

Fabric Efficiency WorkSheet: Existing dwelling (SAP)

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2009

Software Version:

Version: 1.4.0.56

Property Address: Victorian Mid Terrace, worst case

Address : 438, Saffron Lane, LEICESTER, LE2 6SB

1. Overall dwelling dimensions:

	Area(m ²)		Ave Height(m)		Volume(m ³)
Ground floor	77.34	(1a) x	2.5	(2a) =	193.35
First floor	77.34	(1b) x	2.5	(2b) =	193.35
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	154.68	(4)			
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	386.7

2. Ventilation rate:

	main heating		Secondary heating		other		total		m ³ per hour
Number of chimneys	1	+	1	+	0	=	2	x 40 =	80
Number of open flues	1	+	0	+	0	=	1	x 20 =	20
Number of intermittent fans							4	x 10 =	40
Number of passive vents							0	x 10 =	0
Number of flueless gas fires							0	x 40 =	0

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = 140 ÷ (5) = 0.36 (8)

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

Number of storeys in the dwelling (ns) 2 (9)

Additional infiltration [(9)-1]x0.1 = 0.1 (10)

Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction 0.35 (11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 0.2 (12)

If no draught lobby, enter 0.05, else enter 0 0.05 (13)

Percentage of windows and doors draught stripped 50 (14)

Window infiltration 0.25 - [0.2 x (14) ÷ 100] = 0.15 (15)

Infiltration rate (8) + (10) + (11) + (12) + (13) + (15) = 1.21 (16)

Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area 0 (17)

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16) 1.21 (18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides on which sheltered 2 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.85 (20)

Infiltration rate incorporating shelter factor (21) = (18) x (20) = 1.03 (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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Monthly average wind speed from Table 7

(22)m=

5.4	5.1	5.1	4.5	4.1	3.9	3.7	3.7	4.2	4.5	4.8	5.1
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(38)m=	177.48	167.62	167.62	147.9	134.76	128.18	121.75	121.75	138.04	147.9	157.76	167.62	(38)
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Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	446.16	436.3	436.3	416.58	403.43	396.86	390.42	390.42	406.72	416.58	426.44	436.3	
Average = Sum(39) _{1...12} / 12 =												416.87	(39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	2.88	2.82	2.82	2.69	2.61	2.57	2.52	2.52	2.63	2.69	2.76	2.82	
Average = Sum(40) _{1...12} / 12 =												2.7	(40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.94 (42)
 if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA - 13.9)²)] + 0.0013 x (TFA - 13.9)
 if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 109.53 (43)
 Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

	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)													
(44)m=	120.48	116.1	111.72	107.34	102.96	98.58	98.58	102.96	107.34	111.72	116.1	120.48	
Total = Sum(44) _{1...12} =												1314.38	(44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	179.1	156.64	161.64	140.92	135.22	116.68	108.13	124.08	125.56	146.33	159.73	173.45	
Total = Sum(45) _{1...12} =												1727.48	(45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	0	0	0	0	0	0	0	0	0	0	0	0	(46)
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Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (47)

Temperature factor from Table 2b 0 (48)

Energy lost from water storage, kWh/year (47) x (48) = 0 (49)

If manufacturer's declared cylinder loss factor is not known:
 Cylinder volume (litres) including any solar storage within same 0 (50)

If community heating and no tank in dwelling, enter 110 litres in box (50)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in box (50)

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year ((50) x (51) x (52) x (53) = 0 (54)

Enter (49) or (54) in (55) 0 (55)

Water storage loss calculated for each month ((56)m = (55) x (41)m

(56)m=	0	0	0	0	0	0	0	0	0	0	0	0	(56)
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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) - (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	0	0	0	0	0	0	0	0	0	0	0	0	(57)
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Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=

0	0	0	0	0	0	0	0	0	0	0	0	0
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 (59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=

0	0	0	0	0	0	0	0	0	0	0	0	0
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 (61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=

152.24	133.15	137.4	119.79	114.94	99.18	91.91	105.46	106.72	124.38	135.77	147.43
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 (62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRs and/or WWHRs applies, see Appendix G)

(63)m=

0	0	0	0	0	0	0	0	0	0	0	0	0
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 (63)

