# Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.33
*Printed on 10 March 2021 at 09:52:50*

## Project Information:

| | | | |
|---|---|---|---|
| **Assessed By:** | Natalie King (STRO034719) | **Building Type:** | End-terrace House |

## Dwelling Details:

| | | | |
|---|---|---|---|
| **NEW DWELLING DESIGN STAGE** | | Total Floor Area: 105.84m² | |
| **Site Reference :** | Lavant View - The Spires, Chichester | **Plot Reference:** | 118 Tweed [End] DCC2 |
| **Address :** | | | |

## Client Details:

**Name:** Redrow Homes Southern Counties Limited
**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 kg/m² | |
| Dwelling Carbon Dioxide Emission Rate (DER) | 16.41 kg/m² | **OK** |

## 1b TFEE and DFEE

| | | |
|---|---|---|
| Target Fabric Energy Efficiency (TFEE) | 49.8 kWh/m² | |
| Dwelling Fabric Energy Efficiency (DFEE) | 44.6 kWh/m² | |
| | | **OK** |

## 2 Fabric U-values

| **Element** | **Average** | **Highest** | |
|---|---|---|---|
| External wall | 0.28 (max. 0.30) | 0.28 (max. 0.70) | **OK** |
| Party wall | 0.00 (max. 0.20) | - | **OK** |
| Floor | 0.12 (max. 0.25) | 0.12 (max. 0.70) | **OK** |
| Roof | 0.12 (max. 0.20) | 0.21 (max. 0.35) | **OK** |
| Openings | 1.23 (max. 2.00) | 1.50 (max. 3.30) | **OK** |

## 2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

## 3 Air permeability

| | | |
|---|---|---|
| Air permeability at 50 pascals | 5.01 (design value) | |
| Maximum | 10.0 | **OK** |

## 4 Heating efficiency

| | | |
|---|---|---|
| Main Heating system: | Database: (rev 473, product index 017929):<br>Boiler systems with radiators or underfloor heating - mains gas<br>Brand name: Ideal<br>Model: LOGIC COMBI<br>Model qualifier: ESP1 35<br>(Combi)<br>Efficiency 89.6 % SEDBUK2009<br>Minimum 88.0 % | **OK** |
| Secondary heating system: | None | |

# Regulations Compliance Report

## 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<br>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 | 1.84m² |
| Windows facing: North East | 1.28m² |
| Windows facing: South West | 1.31m² |
| Windows facing: North East | 2.43m² |
| Windows facing: South West | 1.31m² |
| Windows facing: South West | 1.31m² |
| Ventilation rate: | 4.00 |
| Blinds/curtains: | Dark-coloured curtain or roller blind<br>Closed 100% of daylight hours |

## 10 Key features

| | |
|---|---|
| Thermal bridging | 0.036 W/m²K |
| Doors U-value | 1.1 W/m²K |
| Roofs U-value | 0.11 W/m²K |
| Party Walls U-value | 0 W/m²K |
| Floors U-value | 0.12 W/m²K |

# Code for Sustainable Homes Report

For use with Nov 2010 addendum 2014 England

## Assessor and House Details

**Assessor Name:** Natalie King **Assessor Number:** STRO034719

**Property Address:**

## Buiding regulation assessment

| | kg/m²/year |
|---|---|
| TER | 17 |
| DER | 16.41 |

## ENE 1 Assessment - Dwelling Emission Rate

**Total Energy Type $CO_2$ Emissions for Codes Levels 1 - 5**

| | % | kg/m²/year | |
|---|---|---|---|
| DER from SAP 2012 DER Worksheet | | 16.41 | *(ZC1)* |
| TER | | 17 | |
| Residual CO2 emissions offset from biofuel CHP | | 0 | *(ZC5)* |
| CO2 emissions offset from additional allowable electricty generation | | 0 | *(ZC7)* |
| Total CO2 emissions offset from SAP Section 16 allowances | | 0 | |
| DER accounting for SAP Section 16 allowances | | 16.41 | |
| % improvement DER/TER | 3.5 | | |

**Total Energy Type CO2 Emissions for Codes Levels 6**

| | kg/m²/year | |
|---|---|---|
| DER accounting for SAP Section 16 allowances | 16.41 | *(ZC1)* |
| CO2 emissions from appliances, equation (L14) | 14.8 | *(ZC2)* |
| CO2 emissions from cooking, equation (L16) | 1.76 | *(ZC3)* |
| Net CO2 emissions | 34.4 | *(ZC8)* |

**Result:**

**Credits awarded for ENE 1 = 0.5**

**Code Level = 3**

## ENE 2 - Fabric energy Efficiency

**Fabric energy Efficiency: 44.61**

**Credits awarded for ENE 2 = 7.3**

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

**Reduction in CO2 Emissions**

| | % | kg/m²/year |
|---|---|---|
| Standard Case CO2 emissions | | 34.42 |
| Standard DER | | 17.86 |
| Actual Case CO2 emissions | | 34.42 |
| Actual DER | | 17.86 |
| Reduction in CO2 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 responsibly of the Accredited OCDEA and Code Assessor to ensure all technologies use in the calculation are appropriate before awarding credits.

