)	0.9 x 0.180 19.64	0.63 x 0.70	0.77	1.0804
Specified U-Value = 1.20				
Full glazed door - Double-glazed, air-filled, low-E, En=0.1, soft coat (North)	0.9 x 2.400 10.63	0.63 x 0.70	0.77	7.7993
Specified U-Value = 1.20				
Full glazed door - Double-glazed, air-filled, low-E, En=0.1, soft coat (East)	0.9 x 3.450 19.64	0.63 x 0.70	0.77	20.7080
Specified U-Value = 1.20				
Full glazed door - Double-glazed, air-filled, low-E, En=0.1, soft coat (West)	0.9 x 6.090 19.64	0.63 x 0.70	0.77	36.5541
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 4.260 26.00	0.63 x 0.70	1.00	43.9606
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											
54.08	54.19	54.30	54.83	54.93	55.40	55.40	55.49	55.22	54.93	54.73	54.52
alpha											
4.61	4.61	4.62	4.66	4.66	4.69	4.69	4.70	4.68	4.66	4.65	4.63
Utilisation factor for gains for living area											
1.00	0.99	0.98	0.91	0.76	0.56	0.42	0.49	0.78	0.97	1.00	1.00 (86)
Mean internal temperature in living area T1											
19.55	19.77	20.14	20.58	20.87	20.97	20.99	20.99	20.89	20.44	19.90	19.52 (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	19.87	19.87	19.87	19.86 (88)
Utilisation factor for gains for rest of dwelling											
1.00	0.99	0.97	0.88	0.69	0.47	0.31	0.38	0.69	0.96	0.99	1.00 (89)
Mean internal temperature in the rest of dwelling T2											
18.54	18.76	19.12	19.55	19.79	19.87	19.88	19.88	19.82	19.43	18.90	18.51 (90)

Living area fraction (46.23 / 92.46) 0.50 (91)

Mean internal temperature (for the whole dwelling)

19.05	19.26	19.63	20.06	20.33	20.42	20.44	20.43	20.35	19.94	19.40	19.01 (92)

Apply adjustment to the mean internal temperature, where appropriate

19.05	19.26	19.63	20.06	20.33	20.42	20.44	20.43	20.35	19.94	19.40	19.01 (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	0.97	0.89	0.72	0.52	0.37	0.43	0.73	0.96	0.99	1.00 (94)
Useful gains											
523.21	665.11	835.99	970.15	908.71	657.79	441.89	461.18	650.94	645.32	527.88	485.14 (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											
1750.96	1701.86	1552.32	1307.36	1008.53	674.54	444.50	466.65	727.24	1091.35	1443.37	1744.63 (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											
913.44	696.70	532.95	242.79	74.27	-	-	-	-	331.85	659.15	937.07

Total space heating requirement per year (kWh/year) (October to May) 4388.22 (98)

Space heating requirement per m² (kWh/m²/year) 47.46 (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												
-	-	-	-	-	1089.37	857.59	879.36	-	-	-	-	(100)
Utilisation factor for loss												
-	-	-	-	-	0.93	0.96	0.94	-	-	-	-	(101)
Useful loss W												
-	-	-	-	-	1014.45	826.52	828.82	-	-	-	-	(102)
Internal gains W												
0.00	0.00	0.00	0.00	0.00	445.66	428.12	435.00	0.00	0.00	0.00	0.00	
Solar gains W												
0.00	0.00	0.00	0.00	0.00	1081.45	1025.67	866.92	0.00	0.00	0.00	0.00	
Gains W												
-	-	-	-	-	1527.11	1453.79	1301.92	-	-	-	-	(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												
-	-	-	-	-	1229.25	1434.06	1416.32	-	-	-	-	(98)
Space cooling kWh												
-	-	-	-	-	369.12	466.69	351.98	-	-	-	-	(104)
Total											1187.80	(104)
Cooled fraction											1.00	(105)
Intermittency factor												
-	-	-	-	-	0.25	0.25	0.25	-	-	-	-	(106)
Space cooling requirement for month												
-	-	-	-	-	92.28	116.67	88.00	-	-	-	-	
Space cooling (June to August)											296.95	(107)
Space cooling requirement per m² (kWh/m²/year)											3.21	(108)

8f. Fabric Energy Efficiency

	kWh/year	
Energy for space heating	47.46	(99)
Energy for space cooling	3.21	(108)
Total	50.67	(109)
Target Fabric Energy Efficiency	**58.3**	(109)

= 50.6724 x 1.15, rounded to 1 d.p.