Output from water heater

(64)m=

152.24	133.15	137.4	119.79	114.94	99.18	91.91	105.46	106.72	124.38	135.77	147.43
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Output from water heater (annual)_{1...12} 1468.36 (64)

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

(65)m=

38.06	33.29	34.35	29.95	28.73	24.8	22.98	26.37	26.68	31.09	33.94	36.86
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 (65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

(66)m=

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m=	147.06	147.06	147.06	147.06	147.06	147.06	147.06	147.06	147.06	147.06	147.06	147.06

 (66)

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

(67)m=

35.91	31.89	25.94	19.64	14.68	12.39	13.39	17.41	23.36	29.66	34.62	36.91
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 (67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=

325.57	328.95	320.43	302.31	279.43	257.93	243.56	240.19	248.7	266.82	289.7	311.2
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 (68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=

37.71	37.71	37.71	37.71	37.71	37.71	37.71	37.71	37.71	37.71	37.71	37.71
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 (69)

Pumps and fans gains (Table 5a)

(70)m=

0	0	0	0	0	0	0	0	0	0	0	0
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 (70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=

-117.65	-117.65	-117.65	-117.65	-117.65	-117.65	-117.65	-117.65	-117.65	-117.65	-117.65	-117.65
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 (71)

Water heating gains (Table 5)

(72)m=

51.16	49.53	46.17	41.59	38.62	34.44	30.88	35.44	37.06	41.79	47.14	49.54
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 (72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=

479.75	477.49	459.66	430.66	399.85	371.88	354.96	360.15	376.24	405.4	438.58	464.77
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 (73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m ²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)
North	0.9x 0.77	x 4.04	x 10.73	x 0.76	x 0.76	= 17.35 (74)
North	0.9x 0.77	x 4.04	x 20.36	x 0.76	x 0.76	= 32.92 (74)

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North	0.9x	0.77	x	4.04	x	33.31	x	0.76	x	0.76	=	53.86	(74)
North	0.9x	0.77	x	4.04	x	54.64	x	0.76	x	0.76	=	88.36	(74)
North	0.9x	0.77	x	4.04	x	75.22	x	0.76	x	0.76	=	121.63	(74)
North	0.9x	0.77	x	4.04	x	84.09	x	0.76	x	0.76	=	135.98	(74)
North	0.9x	0.77	x	4.04	x	79.12	x	0.76	x	0.76	=	127.95	(74)
North	0.9x	0.77	x	4.04	x	61.56	x	0.76	x	0.76	=	99.56	(74)
North	0.9x	0.77	x	4.04	x	41.09	x	0.76	x	0.76	=	66.44	(74)
North	0.9x	0.77	x	4.04	x	24.81	x	0.76	x	0.76	=	40.13	(74)
North	0.9x	0.77	x	4.04	x	13.22	x	0.76	x	0.76	=	21.38	(74)
North	0.9x	0.77	x	4.04	x	8.94	x	0.76	x	0.76	=	14.46	(74)
South	0.9x	0.77	x	4.04	x	47.32	x	0.76	x	0.76	=	76.53	(78)
South	0.9x	0.77	x	4.04	x	77.18	x	0.76	x	0.76	=	124.81	(78)
South	0.9x	0.77	x	4.04	x	94.25	x	0.76	x	0.76	=	152.41	(78)
South	0.9x	0.77	x	4.04	x	105.11	x	0.76	x	0.76	=	169.98	(78)
South	0.9x	0.77	x	4.04	x	108.55	x	0.76	x	0.76	=	175.54	(78)
South	0.9x	0.77	x	4.04	x	108.9	x	0.76	x	0.76	=	176.1	(78)
South	0.9x	0.77	x	4.04	x	107.14	x	0.76	x	0.76	=	173.25	(78)
South	0.9x	0.77	x	4.04	x	103.88	x	0.76	x	0.76	=	167.99	(78)
South	0.9x	0.77	x	4.04	x	99.99	x	0.76	x	0.76	=	161.7	(78)
South	0.9x	0.77	x	4.04	x	85.29	x	0.76	x	0.76	=	137.93	(78)
South	0.9x	0.77	x	4.04	x	56.07	x	0.76	x	0.76	=	90.67	(78)
South	0.9x	0.77	x	4.04	x	40.89	x	0.76	x	0.76	=	66.12	(78)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	93.87	157.74	206.27	258.34	297.17	312.08	301.2	267.55	228.14	178.05	112.05	80.59	(83)
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Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	573.63	635.23	665.93	689	697.02	683.96	656.16	627.7	604.37	583.45	550.63	545.36	(84)
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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.96	0.95	0.94	0.93	0.9	0.85	0.78	0.79	0.88	0.93	0.95	0.96	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	15.4	15.65	16.33	17.08	18.19	19.21	19.99	19.98	19.04	17.76	16.34	15.55	(87)
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Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	18.82	18.86	18.86	18.92	18.97	18.99	19.02	19.02	18.96	18.92	18.89	18.86	(88)
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Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.95	0.95	0.93	0.91	0.87	0.79	0.62	0.64	0.83	0.91	0.94	0.95	(89)
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Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	14.02	14.29	14.96	15.75	16.88	17.89	18.63	18.62	17.71	16.43	14.99	14.18	(90)
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fLA = Living area ÷ (4) =