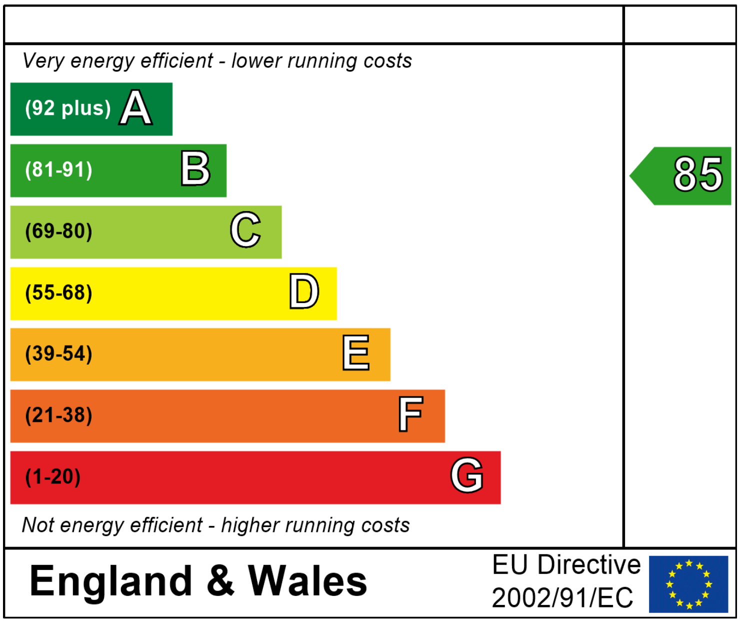
# Predicted Energy Assessment

| | |
|---|---|
| Dwelling type: | End-terrace House |
| Date of assessment: | 24 February 2021 |
| Produced by: | Natalie King |
| Total floor area: | 105.84 m² |

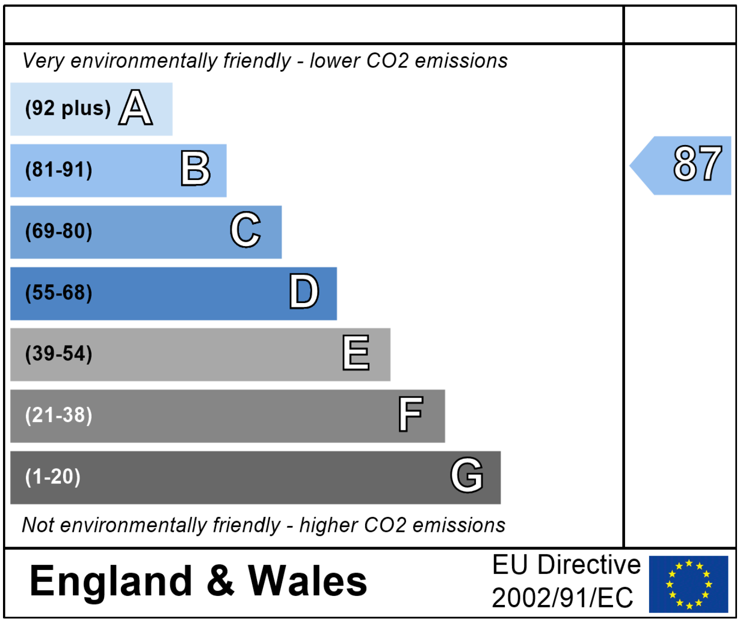
This is a Predicted Energy Assessment for a property which is not yet complete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, an Energy Performance Certificate is required providing information about 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 (CO2) emissions.

## Energy Efficiency Rating




## Environmental Impact ($CO_2$) 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.

The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO2) emissions. The higher the rating the less impact it has on the environment.

# SAP Input

## Property Details: 118 Tweed [End] DCC2

| | |
|---|---|
| Address: | |
| Located in: | England |
| Region: | South East England |
| UPRN: | |
| Date of assessment: | 24 February 2021 |
| Date of certificate: | 10 March 2021 |
| Assessment type: | New dwelling design stage |
| Transaction type: | New dwelling |
| Tenure type: | Unknown |
| Related party disclosure: | No related party |
| Thermal Mass Parameter: | Calculated 245.4 |
| Water use <= 125 litres/person/day: | True |
| PCDF Version: | 473 |

## Property description:

| | | |
|---|---|---|
| Dwelling type: | House | |
| Detachment: | End-terrace | |
| Year Completed: | 2021 | |
| Floor Location: | Floor area: | Storey height: |
| Floor 0 | 52.92 m² | 2.31 m |
| Floor 1 | 52.92 m² | 2.61 m |
| Living area: | 15.18 m² (fraction 0.143) | |
| Front of dwelling faces: | North East | |

## Opening types:

| Name: | Source: | Type: | Glazing: | Argon: | Frame: |
|---|---|---|---|---|---|
| D_28 | Manufacturer | Solid | low-E, En = 0.2, hard coat | Yes | PVC-U |
| D_29 | Manufacturer | Solid | | | PVC-U |
| W_133 | Manufacturer | Windows | low-E, En = 0.2, hard coat | Yes | |
| W_134 | Manufacturer | Windows | low-E, En = 0.2, hard coat | Yes | |
| W_135 | Manufacturer | Windows | low-E, En = 0.2, hard coat | Yes | |
| W_136 | Manufacturer | Windows | low-E, En = 0.2, hard coat | Yes | |
| W_137 | Manufacturer | Windows | low-E, En = 0.2, hard coat | Yes | |
| W_138 | Manufacturer | Windows | low-E, En = 0.2, hard coat | Yes | |

