TER Worksheet
Design - Draft

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

Assessor name	Mr Andrew Hart	Assessor number	2311
Client		Last modified	26/06/2015
Address	Plot 7 Cross Lane, Hoylandswaine, Sheffield, S36		

1. Overall dwelling dimensions

		Area (m²)			Average storey height (m)		Volume (m³)	
Lowest occupied		107.49	(1a)	x	2.40	(2a) =	257.98	(3a)
+1		107.49	(1b)	x	2.60	(2b) =	279.47	(3b)
Total floor area	(1a) + (1b) + (1c) + (1d)...(1n) =	214.98	(4)					
Dwelling volume						(3a) + (3b) + (3c) + (3d)...(3n) =	537.45	(5)

2. Ventilation rate

			m³ per hour	
Number of chimneys	0	x 40 =	0	(6a)
Number of open flues	0	x 20 =	0	(6b)
Number of intermittent fans	4	x 10 =	40	(7a)
Number of passive vents	0	x 10 =	0	(7b)
Number of flueless gas fires	0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues, fans, PSVs	(6a) + (6b) + (7a) + (7b) + (7c) =	40	÷ (5) =	0.07	(8)

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

Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area	5.00	(17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)	0.32	(18)
Number of sides on which the dwelling is sheltered	2	(19)
Shelter factor	1 - [0.075 x (19)] = 0.85	(20)
Infiltration rate incorporating shelter factor	(18) x (20) = 0.28	(21)

Infiltration rate modified for monthly wind speed:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Monthly average wind speed from Table U2	5.10	5.00	4.90	4.40	4.30	3.80	3.80	3.70	4.00	4.30	4.50	4.70	(22)
Wind factor (22)m ÷ 4	1.28	1.25	1.23	1.10	1.08	0.95	0.95	0.93	1.00	1.08	1.13	1.18	(22a)
Adjusted infiltration rate (allowing for shelter and wind factor) (21) x (22a)m	0.35	0.34	0.34	0.30	0.30	0.26	0.26	0.26	0.28	0.30	0.31	0.32	(22b)

Calculate effective air change rate for the applicable case:

If mechanical ventilation: air change rate through system	N/A	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor from Table 4h	N/A	(23c)

d) natural ventilation or whole house positive input ventilation from loft

	0.56	0.56	0.56	0.55	0.54	0.53	0.53	0.53	0.54	0.54	0.55	0.55	(24d)

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

0.56	0.56	0.56	0.55	0.54	0.53	0.53	0.53	0.54	0.54	0.55	0.55

(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	κ-value, kJ/m².K	A x κ, kJ/K	
Window			32.49	x	1.33	=	43.07			(27)
Door			3.90	x	1.20	=	4.68			(26)
Ground floor			107.49	x	0.13	=	13.97			(28a)
External wall			185.46	x	0.18	=	33.38			(29a)
Roof			107.49	x	0.13	=	13.97			(30)
Total area of external elements ∑A, m²			436.83							(31)

Fabric heat loss, W/K = ∑(A × U)	(26)...(30) + (32) =	109.08 (33)
Heat capacity Cm = ∑(A x κ)	(28)...(30) + (32) + (32a)...(32e) =	N/A (34)
Thermal mass parameter (TMP) in kJ/m²K		250.00 (35)
Thermal bridges: ∑(L x Ψ) calculated using Appendix K		16.57 (36)
Total fabric heat loss	(33) + (36) =	125.66 (37)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ventilation heat loss calculated monthly 0.33 x (25)m x (5)	99.64	99.22	98.80	96.84	96.47	94.77	94.77	94.45	95.42	96.47	97.21	97.99	(38)
Heat transfer coefficient, W/K (37)m + (38)m	225.30	224.87	224.45	222.49	222.13	220.42	220.42	220.10	221.08	222.13	222.87	223.65	

Average = ∑(39)1...12/12 = 222.49 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss parameter (HLP), W/m²K (39)m ÷ (4)	1.05	1.05	1.04	1.03	1.03	1.03	1.03	1.02	1.03	1.03	1.04	1.04	

Average = ∑(40)1...12/12 = 1.03 (40)

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

4. Water heating energy requirement

Assumed occupancy, N	3.02 (42)
Annual average hot water usage in litres per day Vd,average = (25 x N) + 36	105.96 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)	116.55	112.32	108.08	103.84	99.60	95.36	95.36	99.60	103.84	108.08	112.32	116.55	

∑(44)1...12 = 1271.50 (44)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy content of hot water used = 4.18 x Vd,m x nm x Tm/3600 kWh/month (see Tables 1b, 1c 1d)	172.85	151.17	156.00	136.00	130.50	112.61	104.35	119.74	121.17	141.21	154.15	167.39	