Project Information

Building type Detached house

Reference	J5067-3		
Date	7 October 2019		
Client	DCM Architectural Consultants Ltd 25 Pigeon Lane Herne Bay Kent CT6 7EH	Project	Unit 3 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)	46.23	2.31	106.79	(3a)
First floor	46.23	2.50	115.57	(3b)
Total floor area	92.46			(4)
Dwelling volume (m^3)			222.37	(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			0.18	(8)
Pressure test, result q50		5.00		(17)
Air permeability			0.43	(18)
Number of sides on which sheltered			2.00	(19)
Shelter factor			0.85	(20)
Infiltration rate incorporating shelter factor			0.37	(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)

0.52	0.49	0.47	0.41	0.42	0.37	0.38	0.39	0.41	0.45	0.46	0.48	
											5.26	(22b)

Ventilation : natural ventilation, intermittent extract fans

Effective air change rate

0.64	0.62	0.61	0.58	0.59	0.57	0.57	0.58	0.58	0.60	0.60	0.62	(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)			**2.520**	**1.15 (1.20)**	2.89			(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 (North)			**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 (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 (North)			**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 Dormer Cheeks - Weatherboard/Battens/9 OSB/51 Cavity/140 Timber Frame Insulated With 120 Celotex XR4000 Between Studs/12.5 P'bd			4.15	0.21	0.87	9.00	37.35	(29)
Walls Brick or (Weatherboard/Battens/100 Medium Dense Block)/51 Cavity/140 Timber Frame Insulated With 120 Celotex XR4000 Between Studs/12.5 P'bd			96.74	0.20	19.35	9.00	870.66	(29)
Ground floors Beam/Medium Dense Block/150 Kingspan TF70/Screed			46.23	0.12	5.55	75.00	3467.25	(28)

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			51.06	0.12	6.13	9.00	459.54	(30)
150 Kingspan K7 Between Rafters/52.5 Kingspan K118 Under Rafters With Breather Membrane								

Total area of external elements Sigma A, m²	226.90	(31)
Fabric heat loss, W/K	62.16	(33)
Heat capacity	4865.04	(34)
Thermal mass parameter, kJ/m²K	52.62	(35)
Effect of thermal bridges	34.04	(36)
Total fabric heat loss	96.19	(37)

Ventilation heat loss calculated monthly

46.64	45.62	44.65	42.89	43.17	41.84	42.09	42.35	42.89	44.04	44.34	45.29	(38)

Heat transfer coefficient, W/K

142.83	141.81	140.85	139.08	139.36	138.03	138.28	138.54	139.08	140.23	140.54	141.48	
											140.01	(39)

Heat loss parameter (HLP), W/m²K

1.54	1.53	1.52	1.50	1.51	1.49	1.50	1.50	1.50	1.52	1.52	1.53	

HLP (average) 1.51 (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 2.66 (42)

Annual average hot water usage in litres per day Vd,average 97.33 (43)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hot water usage in litres per day for each month											
107.06	103.17	99.27	95.38	91.49	87.59	87.59	91.49	95.38	99.27	103.17	107.06 (44)
Energy content of hot water used											
158.76	138.86	143.29	124.92	119.86	103.43	95.85	109.99	111.30	129.71	141.59	153.75

Energy content (annual) 1531.31 (45)

Distribution loss

23.81	20.83	21.49	18.74	17.98	15.52	14.38	16.50	16.69	19.46	21.24	23.06 (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