| **Name:** | **Gap:** | **Frame Factor:** | **g-value:** | **U-value:** | **Area:** | **No. of Openings:** |
|---|---|---|---|---|---|---|
| D_28 | 16mm or more mm | 0.7 | 0.72 | 1.5 | 2.06 | 1 |
| D_29 | mm | 0.7 | 0.72 | 1.1 | 1.89 | 1 |
| W_133 | 16mm or more | 0.7 | 0.72 | 1.2 | 1.84 | 1 |
| W_134 | 16mm or more | 0.7 | 0.72 | 1.2 | 1.28 | 1 |
| W_135 | 16mm or more | 0.7 | 0.72 | 1.2 | 1.31 | 1 |
| W_136 | 16mm or more | 0.7 | 0.72 | 1.2 | 2.43 | 1 |
| W_137 | 16mm or more | 0.7 | 0.72 | 1.2 | 1.31 | 1 |
| W_138 | 16mm or more | 0.7 | 0.72 | 1.2 | 1.31 | 1 |

| Name: | Type-Name: | Location: | Orient: | Width: | Height: |
|---|---|---|---|---|---|
| D_28 | | External Wall | South West | 2.06 | 1 |
| D_29 | | External Wall | North East | 1.89 | 1 |
| W_133 | | External Wall | North East | 1.84 | 1 |
| W_134 | | External Wall | North East | 1.28 | 1 |
| W_135 | | External Wall | South West | 1.31 | 1 |
| W_136 | | External Wall | North East | 2.43 | 1 |
| W_137 | | External Wall | South West | 1.31 | 1 |
| W_138 | | External Wall | South West | 1.31 | 1 |

# SAP Input

Overshading: Average or unknown

## Opaque Elements:

| Type: | Gross area: | Openings: | Net area: | U-value: | Ru value: | Curtain wall: | Kappa: |
|---|---|---|---|---|---|---|---|
| External Elements | | | | | | | |
| External Wall | 98.01 | 13.43 | 84.58 | 0.28 | 0 | False | 150 |
| Roof | 47.47 | 0 | 47.47 | 0.11 | 0 | | 9 |
| Sloping | 6.78 | 0 | 6.78 | 0.21 | 0 | | 9 |
| Ground Floor | 52.92 | | | 0.12 | | | 75 |
| Internal Elements | | | | | | | |
| Block | 36.96 | | | | | | 75 |
| Stud | 164.14 | | | | | | 9 |
| Ceiling | 52.92 | | | | | | 9 |
| Floor | 52.92 | | | | | | 18 |
| Party Elements | | | | | | | |
| Party Wall | 45.01 | | | | | | 70 |

## Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0365

| Length | Psi-value | | |
|---|---|---|---|
| 10.48 | 0.236 | E1 | Steel lintel with perforated steel base plate |
| 8.6 | 0.01 | E3 | Sill |
| 21.48 | 0.005 | E4 | Jamb |
| 20.72 | 0.089 | E5 | Ground floor (normal) |
| 20.72 | -0.002 | E6 | Intermediate floor within a dwelling |
| 19.64 | 0.053 | E10 | Eaves (insulation at ceiling level) |
| 21.58 | 0.017 | E11 | Eaves (insulation at rafter level) |
| 9.46 | 0.051 | E16 | Corner (normal) |
| 9.46 | 0.041 | E18 | Party wall between dwellings |
| 9.14 | 0.043 | P1 | Ground floor |
| 9.14 | 0 | P2 | Intermediate floor within a dwelling |
| 8.6 | 0.035 | P4 | Roof (insulation at ceiling level) |
| 0.67 | 0.058 | P5 | Roof (insulation at rafter level) |

## Ventilation:

Pressure test: Yes (As designed)
Ventilation: Natural ventilation (extract fans)
Number of chimneys: 0
Number of open flues: 0
Number of fans: 2
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 473, 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

# SAP Input

| | |
|---|---|
| | Design flow temperature: Design flow temperature >45°C<br>Boiler interlock: Yes<br>Delayed start |
| **Main heating Control:** | |
| Main heating Control: | Programmer, room thermostat and TRVs<br>Control code: 2106 |
| **Secondary heating system:** | |
| Secondary heating system: | None |
| **Water heating:** | |
| Water heating: | From main heating system<br>Water code: 901<br>Fuel :mains gas<br>No hot water cylinder<br>Solar panel: False |
| **Others:** | |
| Electricity tariff: | Standard Tariff |
| In Smoke Control Area: | Unknown |
| 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:

| | | | |
|---|---|---|---|
| **Assessor Name:** | Natalie King | **Stroma Number:** | STRO034719 |
| **Software Name:** | Stroma FSAP 2012 | **Software Version:** | Version: 1.0.5.33 |

Property Address: 118 Tweed [End] DCC2

**Address :**

## 1. Overall dwelling dimensions:

| | Area(m²) | | | Av. Height(m) | | | Volume(m³) | |
|---|---|---|---|---|---|---|---|---|
| Ground floor | 52.92 | (1a) | x | 2.31 | (2a) | = | 122.25 | (3a) |
| First floor | 52.92 | (1b) | x | 2.61 | (2b) | = | 138.12 | (3b) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n) | 105.84 | (4) | | | | | | |
| Dwelling volume | | | | (3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) | | = | 260.37 | (5) |