∑(45)1...12 = 1667.14 (45)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Distribution loss 0.15 x (45)m	25.93	22.68	23.40	20.40	19.57	16.89	15.65	17.96	18.18	21.18	23.12	25.11	(46)
Water storage loss calculated for each month (55) x (41)m	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(56)
If the vessel contains dedicated solar storage or dedicated WWHRS (56)m x [(47) - Vs] ÷ (47), else (56)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(57)
Primary circuit loss for each month from Table 3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(59)
Combi loss for each month from Table 3a, 3b or 3c	50.96	46.03	50.96	49.32	50.76	47.03	48.60	50.76	49.32	50.96	49.32	50.96	(61)

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

223.81	197.20	206.96	185.32	181.25	159.64	152.94	170.50	170.49	192.17	203.46	218.35	(62)

Solar DHW input calculated using Appendix G or Appendix H

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

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

223.81	197.20	206.96	185.32	181.25	159.64	152.94	170.50	170.49	192.17	203.46	218.35	

∑(64)1...12 = 2262.08 (64)

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

70.21	61.77	64.61	57.55	56.08	49.20	46.84	52.50	52.62	59.69	63.58	68.40	(65)

5. Internal gains

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5)	151.07	151.07	151.07	151.07	151.07	151.07	151.07	151.07	151.07	151.07	151.07	151.07	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	36.23	32.18	26.17	19.81	14.81	12.50	13.51	17.56	23.57	29.93	34.93	37.24	(67)
Appliance gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	385.07	389.06	379.00	357.56	330.50	305.07	288.08	284.08	294.15	315.59	342.65	368.08	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	38.11	38.11	38.11	38.11	38.11	38.11	38.11	38.11	38.11	38.11	38.11	38.11	(69)
Pump and fan gains (Table 5a)	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	(70)
Losses e.g. evaporation (Table 5)	-120.86	-120.86	-120.86	-120.86	-120.86	-120.86	-120.86	-120.86	-120.86	-120.86	-120.86	-120.86	(71)
Water heating gains (Table 5)	94.37	91.92	86.84	79.93	75.38	68.33	62.96	70.57	73.08	80.23	88.31	91.93	(72)
Total internal gains (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m	586.99	584.49	563.33	528.62	492.01	457.22	435.87	443.53	462.12	497.07	537.21	568.57	(73)

6. Solar gains

	Access factor Table 6d		Area m²		Solar flux W/m²		g specific data or Table 6b		FF specific data or Table 6c		Gains W	
East	0.77	x	13.68	x	19.64	x 0.9 x	0.63	x	0.70	=	82.11	(76)
North	0.77	x	0.63	x	10.63	x 0.9 x	0.63	x	0.70	=	2.05	(74)
West	0.77	x	17.55	x	19.64	x 0.9 x	0.63	x	0.70	=	105.34	(80)
South	0.77	x	0.63	x	46.75	x 0.9 x	0.63	x	0.70	=	9.00	(78)

Solar gains in watts ∑(74)m...(82)m

198.50	385.35	629.32	912.65	1115.89	1141.63	1087.13	935.22	729.97	455.67	246.93	163.64	(83)

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

785.49	969.84	1192.65	1441.27	1607.90	1598.86	1523.00	1378.75	1192.09	952.75	784.14	732.21	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1(˚C) 21.00 (85)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains for living area n1,m (see Table 9a)	1.00	1.00	1.00	0.98	0.93	0.79	0.62	0.69	0.93	1.00	1.00	1.00	(86)
Mean internal temp of living area T1 (steps 3 to 7 in Table 9c)	19.67	19.82	20.08	20.43	20.75	20.93	20.99	20.97	20.81	20.39	19.97	19.65	(87)

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

20.04	20.05	20.05	20.05	20.06	20.06	20.06	20.06	20.06	20.06	20.05	20.05	(88)

Utilisation factor for gains for rest of dwelling n2,m

1.00	1.00	1.00	0.98	0.90	0.71	0.50	0.57	0.89	0.99	1.00	1.00	(89)

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

18.24	18.46	18.84	19.35	19.79	20.01	20.06	20.05	19.89	19.30	18.68	18.21	(90)

Living area fraction — Living area ÷ (4) = 0.11 (91)

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

18.40	18.60	18.97	19.47	19.89	20.11	20.16	20.15	19.99	19.42	18.82	18.37	(92)