17.45	15.73	17.33	16.64	17.10	16.44	16.92	17.04	16.55	17.24	16.80	17.41 (61)

Total heat required for water heating calculated for each month

176.21	154.58	160.62	141.56	136.97	119.88	112.77	127.02	127.85	146.94	158.39	171.17 (62)

Output from water heater for each month, kWh/month

176.21	154.58	160.62	141.56	136.97	119.88	112.77	127.02	127.85	146.94	158.39	171.17 (64)

1733.95 (64)

Water heating demand **1734** (64)

Heat gains from water heating, kWh/month

57.15	50.10	51.98	45.70	44.13	38.50	36.10	40.83	41.14	47.44	51.28	55.48 (65)

5. Internal gains

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains, Watts												
159.48	159.48	159.48	159.48	159.48	159.48	159.48	159.48	159.48	159.48	159.48	159.48	(66)
Lighting gains												
57.96	51.48	41.86	31.69	23.69	20.00	21.61	28.09	37.71	47.88	55.88	59.57	(67)
Appliances gains												
363.48	367.25	357.75	337.51	311.97	287.96	271.93	268.15	277.66	297.89	323.44	347.44	(68)
Cooking gains												
53.61	53.61	53.61	53.61	53.61	53.61	53.61	53.61	53.61	53.61	53.61	53.61	(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)												
-106.32	-106.32	-106.32	-106.32	-106.32	-106.32	-106.32	-106.32	-106.32	-106.32	-106.32	-106.32	(71)
Water heating gains												
76.82	74.56	69.86	63.47	59.32	53.48	48.52	54.88	57.15	63.76	71.22	74.56	(72)
Total internal gains												
608.02	603.05	579.23	542.44	504.74	471.20	451.82	460.89	482.27	519.29	560.30	591.34	(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 2.520	23.77	0.72 x 0.70	0.77	20.9173
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 (North)	0.9 x 0.550	12.74	0.72 x 0.70	0.77	2.4464
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					
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 (North)	0.9 x 2.630	12.74	0.72 x 0.70	0.77	11.6982
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												
9.46	9.53	9.59	9.72	9.70	9.79	9.77	9.75	9.72	9.64	9.62	9.55	
alpha												
1.63	1.64	1.64	1.65	1.65	1.65	1.65	1.65	1.65	1.64	1.64	1.64	
Utilisation factor for gains for living area												
0.86	0.82	0.74	0.60	0.47	0.33	0.20	0.22	0.42	0.67	0.81	0.87	(86)
Mean internal temperature in living area T1												
17.71	18.05	18.87	19.78	20.41	20.79	20.94	20.94	20.68	19.83	18.69	17.71	(87)
Temperature during heating periods in rest of dwelling Th2												
19.65	19.66	19.67	19.68	19.68	19.69	19.69	19.69	19.68	19.68	19.67	19.66	(88)
Utilisation factor for gains for rest of dwelling												
0.85	0.80	0.71	0.56	0.41	0.26	0.11	0.12	0.33	0.62	0.79	0.86	(89)
Mean internal temperature in the rest of dwelling T2												
15.57	16.04	17.14	18.33	19.12	19.54	19.67	19.67	19.45	18.44	16.93	15.58	(90)

Living area fraction (46.23 / 92.46) 0.50 (91)

Mean internal temperature (for the whole dwelling)

16.64	17.04	18.00	19.05	19.77	20.16	20.31	20.31	20.07	19.14	17.81	16.65	(92)
Apply adjustment to the mean internal temperature, where appropriate												
16.64	17.04	18.00	19.05	19.77	20.16	20.31	20.31	20.07	19.14	17.81	16.65	(93)

8. Space heating requirement

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains												
0.80	0.75	0.67	0.54	0.41	0.28	0.16	0.17	0.36	0.60	0.74	0.81	(94)
Useful gains												
665.45	753.37	838.50	883.96	745.54	525.60	279.53	264.74	488.18	618.11	628.19	618.39	(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												
1591.69	1594.48	1465.11	1259.32	928.90	588.46	291.74	277.86	579.49	958.57	1279.71	1534.74	(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												
689.13	565.22	466.20	270.26	136.41	-	-	-	-	253.30	469.09	681.77	