## 2. Ventilation rate:

| | main heating | | secondary heating | | other | | total | | m³ per hour | |
|---|---|---|---|---|---|---|---|---|---|---|
| Number of chimneys | 0 | + | 0 | + | 0 | = | 0 | x 40 = | 0 | (6a) |
| Number of open flues | 0 | + | 0 | + | 0 | = | 0 | x 20 = | 0 | (6b) |
| Number of intermittent fans | | | | | | | 2 | x 10 = | 20 | (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 and fans = (6a)+(6b)+(7a)+(7b)+(7c) = | 20 | ÷ (5) = | 0.08 | (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) | | 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 | | 0 | (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 | (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) | 0.33 | (18) |
| *Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used* | | | |
| 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) = | 0.28 | (21) |

Infiltration rate modified for monthly wind speed

Monthly average wind speed from Table 7

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (22)m= | 5.1 | 5 | 4.9 | 4.4 | 4.3 | 3.8 | 3.8 | 3.7 | 4 | 4.3 | 4.5 | 4.7 |

# 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 |

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.35 | 0.35 | 0.34 | 0.31 | 0.3 | 0.26 | 0.26 | 0.26 | 0.28 | 0.3 | 0.31 | 0.33 |

*Calculate effective air change rate for the applicable case*

If mechanical ventilation: 0 (23a)

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

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

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24a)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24a) |

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) |

c) If whole house extract ventilation or positive input ventilation from outside

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24c)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24c) |

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)m² x 0.5]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24d)m= | 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 box (25)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (25)m= | 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) | k-value kJ/m²·K | A X k kJ/K | |
|---|---|---|---|---|---|---|---|---|---|---|
| Doors Type 1 | | | 2.06 | x | 1.5 | = | 3.09 | | | (26) |
| Doors Type 2 | | | 1.89 | x | 1.1 | = | 2.079 | | | (26) |
| Windows Type 1 | | | 1.84 | x1/[1/( 1.2 )+ 0.04] | | = | 2.11 | | | (27) |
| Windows Type 2 | | | 1.28 | x1/[1/( 1.2 )+ 0.04] | | = | 1.47 | | | (27) |
| Windows Type 3 | | | 1.31 | x1/[1/( 1.2 )+ 0.04] | | = | 1.5 | | | (27) |
| Windows Type 4 | | | 2.43 | x1/[1/( 1.2 )+ 0.04] | | = | 2.78 | | | (27) |
| Windows Type 5 | | | 1.31 | x1/[1/( 1.2 )+ 0.04] | | = | 1.5 | | | (27) |
| Windows Type 6 | | | 1.31 | x1/[1/( 1.2 )+ 0.04] | | = | 1.5 | | | (27) |
| Floor | | | 52.92 | x | 0.12 | = | 6.350399 | 75 | 3969 | (28) |
| Walls | 98.01 | 13.43 | 84.58 | x | 0.28 | = | 23.68 | 150 | 12687 | (29) |
| Roof Type1 | 47.47 | 0 | 47.47 | x | 0.11 | = | 5.22 | 9 | 427.23 | (30) |
| Roof Type2 | 6.78 | 0 | 6.78 | x | 0.21 | = | 1.42 | 9 | 61.02 | (30) |
| Total area of elements, m² | | | 205.18 | | | | | | | (31) |
| Party wall | | | 45.01 | x | 0 | = | 0 | 70 | 3150.7 | (32) |
| Internal wall ** | | | 36.96 | | | | | 75 | 2772 | (32c) |
| Internal wall ** | | | 164.14 | | | | | 9 | 1477.26 | (32c) |
| Internal floor | | | 52.92 | | | | | 18 | 952.5599 | (32d) |

# SAP WorkSheet: New dwelling design stage

| | | | | |
|---|---|---|---|---|
| Internal ceiling | 52.92 | 9 | 476.28 | (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) = | 52.7 | (33) |
| Heat capacity Cm = S(A x k ) | ((28)…(30) + (32) + (32a)…(32e) = | 25973.05 | (34) |
| Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K | = (34) ÷ (4) = | 245.4 | (35) |

*For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.*

| | | | |
|---|---|---|---|
| Thermal bridges : S (L x Y) calculated using Appendix K | | 7.48 | (36) |

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

| | | | |
|---|---|---|---|
| Total fabric heat loss | (33) + (36) = | 60.18 | (37) |

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

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (38)m= | 48.37 | 48.16 | 47.95 | 46.98 | 46.8 | 45.96 | 45.96 | 45.81 | 46.29 | 46.8 | 47.17 | 47.55 | (38) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (39)m= | 108.55 | 108.34 | 108.13 | 107.17 | 106.99 | 106.14 | 106.14 | 105.99 | 106.47 | 106.99 | 107.35 | 107.73 | |

Average = Sum(39)$_{1…12}$ /12= 107.17 (39)

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (40)m= | 1.03 | 1.02 | 1.02 | 1.01 | 1.01 | 1 | 1 | 1 | 1.01 | 1.01 | 1.01 | 1.02 | |

Average = Sum(40)$_{1…12}$ /12= 1.01 (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 2.79 (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) + 36 100.4 (43)
*Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 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= | 110.44 | 106.43 | 102.41 | 98.39 | 94.38 | 90.36 | 90.36 | 94.38 | 98.39 | 102.41 | 106.43 | 110.44 | |