1 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	15.4	15.65	16.33	17.08	18.19	19.21	19.99	19.98	19.04	17.76	16.34	15.55	(92)
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Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	15.4	15.65	16.33	17.08	18.19	19.21	19.99	19.98	19.04	17.76	16.34	15.55	(93)
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8. Space heating requirement

Set T_i to the mean internal temperature obtained at step 11 of Table 9b, so that $T_{i,m}=(76)m$ and re-calculate the utilisation factor for gains using Table 9a

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

(94)m=	0.94	0.93	0.91	0.89	0.86	0.8	0.72	0.73	0.83	0.89	0.93	0.94	(94)
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Useful gains, hmG_m , $W = (94)m \times (84)m$

(95)m=	537.53	588.61	607.73	615.03	595.96	546.36	472.32	457.59	500.9	519.49	510.15	511.61	(95)
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Monthly average external temperature from Table 8

(96)m=	4.5	5	6.8	8.7	11.7	14.6	16.9	16.9	14.3	10.8	7	4.9	(96)
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Heat loss rate for mean internal temperature, L_m , $W = [(39)m \times ((93)m - (96)m)]$

(97)m=	4863.62	4647.14	4157.64	3489.64	2616.67	1830.38	1206.71	1200.65	1927.34	2897.59	3981.03	4644.98	(97)
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Space heating requirement for each month, $kWh/month = 0.024 \times [(97)m - (95)m] \times (41)m$

(98)m=	3218.61	2727.33	2641.13	2069.72	1503.41	0	0	0	0	1769.31	2499.03	3075.23	(98)
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Total per year ($kWh/year$) = $Sum(98)_{1..5,9..12} =$ 19503.76

Space heating requirement in $kWh/m^2/year$

126.09 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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Heat loss rate L_m (calculated using $25^\circ C$ internal temperature and external temperature from Table 10)

(100)m=	0	0	0	0	0	3611.39	2654.88	2693.93	0	0	0	0	(100)
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Utilisation factor for loss hm

(101)m=	0	0	0	0	0	0.22	0.28	0.27	0	0	0	0	(101)
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Useful loss, hmL_m (Watts) = $(100)m \times (101)m$

(102)m=	0	0	0	0	0	804.51	732.15	718.54	0	0	0	0	(102)
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Gains (solar gains calculated for applicable weather region, see Table 10)

(103)m=	0	0	0	0	0	935.51	894.14	869.7	0	0	0	0	(103)
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Space cooling requirement for month, whole dwelling, continuous (kWh) = $0.024 \times [(103)m - (102)m] \times (41)m$

set (104)m to zero if $(104)m < 3 \times (98)m$

(104)m=	0	0	0	0	0	0	0	0	0	0	0	0	(104)
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Total = $Sum(104) =$ 0

Cooled fraction

$f_C = \text{cooled area} \div (4) =$ 1 (105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	(106)
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Total = $Sum(104) =$ 0

Space cooling requirement for month = $(104)m \times (105) \times (106)m$

(107)m=	0	0	0	0	0	0	0	0	0	0	0	0	(107)
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Total = $Sum(107) =$ 0

Space cooling requirement in $kWh/m^2/year$

$(107) \div (4) =$ 0 (108)

8f. Fabric Energy Efficiency (calculated only under special conditions, see section 11)

Fabric Energy Efficiency $(99) + (108) =$ 126.09 (109)