Total space heating requirement per year (kWh/year) (October to May) 3531.38 (98)

Space heating requirement per m² (kWh/m²/year) 38.19 (99)

Space heating demand **3531** (98)

Water heating demand **1734** (64)

8c. Space cooling requirement - not applicable

Project Information

Building type Detached house

Reference	J5067-3		
Date	7 October 2019		
Client	DCM Architectural Consultants Ltd 25 Pigeon Lane Herne Bay Kent CT6 7EH	Project	Unit 3 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)	46.23	2.31	106.79	(3a)
First floor	46.23	2.50	115.57	(3b)
Total floor area	92.46			(4)
Dwelling volume (m^3)			222.37	(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		0.18	(8)
Pressure test, result q50	5.00		(17)
Air permeability		0.43	(18)
Number of sides on which sheltered		2.00	(19)
Shelter factor		0.85	(20)
Infiltration rate incorporating shelter factor		0.37	(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)

0.52	0.49	0.47	0.41	0.42	0.37	0.38	0.39	0.41	0.45	0.46	0.48

5.26 (22b)

Ventilation : natural ventilation, intermittent extract fans

Effective air change rate

0.64	0.62	0.61	0.58	0.59	0.57	0.57	0.58	0.58	0.60	0.60	0.62	(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)			**2.520**	**1.15 (1.20)**	2.89			(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 (North)			**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 (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 (North)			**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 Dormer Cheeks - Weatherboard/Battens/9 OSB/51 Cavity/140 Timber Frame Insulated With 120 Celotex XR4000 Between Studs/12.5 P'bd			4.15	0.21	0.87	9.00	37.35	(29)
Walls Brick or (Weatherboard/Battens/100 Medium Dense Block)/51 Cavity/140 Timber Frame Insulated With 120 Celotex XR4000 Between Studs/12.5 P'bd			96.74	0.20	19.35	9.00	870.66	(29)
Ground floors Beam/Medium Dense Block/150 Kingspan TF70/Screed			46.23	0.12	5.55	75.00	3467.25	(28)

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			51.06	0.12	6.13	9.00	459.54	(30)
150 Kingspan K7 Between Rafters/52.5 Kingspan K118 Under Rafters With Breather Membrane								

Total area of external elements Sigma A, m²	226.90	(31)
Fabric heat loss, W/K	62.16	(33)
Heat capacity	4865.04	(34)
Thermal mass parameter, kJ/m²K	52.62	(35)
Effect of thermal bridges	34.04	(36)
Total fabric heat loss	96.19	(37)

Ventilation heat loss calculated monthly

46.64	45.62	44.65	42.89	43.17	41.84	42.09	42.35	42.89	44.04	44.34	45.29	(38)

Heat transfer coefficient, W/K

142.83	141.81	140.85	139.08	139.36	138.03	138.28	138.54	139.08	140.23	140.54	141.48

140.01 (39)

Heat loss parameter (HLP), W/m²K

1.54	1.53	1.52	1.50	1.51	1.49	1.50	1.50	1.50	1.52	1.52	1.53

HLP (average) 1.51 (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 2.66 (42)

Annual average hot water usage in litres per day Vd,average 97.33 (43)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hot water usage in litres per day for each month											
107.06	103.17	99.27	95.38	91.49	87.59	87.59	91.49	95.38	99.27	103.17	107.06 (44)
Energy content of hot water used											
158.76	138.86	143.29	124.92	119.86	103.43	95.85	109.99	111.30	129.71	141.59	153.75

Energy content (annual) 1531.31 (45)

