

# Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.4.23  
Printed on 13 January 2020 at 15:41:32

## Project Information:

**Assessed By:** Mitchel Armitage-Neiles (STRO029948)

**Building Type:** Mid-terrace House

## Dwelling Details:

### NEW DWELLING DESIGN STAGE

Total Floor Area: 82.76m<sup>2</sup>

**Site Reference :** Fishers Farm (Phase 2)

**Plot Reference:** Plot 116 Dart [Mid] DCC3

**Address :**

## Client Details:

**Name:** Redrow Homes South East

**Address :**

**This report covers items included within the SAP calculations.**

**It is not a complete report of regulations compliance.**

## 1a TER and DER

Fuel for main heating system: Mains gas

Fuel factor: 1.00 (mains gas)

Target Carbon Dioxide Emission Rate (TER) 17.06 kg/m<sup>2</sup>

Dwelling Carbon Dioxide Emission Rate (DER) 15.75 kg/m<sup>2</sup> **OK**

## 1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 45.7 kWh/m<sup>2</sup>

Dwelling Fabric Energy Efficiency (DFEE) 38.4 kWh/m<sup>2</sup> **OK**

## 2 Fabric U-values

Element	Average	Highest	
External wall	0.28 (max. 0.30)	0.28 (max. 0.70)	<b>OK</b>
Party wall	0.00 (max. 0.20)	-	<b>OK</b>
Floor	0.12 (max. 0.25)	0.12 (max. 0.70)	<b>OK</b>
Roof	0.11 (max. 0.20)	0.11 (max. 0.35)	<b>OK</b>
Openings	1.29 (max. 2.00)	1.50 (max. 3.30)	<b>OK</b>

## 2a Thermal bridging

Thermal bridging calculated using user-specified y-value of 0.15

Reference: Measured

## 3 Air permeability

Air permeability at 50 pascals 5.01 (design value)

Maximum 10.0 **OK**

## 4 Heating efficiency

Main Heating system:

Database: (rev 454, product index 017929):

Boiler systems with radiators or underfloor heating - mains gas

Brand name: Ideal

Model: LOGIC COMBI

Model qualifier: ESP1 35

(Combi)

Efficiency 89.6 % SEDBUK2009

Minimum 88.0 % **OK**

# Regulations Compliance Report

Secondary heating system: None

## 5 Cylinder insulation

Hot water Storage: No cylinder

## 6 Controls

Space heating controls: Programmer, room thermostat and TRVs **OK**

Hot water controls: No cylinder thermostat  
No cylinder

Boiler interlock: Yes **OK**

## 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): Not significant **OK**

Based on:

Overshading: Average or unknown  
Windows facing: North East 4.76m<sup>2</sup>  
Windows facing: South West 3m<sup>2</sup>  
Windows facing: South West 5.22m<sup>2</sup>  
Ventilation rate: 8.00  
Blinds/curtains: None

## 10 Key features

Doors U-value: 1.1 W/m<sup>2</sup>K  
Roofs U-value: 0.11 W/m<sup>2</sup>K  
Party Walls U-value: 0 W/m<sup>2</sup>K  
Floors U-value: 0.12 W/m<sup>2</sup>K

# Code for Sustainable Homes Report

For use with Nov 2010 addendum 2014 England

## Assessor and House Details

**Assessor Name:** Mitchel Armitage-Neiles **Assessor Number:** STRO029948

**Property Address:**

## Buiding regulation assessment

	kg/m <sup>2</sup> /year
TER	17.06
DER	15.75

## ENE 1 Assessment - Dwelling Emission Rate

### Total Energy Type CO<sub>2</sub> Emissions for Codes Levels 1 - 5

	%	kg/m <sup>2</sup> /year	
DER from SAP 2012 DER Worksheet		15.75	(ZC1)
TER		17.06	
Residual CO <sub>2</sub> emissions offset from biofuel CHP		0	(ZC5)
CO <sub>2</sub> emissions offset from additional allowable electricity generation		0	(ZC7)
Total CO <sub>2</sub> emissions offset from SAP Section 16 allowances		0	
DER accounting for SAP Section 16 allowances		15.75	
% improvement DER/TER	7.7		