Total = Sum(44)$_{1…12}$ = 1204.81 (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= | 163.78 | 143.24 | 147.81 | 128.87 | 123.65 | 106.7 | 98.88 | 113.46 | 114.82 | 133.81 | 146.06 | 158.61 | |

Total = Sum(45)$_{1…12}$ = 1579.7 (45)

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (46)m= | 24.57 | 21.49 | 22.17 | 19.33 | 18.55 | 16.01 | 14.83 | 17.02 | 17.22 | 20.07 | 21.91 | 23.79 | (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)

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| | | | |
|---|---|---|---|
| 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) |
| Energy lost from water storage, kWh/year | (47) x (51) x (52) x (53) = | 0 | (54) |
| Enter (50) or (54) in (55) | | 0 | (55) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (56)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (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 | (57) |

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 | (59) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (61)m= | 14.15 | 12.77 | 14.11 | 13.62 | 14.04 | 13.54 | 13.97 | 14.01 | 13.58 | 14.08 | 13.66 | 14.14 | (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= | 177.93 | 156.01 | 161.93 | 142.49 | 137.69 | 120.25 | 112.85 | 127.47 | 128.4 | 147.89 | 159.72 | 172.75 | (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 | (63) |

Output from water heater

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (64)m= | 177.93 | 156.01 | 161.93 | 142.49 | 137.69 | 120.25 | 112.85 | 127.47 | 128.4 | 147.89 | 159.72 | 172.75 |

Output from water heater (annual)$_{1…12}$ — 1745.37 (64)

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (65)m= | 57.99 | 50.82 | 52.68 | 46.25 | 44.62 | 38.86 | 36.37 | 41.23 | 41.57 | 48.01 | 51.98 | 56.27 | (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

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (66)m= | 167.24 | 167.24 | 167.24 | 167.24 | 167.24 | 167.24 | 167.24 | 167.24 | 167.24 | 167.24 | 167.24 | 167.24 | (66) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (67)m= | 69.87 | 62.06 | 50.47 | 38.21 | 28.56 | 24.11 | 26.06 | 33.87 | 45.46 | 57.72 | 67.37 | 71.82 | (67) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (68)m= | 396.18 | 400.29 | 389.93 | 367.87 | 340.03 | 313.87 | 296.39 | 292.28 | 302.64 | 324.69 | 352.53 | 378.7 | (68) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (69)m= | 54.51 | 54.51 | 54.51 | 54.51 | 54.51 | 54.51 | 54.51 | 54.51 | 54.51 | 54.51 | 54.51 | 54.51 | (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= | -111.5 | -111.5 | -111.5 | -111.5 | -111.5 | -111.5 | -111.5 | -111.5 | -111.5 | -111.5 | -111.5 | -111.5 | (71) |