Distribution loss											
23.81	20.83	21.49	18.74	17.98	15.52	14.38	16.50	16.69	19.46	21.24	23.06 (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											
17.45	15.73	17.33	16.64	17.10	16.44	16.92	17.04	16.55	17.24	16.80	17.41 (61)
Total heat required for water heating calculated for each month											
176.21	154.58	160.62	141.56	136.97	119.88	112.77	127.02	127.85	146.94	158.39	171.17 (62)
Output from water heater for each month, kWh/month											
176.21	154.58	160.62	141.56	136.97	119.88	112.77	127.02	127.85	146.94	158.39	171.17 (64)

1733.95 (64)

Heat gains from water heating, kWh/month											
57.15	50.10	51.98	45.70	44.13	38.50	36.10	40.83	41.14	47.44	51.28	55.48 (65)

5. Internal gains

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains, Watts												
159.48	159.48	159.48	159.48	159.48	159.48	159.48	159.48	159.48	159.48	159.48	159.48	(66)
Lighting gains												
57.96	51.48	41.86	31.69	23.69	20.00	21.61	28.09	37.71	47.88	55.88	59.57	(67)
Appliances gains												
363.48	367.25	357.75	337.51	311.97	287.96	271.93	268.15	277.66	297.89	323.44	347.44	(68)
Cooking gains												
53.61	53.61	53.61	53.61	53.61	53.61	53.61	53.61	53.61	53.61	53.61	53.61	(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)												
-106.32	-106.32	-106.32	-106.32	-106.32	-106.32	-106.32	-106.32	-106.32	-106.32	-106.32	-106.32	(71)
Water heating gains												
76.82	74.56	69.86	63.47	59.32	53.48	48.52	54.88	57.15	63.76	71.22	74.56	(72)
Total internal gains												
608.02	603.05	579.23	542.44	504.74	471.20	451.82	460.89	482.27	519.29	560.30	591.34	(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 2.520	23.77	0.72 x 0.70	0.77	20.9173
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 (North)	0.9 x 0.550	12.74	0.72 x 0.70	0.77	2.4464
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				
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 (North)	0.9 x 2.630	12.74	0.72 x 0.70	0.77	11.6982
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											
9.46	9.53	9.59	9.72	9.70	9.79	9.77	9.75	9.72	9.64	9.62	9.55
alpha											
1.63	1.64	1.64	1.65	1.65	1.65	1.65	1.65	1.65	1.64	1.64	1.64
Utilisation factor for gains for living area											
0.86	0.82	0.74	0.60	0.47	0.33	0.20	0.22	0.42	0.67	0.81	0.87 (86)
Mean internal temperature in living area T1											
17.71	18.05	18.87	19.78	20.41	20.79	20.94	20.94	20.68	19.83	18.69	17.71 (87)
Temperature during heating periods in rest of dwelling Th2											
19.65	19.66	19.67	19.68	19.68	19.69	19.69	19.69	19.68	19.68	19.67	19.66 (88)
Utilisation factor for gains for rest of dwelling											
0.85	0.80	0.71	0.56	0.41	0.26	0.11	0.12	0.33	0.62	0.79	0.86 (89)
Mean internal temperature in the rest of dwelling T2											
15.57	16.04	17.14	18.33	19.12	19.54	19.67	19.67	19.45	18.44	16.93	15.58 (90)

Living area fraction (46.23 / 92.46) 0.50 (91)

Mean internal temperature (for the whole dwelling)

16.64	17.04	18.00	19.05	19.77	20.16	20.31	20.31	20.07	19.14	17.81	16.65 (92)

Apply adjustment to the mean internal temperature, where appropriate

16.64	17.04	18.00	19.05	19.77	20.16	20.31	20.31	20.07	19.14	17.81	16.65 (93)

8. Space heating requirement

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation factor for gains											
0.80	0.75	0.67	0.54	0.41	0.28	0.16	0.17	0.36	0.60	0.74	0.81 (94)
Useful gains											
665.45	753.37	838.50	883.96	745.54	525.60	279.53	264.74	488.18	618.11	628.19	618.39 (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											
1591.69	1594.48	1465.11	1259.32	928.90	588.46	291.74	277.86	579.49	958.57	1279.71	1534.74 (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											
689.13	565.22	466.20	270.26	136.41	-	-	-	-	253.30	469.09	681.77