### Total Energy Type CO<sub>2</sub> Emissions for Codes Levels 6

	kg/m <sup>2</sup> /year	
DER accounting for SAP Section 16 allowances	15.75	(ZC1)
CO <sub>2</sub> emissions from appliances, equation (L14)	16.06	(ZC2)
CO <sub>2</sub> emissions from cooking, equation (L16)	2.17	(ZC3)
Net CO <sub>2</sub> emissions	36	(ZC8)

### Result:

**Credits awarded for ENE 1 = 1.2**

**Code Level = 3**

## ENE 2 - Fabric energy Efficiency

**Fabric energy Efficiency: 38.39**

**Credits awarded for ENE 2 = 7.2**

## ENE 7 - Low or Zero Carbon (LZC) Technologies

### Reduction in CO<sub>2</sub> Emissions

	%	kg/m <sup>2</sup> /year	
Standard Case CO <sub>2</sub> emissions		35.98	
Standard DER		17.76	
Actual Case CO <sub>2</sub> emissions		35.98	
Actual DER		17.76	
Reduction in CO <sub>2</sub> emissions	0		

**Credits awarded for ENE 7 = 0**

Technologies eligible to contribute to achieving the requirements of this issue must produce energy from renewable sources and meet all other ancillary requirements as defined by Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC.

The following requirements must also be met:

- Where not provided by accredited external renewables there must be a direct supply of energy produced to the dwelling under assessment.
- Where covered by the Microgeneration Certification Scheme (MCS), technologies under 50kWe or 300kWth must be certified.
- Combined Heat and Power (CHP) schemes above 50kWe must be certified under the CHPQA standard.
- All technologies must be accounted for by SAP.

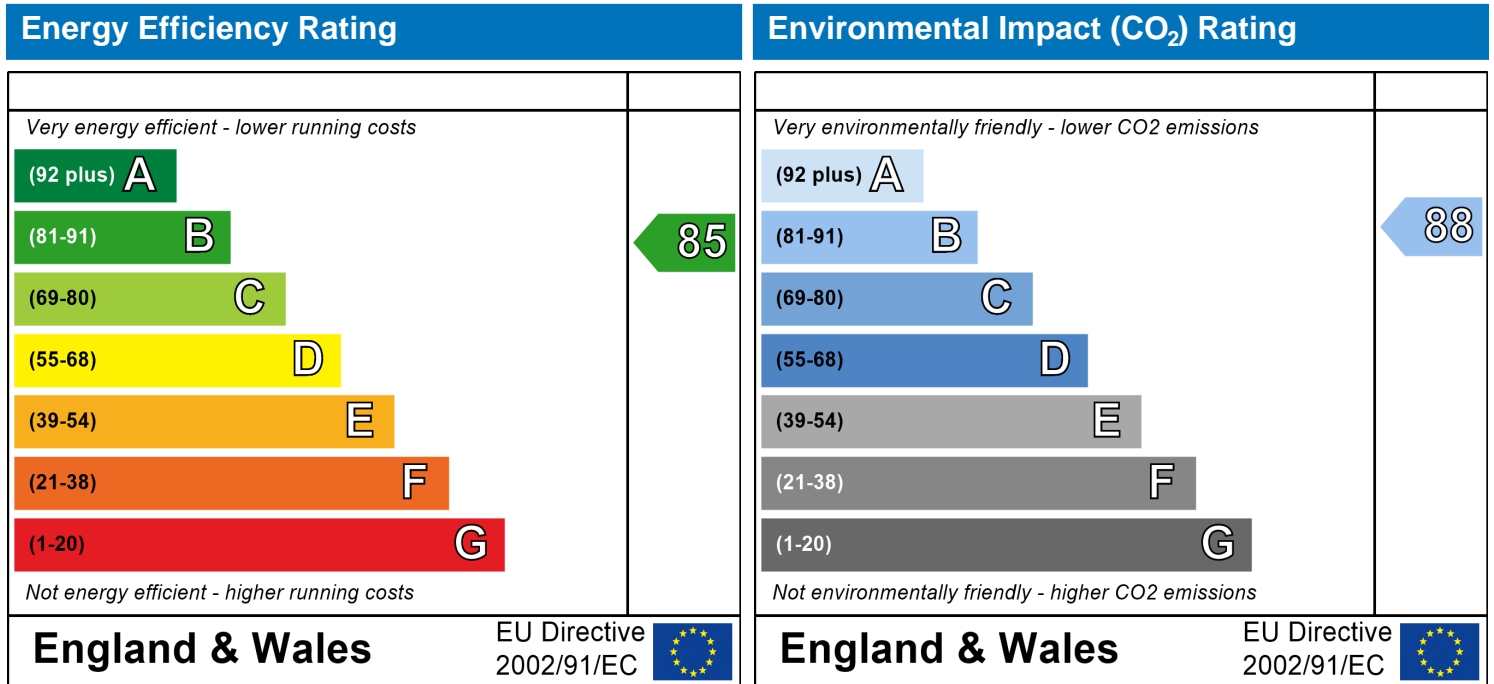
CHP schemes fuelled by mains gas are eligible to contribute to performance against this issue. Where these schemes are above 50kWe they must be certified under the CHPQA.