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Water heating gains (Table 5)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (72)m= | 77.95 | 75.63 | 70.8 | 64.24 | 59.98 | 53.98 | 48.88 | 55.42 | 57.74 | 64.53 | 72.2 | 75.64 | (72) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (73)m= | 657.26 | 651.23 | 624.46 | 583.58 | 541.83 | 505.22 | 484.59 | 494.82 | 519.09 | 560.2 | 605.35 | 639.41 | (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 m² | | Flux Table 6a | | g_ Table 6b | | FF Table 6c | | Gains (W) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Northeast 0.9x | 0.77 | x | 1.84 | x | 11.28 | x | 0.72 | x | 0.7 | = | 7.25 | (75) |
| Northeast 0.9x | 0.77 | x | 1.28 | x | 11.28 | x | 0.72 | x | 0.7 | = | 5.04 | (75) |
| Northeast 0.9x | 0.77 | x | 2.43 | x | 11.28 | x | 0.72 | x | 0.7 | = | 9.58 | (75) |
| Northeast 0.9x | 0.77 | x | 1.84 | x | 22.97 | x | 0.72 | x | 0.7 | = | 14.76 | (75) |
| Northeast 0.9x | 0.77 | x | 1.28 | x | 22.97 | x | 0.72 | x | 0.7 | = | 10.27 | (75) |
| Northeast 0.9x | 0.77 | x | 2.43 | x | 22.97 | x | 0.72 | x | 0.7 | = | 19.49 | (75) |
| Northeast 0.9x | 0.77 | x | 1.84 | x | 41.38 | x | 0.72 | x | 0.7 | = | 26.59 | (75) |
| Northeast 0.9x | 0.77 | x | 1.28 | x | 41.38 | x | 0.72 | x | 0.7 | = | 18.5 | (75) |
| Northeast 0.9x | 0.77 | x | 2.43 | x | 41.38 | x | 0.72 | x | 0.7 | = | 35.12 | (75) |
| Northeast 0.9x | 0.77 | x | 1.84 | x | 67.96 | x | 0.72 | x | 0.7 | = | 43.67 | (75) |
| Northeast 0.9x | 0.77 | x | 1.28 | x | 67.96 | x | 0.72 | x | 0.7 | = | 30.38 | (75) |
| Northeast 0.9x | 0.77 | x | 2.43 | x | 67.96 | x | 0.72 | x | 0.7 | = | 57.68 | (75) |
| Northeast 0.9x | 0.77 | x | 1.84 | x | 91.35 | x | 0.72 | x | 0.7 | = | 58.7 | (75) |
| Northeast 0.9x | 0.77 | x | 1.28 | x | 91.35 | x | 0.72 | x | 0.7 | = | 40.84 | (75) |
| Northeast 0.9x | 0.77 | x | 2.43 | x | 91.35 | x | 0.72 | x | 0.7 | = | 77.53 | (75) |
| Northeast 0.9x | 0.77 | x | 1.84 | x | 97.38 | x | 0.72 | x | 0.7 | = | 62.59 | (75) |
| Northeast 0.9x | 0.77 | x | 1.28 | x | 97.38 | x | 0.72 | x | 0.7 | = | 43.54 | (75) |
| Northeast 0.9x | 0.77 | x | 2.43 | x | 97.38 | x | 0.72 | x | 0.7 | = | 82.65 | (75) |
| Northeast 0.9x | 0.77 | x | 1.84 | x | 91.1 | x | 0.72 | x | 0.7 | = | 58.55 | (75) |
| Northeast 0.9x | 0.77 | x | 1.28 | x | 91.1 | x | 0.72 | x | 0.7 | = | 40.73 | (75) |
| Northeast 0.9x | 0.77 | x | 2.43 | x | 91.1 | x | 0.72 | x | 0.7 | = | 77.32 | (75) |
| Northeast 0.9x | 0.77 | x | 1.84 | x | 72.63 | x | 0.72 | x | 0.7 | = | 46.67 | (75) |
| Northeast 0.9x | 0.77 | x | 1.28 | x | 72.63 | x | 0.72 | x | 0.7 | = | 32.47 | (75) |
| Northeast 0.9x | 0.77 | x | 2.43 | x | 72.63 | x | 0.72 | x | 0.7 | = | 61.64 | (75) |
| Northeast 0.9x | 0.77 | x | 1.84 | x | 50.42 | x | 0.72 | x | 0.7 | = | 32.4 | (75) |
| Northeast 0.9x | 0.77 | x | 1.28 | x | 50.42 | x | 0.72 | x | 0.7 | = | 22.54 | (75) |
| Northeast 0.9x | 0.77 | x | 2.43 | x | 50.42 | x | 0.72 | x | 0.7 | = | 42.79 | (75) |
| Northeast 0.9x | 0.77 | x | 1.84 | x | 28.07 | x | 0.72 | x | 0.7 | = | 18.04 | (75) |
| Northeast 0.9x | 0.77 | x | 1.28 | x | 28.07 | x | 0.72 | x | 0.7 | = | 12.55 | (75) |
| Northeast 0.9x | 0.77 | x | 2.43 | x | 28.07 | x | 0.72 | x | 0.7 | = | 23.82 | (75) |
| Northeast 0.9x | 0.77 | x | 1.84 | x | 14.2 | x | 0.72 | x | 0.7 | = | 9.12 | (75) |
| Northeast 0.9x | 0.77 | x | 1.28 | x | 14.2 | x | 0.72 | x | 0.7 | = | 6.35 | (75) |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Northeast 0.9x | 0.77 | x | 2.43 | x | 14.2 | x | 0.72 | x | 0.7 | = | 12.05 | (75) |
| Northeast 0.9x | 0.77 | x | 1.84 | x | 9.21 | x | 0.72 | x | 0.7 | = | 5.92 | (75) |
| Northeast 0.9x | 0.77 | x | 1.28 | x | 9.21 | x | 0.72 | x | 0.7 | = | 4.12 | (75) |
| Northeast 0.9x | 0.77 | x | 2.43 | x | 9.21 | x | 0.72 | x | 0.7 | = | 7.82 | (75) |
| Southwest0.9x | 0.77 | x | 1.31 | x | 36.79 | | 0.72 | x | 0.7 | = | 16.83 | (79) |
| Southwest0.9x | 0.77 | x | 1.31 | x | 36.79 | | 0.72 | x | 0.7 | = | 16.83 | (79) |
| Southwest0.9x | 0.77 | x | 1.31 | x | 36.79 | | 0.72 | x | 0.7 | = | 16.83 | (79) |
| Southwest0.9x | 0.77 | x | 1.31 | x | 62.67 | | 0.72 | x | 0.7 | = | 28.68 | (79) |
| Southwest0.9x | 0.77 | x | 1.31 | x | 62.67 | | 0.72 | x | 0.7 | = | 28.68 | (79) |
| Southwest0.9x | 0.77 | x | 1.31 | x | 62.67 | | 0.72 | x | 0.7 | = | 28.68 | (79) |
| Southwest0.9x | 0.77 | x | 1.31 | x | 85.75 | | 0.72 | x | 0.7 | = | 39.24 | (79) |
| Southwest0.9x | 0.77 | x | 1.31 | x | 85.75 | | 0.72 | x | 0.7 | = | 39.24 | (79) |
| Southwest0.9x | 0.77 | x | 1.31 | x | 85.75 | | 0.72 | x | 0.7 | = | 39.24 | (79) |
| Southwest0.9x | 0.77 | x | 1.31 | x | 106.25 | | 0.72 | x | 0.7 | = | 48.62 | (79) |
| Southwest0.9x | 0.77 | x | 1.31 | x | 106.25 | | 0.72 | x | 0.7 | = | 48.62 | (79) |
| Southwest0.9x | 0.77 | x | 1.31 | x | 106.25 | | 0.72 | x | 0.7 | = | 48.62 | (79) |
| Southwest0.9x | 0.77 | x | 1.31 | x | 119.01 | | 0.72 | x | 0.7 | = | 54.45 | (79) |
| Southwest0.9x | 0.77 | x | 1.31 | x | 119.01 | | 0.72 | x | 0.7 | = | 54.45 | (79) |
| Southwest0.9x | 0.77 | x | 1.31 | x | 119.01 | | 0.72 | x | 0.7 | = | 54.45 | (79) |
| Southwest0.9x | 0.77 | x | 1.31 | x | 118.15 | | 0.72 | x | 0.7 | = | 54.06 | (79) |
| Southwest0.9x | 0.77 | x | 1.31 | x | 118.15 | | 0.72 | x | 0.7 | = | 54.06 | (79) |
| Southwest0.9x | 0.77 | x | 1.31 | x | 118.15 | | 0.72 | x | 0.7 | = | 54.06 | (79) |
| Southwest0.9x | 0.77 | x | 1.31 | x | 113.91 | | 0.72 | x | 0.7 | = | 52.12 | (79) |
| Southwest0.9x | 0.77 | x | 1.31 | x | 113.91 | | 0.72 | x | 0.7 | = | 52.12 | (79) |
| Southwest0.9x | 0.77 | x | 1.31 | x | 113.91 | | 0.72 | x | 0.7 | = | 52.12 | (79) |
| Southwest0.9x | 0.77 | x | 1.31 | x | 104.39 | | 0.72 | x | 0.7 | = | 47.76 | (79) |
| Southwest0.9x | 0.77 | x | 1.31 | x | 104.39 | | 0.72 | x | 0.7 | = | 47.76 | (79) |
| Southwest0.9x | 0.77 | x | 1.31 | x | 104.39 | | 0.72 | x | 0.7 | = | 47.76 | (79) |
| Southwest0.9x | 0.77 | x | 1.31 | x | 92.85 | | 0.72 | x | 0.7 | = | 42.48 | (79) |
| Southwest0.9x | 0.77 | x | 1.31 | x | 92.85 | | 0.72 | x | 0.7 | = | 42.48 | (79) |
| Southwest0.9x | 0.77 | x | 1.31 | x | 92.85 | | 0.72 | x | 0.7 | = | 42.48 | (79) |
| Southwest0.9x | 0.77 | x | 1.31 | x | 69.27 | | 0.72 | x | 0.7 | = | 31.69 | (79) |
| Southwest0.9x | 0.77 | x | 1.31 | x | 69.27 | | 0.72 | x | 0.7 | = | 31.69 | (79) |
| Southwest0.9x | 0.77 | x | 1.31 | x | 69.27 | | 0.72 | x | 0.7 | = | 31.69 | (79) |
| Southwest0.9x | 0.77 | x | 1.31 | x | 44.07 | | 0.72 | x | 0.7 | = | 20.16 | (79) |
| Southwest0.9x | 0.77 | x | 1.31 | x | 44.07 | | 0.72 | x | 0.7 | = | 20.16 | (79) |
| Southwest0.9x | 0.77 | x | 1.31 | x | 44.07 | | 0.72 | x | 0.7 | = | 20.16 | (79) |
| Southwest0.9x | 0.77 | x | 1.31 | x | 31.49 | | 0.72 | x | 0.7 | = | 14.41 | (79) |
| Southwest0.9x | 0.77 | x | 1.31 | x | 31.49 | | 0.72 | x | 0.7 | = | 14.41 | (79) |
| Southwest0.9x | 0.77 | x | 1.31 | x | 31.49 | | 0.72 | x | 0.7 | = | 14.41 | (79) |