Total space heating requirement per year (kWh/year) (October to May) 3531.38 (98)

Space heating requirement per m² (kWh/m²/year) 38.19 (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												
689.13	565.22	466.20	270.26	136.41	-	-	-	-	253.30	469.09	681.77	(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)												
742.59	609.08	502.37	291.23	147.00	-	-	-	-	272.95	505.49	734.66	(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												
176.21	154.58	160.62	141.56	136.97	119.88	112.77	127.02	127.85	146.94	158.39	171.17	(64)

Efficiency of water heater	87.10	(216)

89.24	89.21	89.09	88.85	88.43	87.10	87.10	87.10	87.10	88.79	89.10	89.24	(217)
Water heating fuel												
197.46	173.29	180.28	159.32	154.89	137.63	129.47	145.84	146.79	165.50	177.76	191.79	(219)

Annual totals	kWh/year	
Space heating fuel used, main system 1	3805.37	(211)
Space heating fuel (secondary)	0.00	(215)
Water heating fuel	1960.02	(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)	409.43	(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	6249.81	(238)

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

	kWh/year	Fuel price p/kWh	£/year	
Space heating - main system 1	3805.370	4.040	153.74	(240)
Space heating - main system 2	0.000	0.000	0.00	(241)
Water heating				
Water heating cost	1960.02	4.040	79.18	(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	409.426	14.460	59.20	(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			415.97	(255)

12a. Carbon dioxide emissions

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating, main system 1	3805.37	0.216	821.96	(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	1960.02	0.216	423.36	(264)
Space and water heating			1245.32	(265)
Electricity for pumps and fans	75.00	0.519	38.93	(267)
Electricity for lighting	409.43	0.519	212.49	(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			1496.74	(272)

13a. Primary energy

	Energy kWh/year	Primary factor	P. Energy (kWh/year)	
Space heating, main	3805.37	1.220	4642.55	(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	1960.02	1.220	2391.22	(264)
Space and water heating			7033.77	(265)
Electricity for pumps/fans	75.00	3.070	230.25	(267)
Electricity for lighting	409.43	3.070	1256.94	(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			**8520.96**	(272)
Primary energy kWh/m²/year			**92.16**	(273)

Project Information

Building type Detached house

Reference	J5067-3		
Date	7 October 2019		
Client	DCM Architectural Consultants Ltd 25 Pigeon Lane Herne Bay Kent CT6 7EH	Project	Unit 3 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)	46.23	2.31	106.79	(3a)
First floor	46.23	2.50	115.57	(3b)
Total floor area	92.46			(4)
Dwelling volume (m^3)			222.37	(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		0.18	(8)
Pressure test, result q50	5.00		(17)
Air permeability		0.43	(18)
Number of sides on which sheltered		2.00	(19)
Shelter factor		0.85	(20)
Infiltration rate incorporating shelter factor		0.37	(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)

0.47	0.46	0.45	0.40	0.39	0.35	0.35	0.34	0.37	0.39	0.41	0.43	
												4.80 (22b)

Ventilation : natural ventilation, intermittent extract fans

Effective air change rate

0.61	0.60	0.60	0.58	0.58	0.56	0.56	0.56	0.57	0.58	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)			**2.520**	**1.15 (1.20)**	2.89			(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 (North)			**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 (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 (North)			**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 Dormer Cheeks - Weatherboard/Battens/9 OSB/51 Cavity/140 Timber Frame Insulated With 120 Celotex XR4000 Between Studs/12.5 P'bd			4.15	0.21	0.87	9.00	37.35	(29)
Walls Brick or (Weatherboard/Battens/100 Medium Dense Block)/51 Cavity/140 Timber Frame Insulated With 120 Celotex XR4000 Between Studs/12.5 P'bd			96.74	0.20	19.35	9.00	870.66	(29)
Ground floors Beam/Medium Dense Block/150 Kingspan TF70/Screed			46.23	0.12	5.55	75.00	3467.25	(28)