It is the responsibility of the Accredited OCDEA and Code Assessor to ensure all technologies use in the calculation are appropriate before awarding credits.

Dwelling type: Mid-terrace House  
 Date of assessment: 01 August 2019  
 Produced by: Mitchel Armitage-Neiles  
 Total floor area: 82.76 m<sup>2</sup>

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<sub>2</sub>) emissions.



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.

The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO<sub>2</sub>) emissions. The higher the rating the less impact it has on the environment.

# SAP Input

## Property Details: Plot 116 Dart [Mid] DCC3

Address:  
 Located in: England  
 Region: South East England  
 UPRN:  
 Date of assessment: 01 August 2019  
 Date of certificate: 13 January 2020  
 Assessment type: New dwelling design stage  
 Transaction type: New dwelling  
 Tenure type: Unknown  
 Related party disclosure: No related party  
 Thermal Mass Parameter: Calculated 137.87  
 Water use <= 125 litres/person/day: True  
 PCDF Version: 454

## Property description:

Dwelling type: House  
 Detachment: Mid-terrace  
 Year Completed: 2019  
 Floor Location: Floor area: Storey height:  
 Floor 0 41.38 m<sup>2</sup> 2.31 m  
 Floor 1 41.38 m<sup>2</sup> 2.61 m  
 Living area: 14.96 m<sup>2</sup> (fraction 0.181)  
 Front of dwelling faces: North East

## Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
Door	Manufacturer	Solid	low-E, En = 0.2, hard coat	Yes	PVC-U
Front	Manufacturer	Windows	low-E, En = 0.2, hard coat	Yes	
Rear	Manufacturer	Windows	low-E, En = 0.2, hard coat	Yes	
Patio	Manufacturer	Windows	low-E, En = 0.2, hard coat	Yes	

Name:	Gap:	Frame Factor:	g-value:	U-value:	Area:	No. of Openings:
Door	16mm or more mm	0.7	0.72	1.1	2.05	1
Front	16mm or more	0.7	0.72	1.2	4.76	1
Rear	16mm or more	0.7	0.72	1.2	3	1
Patio	16mm or more	0.7	0.72	1.5	5.22	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
Door		Walls	North East	0	0
Front		Walls	North East	0	0
Rear		Walls	South West	0	0
Patio		Walls	South West	0	0

Overshading: Average or unknown

## Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
<u>External Elements</u>							
Walls	65.91	15.03	50.88	0.28	0	False	48
External Roof	41.38	0	41.38	0.11	0		9
Floor	41.38			0.12			75
<u>Internal Elements</u>							
Stud	137.01						9
Ceiling	41.38						9

# SAP Input

Floor	41.38	18
<u>Party Elements</u>		
Party Wall	65.45	48

## Thermal bridges:

Thermal bridges:	User-defined (individual PSI-values) Y-Value = 0.0432			
	<b>Length</b>	<b>Psi-value</b>		
	9.7	0.236	E1	Steel lintel with perforated steel base plate
	6.23	0.01	E3	Sill
	20.1	0.005	E4	Jamb
	18.19	0.089	E5	Ground floor (normal)
	9.16	-0.002	E6	Intermediate floor within a dwelling
	9.16	0.053	E10	Eaves (insulation at ceiling level)
	15.06	0.041	E18	Party wall between dwellings
	4.62	0.051	E16	Corner (normal)
	9.08	0.043	P1	Ground floor
	18.16	0.035	P4	Roof (insulation at ceiling level)