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (83)m= | 72.38 | 130.55 | 197.92 | 277.57 | 340.43 | 350.95 | 332.95 | 284.07 | 225.19 | 149.49 | 88.01 | 61.08 | (83) |

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Total gains – internal and solar (84)m = (73)m + (83)m , watts

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (84)m= | 729.64 | 781.78 | 822.38 | 861.16 | 882.26 | 856.17 | 817.54 | 778.89 | 744.28 | 709.69 | 693.37 | 700.49 | (84) |

## 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= | 1 | 0.99 | 0.99 | 0.96 | 0.89 | 0.73 | 0.56 | 0.61 | 0.84 | 0.97 | 0.99 | 1 | (86) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (87)m= | 20 | 20.11 | 20.3 | 20.57 | 20.81 | 20.95 | 20.99 | 20.99 | 20.9 | 20.61 | 20.26 | 19.97 | (87) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (88)m= | 20.06 | 20.06 | 20.07 | 20.07 | 20.07 | 20.08 | 20.08 | 20.08 | 20.08 | 20.07 | 20.07 | 20.07 | (88) |

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (89)m= | 0.99 | 0.99 | 0.98 | 0.95 | 0.85 | 0.65 | 0.45 | 0.5 | 0.77 | 0.95 | 0.99 | 1 | (89) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (90)m= | 19.15 | 19.26 | 19.46 | 19.72 | 19.94 | 20.06 | 20.08 | 20.08 | 20.02 | 19.76 | 19.42 | 19.13 | (90) |

fLA = Living area ÷ (4) = | 0.14 | (91)