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

18.40	18.60	18.97	19.47	19.89	20.11	20.16	20.15	19.99	19.42	18.82	18.37	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, ηm	1.00	1.00	0.99	0.97	0.89	0.71	0.51	0.58	0.88	0.99	1.00	1.00	(94)
Useful gains, ηmGm, W (94)m x (84)m	785.19	968.58	1185.99	1401.31	1435.52	1137.89	773.86	805.20	1049.95	943.23	783.37	732.02	(95)
Monthly average external temperature from Table U1	4.30	4.90	6.50	8.90	11.70	14.60	16.60	16.40	14.10	10.60	7.10	4.20	(96)
Heat loss rate for mean internal temperature, Lm, W [(39)m x [(93)m - (96)m]	3175.66	3080.99	2799.02	2351.38	1819.16	1214.91	783.74	825.40	1301.40	1958.52	2611.14	3168.28	(97)
Space heating requirement, kWh/month 0.024 x [(97)m - (95)m] x (41)m	1778.51	1419.54	1200.10	684.05	285.43	0.00	0.00	0.00	0.00	755.38	1316.00	1812.58	

∑(98)1...5, 10...12 = 9251.59 (98)

Space heating requirement kWh/m²/year — (98) ÷ (4) = 43.03 (99)

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

Space heating

Fraction of space heat from secondary/supplementary system (table 11) — 0.00 (201)

Fraction of space heat from main system(s) — 1 - (201) = 1.00 (202)

Fraction of space heat from main system 2 — 0.00 (202)

Fraction of total space heat from main system 1 — (202) x [1- (203)] = 1.00 (204)

Fraction of total space heat from main system 2 — (202) x (203) = 0.00 (205)

Efficiency of main system 1 (%) — 93.40 (206)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating fuel (main system 1), kWh/month	1904.19	1519.85	1284.90	732.39	305.60	0.00	0.00	0.00	0.00	808.76	1408.99	1940.67	

∑(211)1...5, 10...12 = 9905.34 (211)

Water heating

Efficiency of water heater

89.15	89.03	88.76	88.04	86.19	80.30	80.30	80.30	80.30	88.15	88.90	89.19	(217)

Water heating fuel, kWh/month

251.05	221.49	233.17	210.49	210.29	198.80	190.47	212.33	212.31	218.00	228.86	244.81	

∑(219a)1...12 = 2632.07 (219)

Annual totals

Space heating fuel - main system 1 — 9905.34

Water heating fuel — 2632.07

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

central heating pump or water pump within warm air heating unit	30.00		(230c)
boiler flue fan	45.00		(230e)
Total electricity for the above, kWh/year		75.00	(231)
Electricity for lighting (Appendix L)		639.87	(232)
Total delivered energy for all uses	(211)...(221) + (231) + (232)...(237b) =	13252.28	(238)

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

	Fuel kWh/year		Fuel price		Fuel cost £/year	
Space heating - main system 1	9905.34	x	3.48	x 0.01 =	344.71	(240)
Water heating	2632.07	x	3.48	x 0.01 =	91.60	(247)
Pumps and fans	75.00	x	13.19	x 0.01 =	9.89	(249)
Electricity for lighting	639.87	x	13.19	x 0.01 =	84.40	(250)
Additional standing charges					120.00	(251)
Total energy cost				(240)...(242) + (245)...(254) =	650.59	(255)

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

Energy cost deflator (Table 12)	0.42	(256)
Energy cost factor (ECF)	1.05	(257)
SAP value	85.34	
SAP rating (section 13)	85	(258)
SAP band	B	

12a. CO_2 emissions - individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO_2/kWh		Emissions kg CO_2/year	
Space heating - main system 1	9905.34	x	0.22	=	2139.55	(261)
Water heating	2632.07	x	0.22	=	568.53	(264)
Space and water heating			(261) + (262) + (263) + (264) =		2708.08	(265)
Pumps and fans	75.00	x	0.52	=	38.93	(267)
Electricity for lighting	639.87	x	0.52	=	332.09	(268)
Total CO_2, kg/year				(265)...(271) =	3079.10	(272)
Dwelling CO_2 emission rate				(272) ÷ (4) =	14.32	(273)
EI value					84.13	
EI rating (section 14)					84	(274)
EI band					B	

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

	Energy kWh/year		Primary factor		Primary Energy kWh/year	
Space heating - main system 1	9905.34	x	1.22	=	12084.51	(261)
Water heating	2632.07	x	1.22	=	3211.12	(264)
Space and water heating			(261) + (262) + (263) + (264) =		15295.64	(265)
Pumps and fans	75.00	x	3.07	=	230.25	(267)
Electricity for lighting	639.87	x	3.07	=	1964.41	(268)
Primary energy kWh/year					17490.30	(272)
Dwelling primary energy rate kWh/m2/year					81.36	(273)

DRAFT