## Ventilation:

Pressure test:	Yes (As designed)
Ventilation:	Natural ventilation (extract fans)
Number of chimneys:	0
Number of open flues:	0
Number of fans:	3
Number of passive stacks:	0
Number of sides sheltered:	2
Pressure test:	5.01

## Main heating system:

Main heating system:	Boiler systems with radiators or underfloor heating
	Gas boilers and oil boilers
	Fuel: mains gas
	Info Source: Boiler Database
	Database: (rev 454, product index 017929) Efficiency: Winter 87.3 % Summer: 90.5
	Brand name: Ideal
	Model: LOGIC COMBI
	Model qualifier: ESP1 35
	(Combi boiler)
	Systems with radiators
	Central heating pump : 2013 or later
	Design flow temperature: Design flow temperature >45°C
	Boiler interlock: Yes
	Delayed start

## Main heating Control:

Main heating Control:	Programmer, room thermostat and TRVs
	Control code: 2106

## Secondary heating system:

Secondary heating system:	None
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## Water heating:

Water heating:	From main heating system
	Water code: 901
	Fuel :mains gas
	No hot water cylinder
	Solar panel: False

## Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown

# SAP Input

Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Low rise urban / suburban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

## SAP WorkSheet: New dwelling design stage

### User Details:

<b>Assessor Name:</b>	Mitchel Armitage-Neiles	<b>Stroma Number:</b>	STRO029948
<b>Software Name:</b>	Stroma FSAP 2012	<b>Software Version:</b>	Version: 1.0.4.23

Property Address: Plot 116 Dart [Mid] DCC3

### Address :

#### 1. Overall dwelling dimensions:

	Area(m <sup>2</sup> )		Av. Height(m)		Volume(m <sup>3</sup> )
Ground floor	41.38	(1a) x	2.31	(2a) =	95.59
First floor	41.38	(1b) x	2.61	(2b) =	108
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	82.76	(4)			
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	203.59

#### 2. Ventilation rate:

	main heating		secondary heating		other		total		m <sup>3</sup> per hour
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0
Number of open flues	0	+	0	+	0	=	0	x 20 =	0
Number of intermittent fans							3	x 10 =	30
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) =	30	÷ (5) =	0.15	(8)
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction <i>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</i>			0	(11)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5.01000022888184	(17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)			0.4	(18)
<i>Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used</i>				
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.34	(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=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
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# SAP WorkSheet: New dwelling design stage

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18
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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

	0.43	0.42	0.41	0.37	0.36	0.32	0.32	0.31	0.34	0.36	0.38	0.4
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Calculate effective air change rate for the applicable case

If mechanical ventilation:

0	(23a)
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If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)) , otherwise (23b) = (23a)

0	(23b)
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If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

0	(23c)
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a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) x [1 - (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)
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b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)
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c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)
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d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m<sup>2</sup> x 0.5]

(24d)m=	0.59	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.57	0.58	(24d)
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Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.59	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.57	0.58	(25)
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### 3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m <sup>2</sup> )	Openings m <sup>2</sup>	Net Area A ,m <sup>2</sup>	U-value W/m <sup>2</sup> K	A X U (W/K)	k-value kJ/m <sup>2</sup> -K	A X k kJ/K
Doors			2.05	x 1.1	= 2.255		(26)
Windows Type 1			4.76	x 1/[1/(1.2)+0.04]	= 5.45		(27)
Windows Type 2			3	x 1/[1/(1.2)+0.04]	= 3.44		(27)
Windows Type 3			5.22	x 1/[1/(1.5)+0.04]	= 7.39		(27)
Floor			41.38	x 0.12	= 4.9656	75	3103.5 (28)
Walls	65.91	15.03	50.88	x 0.28	= 14.25	48	2442.24 (29)
Roof	41.38	0	41.38	x 0.11	= 4.55	9	372.42 (30)
Total area of elements, m <sup>2</sup>			148.67				(31)
Party wall			65.45	x 0	= 0	48	3141.6 (32)
Internal wall **			137.01			9	1233.09 (32c)
Internal floor			41.38			18	744.84 (32d)
Internal ceiling			41.38			9	372.42 (32e)

\* for windows and roof windows, use effective window U-value calculated using formula 1/[1/(U-value)+0.04] as given in paragraph 3.2

\*\* include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 42.29 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 11410.11 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m<sup>2</sup>K = (34) ÷ (4) = 137.87 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f