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			51.06	0.12	6.13	9.00	459.54	(30)
150 Kingspan K7 Between Rafters/52.5 Kingspan K118 Under Rafters With Breather Membrane								

Total area of external elements Sigma A, m²	226.90	(31)
Fabric heat loss, W/K	62.16	(33)
Heat capacity	4865.04	(34)
Thermal mass parameter, kJ/m²K	52.62	(35)
Effect of thermal bridges	34.04	(36)
Total fabric heat loss	96.19	(37)

Ventilation heat loss calculated monthly

44.65	44.34	44.04	42.62	42.35	41.11	41.11	40.88	41.59	42.35	42.89	43.45	(38)

Heat transfer coefficient, W/K

140.85	140.54	140.23	138.81	138.54	137.30	137.30	137.07	137.78	138.54	139.08	139.64	
											138.81	(39)

Heat loss parameter (HLP), W/m²K

1.52	1.52	1.52	1.50	1.50	1.48	1.48	1.48	1.49	1.50	1.50	1.51	

HLP (average) 1.50 (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 2.66 (42)

Annual average hot water usage in litres per day Vd,average 97.33 (43)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month												
107.06	103.17	99.27	95.38	91.49	87.59	87.59	91.49	95.38	99.27	103.17	107.06	(44)
Energy content of hot water used												
158.76	138.86	143.29	124.92	119.86	103.43	95.85	109.99	111.30	129.71	141.59	153.75	

Energy content (annual) 1531.31 (45)

Distribution loss												
23.81	20.83	21.49	18.74	17.98	15.52	14.38	16.50	16.69	19.46	21.24	23.06	(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												
17.45	15.73	17.33	16.64	17.10	16.44	16.92	17.04	16.55	17.24	16.80	17.41	(61)
Total heat required for water heating calculated for each month												
176.21	154.58	160.62	141.56	136.97	119.88	112.77	127.02	127.85	146.94	158.39	171.17	(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	1.1843	(H8)
Solar utilisation factor	0.5702	(H9)
Collector performance factor	0.8793	(H10)
Dedicated solar storage volume	75.0000	(H11)
Effective solar volume	75.0000	(H13)
Daily hot water demand	97.3255	(H14)
Volume ratio Veff/V	0.7706	(H15)
Veff/V factor	0.9479	(H16)
Solar input	-861.8464	(H17)

Solar DHW input												
-24.99	-41.70	-71.03	-95.19	-117.60	-115.62	-114.09	-99.68	-78.07	-53.31	-29.64	-20.91	(63)
Output from water heater for each month, kWh/month												
151.22	112.88	89.59	46.37	19.37	4.26	0.00	27.34	49.78	93.63	128.74	150.25	(64)

873.43 (64)

Heat gains from water heating, kWh/month												
57.15	50.10	51.98	45.70	44.13	38.50	36.10	40.83	41.14	47.44	51.26	55.48	(65)

5. Internal gains

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains, Watts												
159.48	159.48	159.48	159.48	159.48	159.48	159.48	159.48	159.48	159.48	159.48	159.48	(66)
Lighting gains												
57.96	51.48	41.86	31.69	23.69	20.00	21.61	28.09	37.71	47.88	55.88	59.57	(67)
Appliances gains												
363.48	367.25	357.75	337.51	311.97	287.96	271.93	268.15	277.66	297.89	323.44	347.44	(68)
Cooking gains												
53.61	53.61	53.61	53.61	53.61	53.61	53.61	53.61	53.61	53.61	53.61	53.61	(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)												
-106.32	-106.32	-106.32	-106.32	-106.32	-106.32	-106.32	-106.32	-106.32	-106.32	-106.32	-106.32	(71)
Water heating gains												
76.82	74.56	69.86	63.47	59.32	53.48	48.52	54.88	57.15	63.76	71.22	74.56	(72)
Total internal gains												
608.02	603.05	579.23	542.44	504.74	471.20	451.82	460.89	482.27	519.29	560.30	591.34	(73)