# SAP WorkSheet: New dwelling design stage

can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 6.42 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 48.71 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	39.84	39.59	39.36	38.24	38.03	37.06	37.06	36.88	37.43	38.03	38.45	38.9	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	88.55	88.3	88.07	86.95	86.74	85.77	85.77	85.59	86.14	86.74	87.16	87.6	
Average = Sum(39) <sub>1...12</sub> / 12 =												86.95 (39)	

Heat loss parameter (HLP), W/m<sup>2</sup>K (40)m = (39)m ÷ (4)

(40)m=	1.07	1.07	1.06	1.05	1.05	1.04	1.04	1.03	1.04	1.05	1.05	1.06	
Average = Sum(40) <sub>1...12</sub> / 12 =												1.05 (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 2.51 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA - 13.9)<sup>2</sup>)] + 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 93.89 (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	
(44)m=	103.28	99.52	95.76	92.01	88.25	84.5	84.5	88.25	92.01	95.76	99.52	103.28	
Total = Sum(44) <sub>1...12</sub> =												1126.65 (44)	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

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=	153.16	133.95	138.22	120.51	115.63	99.78	92.46	106.1	107.37	125.13	136.59	148.32	
Total = Sum(45) <sub>1...12</sub> =												1477.21 (45)	

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

(46)m= 

22.97	20.09	20.73	18.08	17.34	14.97	13.87	15.92	16.11	18.77	20.49	22.25
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 (46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0 (50)

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

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

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

# SAP WorkSheet: New dwelling design stage

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) =

0
0

(54)  
 Enter (50) or (54) in (55) (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
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(56)

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
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(57)

Primary circuit loss (annual) from Table 3 

0
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(58)

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

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

14.12	12.75	14.07	13.58	14	13.52	13.94	13.98	13.55	14.04	13.64	14.11
-------	-------	-------	-------	----	-------	-------	-------	-------	-------	-------	-------

(61)

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

167.28	146.7	152.3	134.09	129.63	113.3	106.4	120.08	120.92	139.17	150.22	162.44
--------	-------	-------	--------	--------	-------	-------	--------	--------	--------	--------	--------

(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 FGHRHS and/or WWHRHS applies, see Appendix G)  
 (63)m= 

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

(63)

Output from water heater  
 (64)m= 

167.28	146.7	152.3	134.09	129.63	113.3	106.4	120.08	120.92	139.17	150.22	162.44
--------	-------	-------	--------	--------	-------	-------	--------	--------	--------	--------	--------

(64)  
Output from water heater (annual)<sub>1...12</sub>

1642.52
---------

Heat gains from water heating, kWh/month  $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$   
 (65)m= 

54.46	47.72	49.48	43.46	41.95	36.56	34.23	38.77	39.09	45.12	48.82	52.85
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(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
	150.79	150.79	150.79	150.79	150.79	150.79	150.79	150.79	150.79	150.79	150.79	150.79

(66)

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

52.55	46.68	37.96	28.74	21.48	18.14	19.6	25.47	34.19	43.41	50.67	54.01
-------	-------	-------	-------	-------	-------	------	-------	-------	-------	-------	-------

(67)

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

335.99	339.47	330.69	311.98	288.37	266.18	251.36	247.87	256.66	275.36	298.97	321.16
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

(68)

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

52.59	52.59	52.59	52.59	52.59	52.59	52.59	52.59	52.59	52.59	52.59	52.59
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(69)

Pumps and fans gains (Table 5a)  
 (70)m= 

3	3	3	3	3	3	3	3	3	3	3	3
---	---	---	---	---	---	---	---	---	---	---	---

(70)

Losses e.g. evaporation (negative values) (Table 5)  
 (71)m= 

-100.53	-100.53	-100.53	-100.53	-100.53	-100.53	-100.53	-100.53	-100.53	-100.53	-100.53	-100.53
---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------

(71)

Water heating gains (Table 5)  
 (72)m= 

73.19	71.02	66.5	60.37	56.38	50.77	46.01	52.12	54.29	60.64	67.81	71.03
-------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(72)

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

567.59	563.03	541.01	506.94	472.09	440.95	422.82	431.31	450.99	485.27	523.31	552.06
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

(73)

## 6. Solar gains:

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

# SAP WorkSheet: New dwelling design stage

Orientation:	Access Factor Table 6d	Area m <sup>2</sup>	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)
Northeast 0.9x	0.77	4.76	11.28	0.72	0.7	18.76 (75)
Northeast 0.9x	0.77	4.76	22.97	0.72	0.7	38.18 (75)
Northeast 0.9x	0.77	4.76	41.38	0.72	0.7	68.79 (75)
Northeast 0.9x	0.77	4.76	67.96	0.72	0.7	112.98 (75)
Northeast 0.9x	0.77	4.76	91.35	0.72	0.7	151.87 (75)
Northeast 0.9x	0.77	4.76	97.38	0.72	0.7	161.91 (75)
Northeast 0.9x	0.77	4.76	91.1	0.72	0.7	151.46 (75)
Northeast 0.9x	0.77	4.76	72.63	0.72	0.7	120.74 (75)
Northeast 0.9x	0.77	4.76	50.42	0.72	0.7	83.83 (75)
Northeast 0.9x	0.77	4.76	28.07	0.72	0.7	46.66 (75)
Northeast 0.9x	0.77	4.76	14.2	0.72	0.7	23.6 (75)
Northeast 0.9x	0.77	4.76	9.21	0.72	0.7	15.32 (75)
Southwest 0.9x	0.77	3	36.79	0.72	0.7	38.55 (79)
Southwest 0.9x	0.77	5.22	36.79	0.72	0.7	67.08 (79)
Southwest 0.9x	0.77	3	62.67	0.72	0.7	65.67 (79)
Southwest 0.9x	0.77	5.22	62.67	0.72	0.7	114.27 (79)
Southwest 0.9x	0.77	3	85.75	0.72	0.7	89.85 (79)
Southwest 0.9x	0.77	5.22	85.75	0.72	0.7	156.34 (79)
Southwest 0.9x	0.77	3	106.25	0.72	0.7	111.33 (79)
Southwest 0.9x	0.77	5.22	106.25	0.72	0.7	193.72 (79)
Southwest 0.9x	0.77	3	119.01	0.72	0.7	124.7 (79)
Southwest 0.9x	0.77	5.22	119.01	0.72	0.7	216.98 (79)
Southwest 0.9x	0.77	3	118.15	0.72	0.7	123.8 (79)
Southwest 0.9x	0.77	5.22	118.15	0.72	0.7	215.41 (79)
Southwest 0.9x	0.77	3	113.91	0.72	0.7	119.36 (79)
Southwest 0.9x	0.77	5.22	113.91	0.72	0.7	207.68 (79)
Southwest 0.9x	0.77	3	104.39	0.72	0.7	109.38 (79)
Southwest 0.9x	0.77	5.22	104.39	0.72	0.7	190.32 (79)
Southwest 0.9x	0.77	3	92.85	0.72	0.7	97.29 (79)
Southwest 0.9x	0.77	5.22	92.85	0.72	0.7	169.29 (79)
Southwest 0.9x	0.77	3	69.27	0.72	0.7	72.58 (79)
Southwest 0.9x	0.77	5.22	69.27	0.72	0.7	126.29 (79)
Southwest 0.9x	0.77	3	44.07	0.72	0.7	46.18 (79)
Southwest 0.9x	0.77	5.22	44.07	0.72	0.7	80.35 (79)
Southwest 0.9x	0.77	3	31.49	0.72	0.7	32.99 (79)
Southwest 0.9x	0.77	5.22	31.49	0.72	0.7	57.41 (79)

Solar gains in watts, calculated for each month

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

(83)m=	124.39	218.12	314.99	418.03	493.55	501.12	478.49	420.45	350.41	245.53	150.13	105.72	(83)
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Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	691.98	781.15	856	924.97	965.64	942.06	901.31	851.77	801.4	730.8	673.44	657.78	(84)
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# SAP WorkSheet: New dwelling design stage

## 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	0.94	0.9	0.82	0.7	0.54	0.41	0.44	0.65	0.85	0.94	0.96	(86)

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

(87)m=	19.53	19.76	20.08	20.47	20.76	20.93	20.98	20.97	20.87	20.49	19.95	19.49	(87)
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Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.03	20.03	20.03	20.04	20.04	20.05	20.05	20.05	20.05	20.04	20.04	20.03	(88)
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Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.95	0.93	0.88	0.79	0.65	0.47	0.32	0.36	0.58	0.82	0.92	0.96	(89)
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Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.7	18.92	19.24	19.61	19.87	20.01	20.05	20.04	19.97	19.64	19.12	18.67	(90)
--------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) = 0.18 (91)

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

(92)m=	18.85	19.08	19.39	19.77	20.04	20.18	20.21	20.21	20.13	19.79	19.27	18.82	(92)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(93)m=	18.7	18.93	19.24	19.62	19.89	20.03	20.06	20.06	19.98	19.64	19.12	18.67	(93)
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## 8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,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	0.91	0.86	0.78	0.64	0.47	0.32	0.36	0.58	0.8	0.91	0.95	(94)
--------	------	------	------	------	------	------	------	------	------	-----	------	------	------

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	649.13	711.57	739.83	718.88	622.23	444.21	292.84	307.14	462.53	585.52	611.78	622.03	(95)
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Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
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Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m ]

(97)m=	1275.39	1238.47	1122.29	931.99	710.01	465.65	297.13	313.39	506.42	784.5	1048	1267.27	(97)
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Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	465.93	354.08	284.55	153.44	65.3	0	0	0	0	148.04	314.08	480.06	
Total per year (kWh/year) = Sum(98) <sub>1...5,9...12</sub> =												2265.49	(98)

Space heating requirement in kWh/m<sup>2</sup>/year 27.37 (99)

## 9a. Energy requirements – Individual heating systems including micro-CHP)

### Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 90.5 (206)

Efficiency of secondary/supplementary heating system, % 0 (208)

## SAP WorkSheet: New dwelling design stage

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)												
465.93	354.08	284.55	153.44	65.3	0	0	0	0	148.04	314.08	480.06	
$(211)m = \{[(98)m \times (204)]\} \times 100 \div (206)$												(211)
514.84	391.25	314.42	169.55	72.16	0	0	0	0	163.58	347.05	530.45	
$Total (kWh/year) = \text{Sum}(211)_{1..5,10..12} =$											2503.3 (211)	
Space heating fuel (secondary), kWh/month												
$= \{[(98)m \times (201)]\} \times 100 \div (208)$												
$(215)m =$												
0	0	0	0	0	0	0	0	0	0	0	0	
$Total (kWh/year) = \text{Sum}(215)_{1..5,10..12} =$											0 (215)	

### Water heating

Output from water heater (calculated above)												
167.28	146.7	152.3	134.09	129.63	113.3	106.4	120.08	120.92	139.17	150.22	162.44	
Efficiency of water heater												87.3 (216)
$(217)m =$												(217)
89.63	89.54	89.36	88.98	88.35	87.3	87.3	87.3	87.3	88.92	89.44	89.67	
Fuel for water heating, kWh/month												
$(219)m = (64)m \times 100 \div (217)m$												
$(219)m =$												
186.63	163.84	170.44	150.69	146.73	129.78	121.88	137.55	138.51	156.51	167.96	181.15	
$Total = \text{Sum}(219a)_{1..12} =$											1851.67 (219)	

### Annual totals

	kWh/year	kWh/year
Space heating fuel used, main system 1		2503.3
Water heating fuel used		1851.67
Electricity for pumps, fans and electric keep-hot		
central heating pump:	30	(230c)
boiler with a fan-assisted flue	45	(230e)
Total electricity for the above, kWh/year	$\text{sum of } (230a)...(230g) =$	75 (231)
Electricity for lighting		371.24 (232)

### 10a. Fuel costs - individual heating systems:

	Fuel kWh/year		Fuel Price (Table 12)		Fuel Cost £/year
Space heating - main system 1	(211) x		3.48	x 0.01 =	87.11 (240)
Space heating - main system 2	(213) x		0	x 0.01 =	0 (241)
Space heating - secondary	(215) x		13.19	x 0.01 =	0 (242)
Water heating cost (other fuel)	(219)		3.48	x 0.01 =	64.44 (247)
Pumps, fans and electric keep-hot	(231)		13.19	x 0.01 =	9.89 (249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a)					
Energy for lighting	(232)		13.19	x 0.01 =	48.97 (250)
Additional standing charges (Table 12)					120 (251)
Appendix Q items: repeat lines (253) and (254) as needed					
<b>Total energy cost</b>		$(245)...(247) + (250)...(254) =$			330.41 (255)

# SAP WorkSheet: New dwelling design stage

## 11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	$[(255) \times (256)] \div [(4) + 45.0] =$	1.09	(257)
<b>SAP rating (Section 12)</b>		84.85	(258)

## 12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year
Space heating (main system 1)	(211) x	0.216	=	540.71 (261)
Space heating (secondary)	(215) x	0.519	=	0 (263)
Water heating	(219) x	0.216	=	399.96 (264)
Space and water heating	(261) + (262) + (263) + (264) =			940.67 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93 (267)
Electricity for lighting	(232) x	0.519	=	192.67 (268)
Total CO2, kg/year		sum of (265)...(271) =		1172.27 (272)
<b>CO2 emissions per m<sup>2</sup></b>		(272) ÷ (4) =		14.16 (273)
El rating (section 14)				88 (274)

## 13a. Primary Energy

	Energy kWh/year	Primary factor		P. Energy kWh/year
Space heating (main system 1)	(211) x	1.22	=	3054.03 (261)
Space heating (secondary)	(215) x	3.07	=	0 (263)
Energy for water heating	(219) x	1.22	=	2259.04 (264)
Space and water heating	(261) + (262) + (263) + (264) =			5313.06 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	3.07	=	230.25 (267)
Electricity for lighting	(232) x	0	=	1139.7 (268)
'Total Primary Energy		sum of (265)...(271) =		6683.01 (272)
<b>Primary energy kWh/m<sup>2</sup>/year</b>		(272) ÷ (4) =		80.75 (273)

# SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 13 January 2020

## Property Details: Plot 116 Dart [Mid] DCC3

<b>Dwelling type:</b>	Mid-terrace House
<b>Located in:</b>	England
<b>Region:</b>	South East England
<b>Cross ventilation possible:</b>	Yes
<b>Number of storeys:</b>	2
<b>Front of dwelling faces:</b>	North East
<b>Overshading:</b>	Average or unknown
<b>Overhangs:</b>	None
<b>Thermal mass parameter:</b>	Calculated 137.87
<b>Night ventilation:</b>	False
<b>Blinds, curtains, shutters:</b>	None
<b>Ventilation rate during hot weather (ach):</b>	8 ( Windows fully open)

## Overheating Details:

<b>Summer ventilation heat loss coefficient:</b>	537.48	<b>(P1)</b>
<b>Transmission heat loss coefficient:</b>	48.7	
<b>Summer heat loss coefficient:</b>	586.18	<b>(P2)</b>

## Overhangs:

<b>Orientation:</b>	<b>Ratio:</b>	<b>Z_overhangs:</b>
North East (Front)	0	1
South West (Rear)	0	1
South West (Patio)	0	1

## Solar shading:

<b>Orientation:</b>	<b>Z blinds:</b>	<b>Solar access:</b>	<b>Overhangs:</b>	<b>Z summer:</b>	
North East (Front)	1	0.9	1	0.9	<b>(P8)</b>
South West (Rear)	1	0.9	1	0.9	<b>(P8)</b>
South West (Patio)	1	0.9	1	0.9	<b>(P8)</b>

## Solar gains:

<b>Orientation</b>		<b>Area</b>	<b>Flux</b>	<b>g_</b>	<b>FF</b>	<b>Shading</b>	<b>Gains</b>	
North East (Front)	0.9 x	4.76	105.45	0.72	0.7	0.9	204.92	
South West (Rear)	0.9 x	3	126.97	0.72	0.7	0.9	155.5	
South West (Patio)	0.9 x	5.22	126.97	0.72	0.7	0.9	270.58	
						<b>Total</b>	631	<b>(P3/P4)</b>

## Internal gains:

	<b>June</b>	<b>July</b>	<b>August</b>	
Internal gains	437.95	419.82	428.31	
Total summer gains	1106.95	1050.82	986.28	<b>(P5)</b>
Summer gain/loss ratio	1.89	1.79	1.68	<b>(P6)</b>
Mean summer external temperature (South East England)	15.4	17.4	17.5	
Thermal mass temperature increment	1.03	1.03	1.03	
Threshold temperature	18.32	20.23	20.22	<b>(P7)</b>
<b>Likelihood of high internal temperature</b>	<b>Not significant</b>	<b>Not significant</b>	<b>Not significant</b>	

**Assessment of likelihood of high internal temperature:** Not significant