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (92)m= | 19.28 | 19.38 | 19.58 | 19.84 | 20.07 | 20.19 | 20.21 | 20.21 | 20.15 | 19.88 | 19.54 | 19.25 | (92) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (93)m= | 19.13 | 19.23 | 19.43 | 19.69 | 19.92 | 20.04 | 20.06 | 20.06 | 20 | 19.73 | 19.39 | 19.1 | (93) |

## 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 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Utilisation factor for gains, hm: | | | | | | | | | | | | | |
| (94)m= | 0.99 | 0.99 | 0.98 | 0.94 | 0.84 | 0.65 | 0.45 | 0.49 | 0.77 | 0.95 | 0.99 | 0.99 | (94) |
| Useful gains, hmGm , W = (94)m x (84)m | | | | | | | | | | | | | |
| (95)m= | 724.17 | 772.39 | 802.93 | 810.02 | 745.04 | 554.15 | 364.78 | 383.62 | 570.57 | 671.39 | 683.53 | 696.23 | (95) |
| 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) |
| Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m ] | | | | | | | | | | | | | |
| (97)m= | 1609.24 | 1552.96 | 1397.89 | 1156.56 | 878.96 | 577.12 | 367.21 | 387.76 | 627.95 | 977.17 | 1319.23 | 1605.73 | (97) |
| Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m | | | | | | | | | | | | | |
| (98)m= | 658.5 | 524.54 | 442.65 | 249.51 | 99.64 | 0 | 0 | 0 | 0 | 227.5 | 457.7 | 676.67 | |

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = | 3336.71 | (98)

Space heating requirement in kWh/m²/year | 31.53 | (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) |

# SAP WorkSheet: New dwelling design stage

| | | |
|---|---|---|
| Efficiency of main space heating system 1 | 90.5 | (206) |
| Efficiency of secondary/supplementary heating system, % | 0 | (208) |

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | kWh/year | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Space heating requirement (calculated above) | 658.5 | 524.54 | 442.65 | 249.51 | 99.64 | 0 | 0 | 0 | 0 | 227.5 | 457.7 | 676.67 | | |
| (211)m = {[(98)m x (204)] } x 100 ÷ (206) | 727.62 | 579.61 | 489.12 | 275.7 | 110.1 | 0 | 0 | 0 | 0 | 251.38 | 505.75 | 747.7 | | (211) |
| Total (kWh/year) =Sum(211)$_{1...5,10....12}$= | | | | | | | | | | | | | 3686.98 | (211) |
| Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208) | | | | | | | | | | | | | | |
| (215)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| Total (kWh/year) =Sum(215)$_{1...5,10....12}$= | | | | | | | | | | | | | 0 | (215) |

**Water heating**

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Output from water heater (calculated above) | 177.93 | 156.01 | 161.93 | 142.49 | 137.69 | 120.25 | 112.85 | 127.47 | 128.4 | 147.89 | 159.72 | 172.75 | | |
| Efficiency of water heater | | | | | | | | | | | | | 87.3 | (216) |
| (217)m= | 89.8 | 89.75 | 89.62 | 89.31 | 88.62 | 87.3 | 87.3 | 87.3 | 87.3 | 89.21 | 89.65 | 89.83 | | (217) |
| Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m | | | | | | | | | | | | | | |
| (219)m= | 198.14 | 173.84 | 180.68 | 159.54 | 155.38 | 137.74 | 129.26 | 146.02 | 147.08 | 165.77 | 178.16 | 192.31 | | |
| Total = Sum(219a)$_{1...12}$ = | | | | | | | | | | | | | 1963.92 | (219) |

| **Annual totals** | | **kWh/year** | **kWh/year** | |
|---|---|---|---|---|
| Space heating fuel used, main system 1 | | | 3686.98 | |
| Water heating fuel used | | | 1963.92 | |
| 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 | sum of (230a)…(230g) = | | 75 | (231) |
| Electricity for lighting | | | 493.59 | (232) |
| Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) = | | | 6306.79 | (338) |

## 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 = | 128.31 | (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 = | 68.34 | (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 = | 65.1 | (250) |

# SAP WorkSheet: New dwelling design stage

| | | | | |
|---|---|---|---|---|
| Additional standing charges (Table 12) | | | 120 | (251) |
| Appendix Q items: repeat lines (253) and (254) as needed | | | | |
| **Total energy cost** | (245)...(247) + (250)…(254) = | | 391.65 | (255) |

## 11a. SAP rating - individual heating systems

| | | | | |
|---|---|---|---|---|
| Energy cost deflator (Table 12) | | | 0.42 | (256) |
| Energy cost factor (ECF) | [(255) x (256)] ÷ [(4) + 45.0] = | | 1.09 | (257) |
| **SAP rating (Section 12)** | | | 84.79 | (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 | = | 796.39 | (261) |
| Space heating (secondary) | (215) x | 0.519 | = | 0 | (263) |
| Water heating | (219) x | 0.216 | = | 424.21 | (264) |
| Space and water heating | (261) + (262) + (263) + (264) = | | | 1220.59 | (265) |
| Electricity for pumps, fans and electric keep-hot | (231) x | 0.519 | = | 38.93 | (267) |
| Electricity for lighting | (232) x | 0.519 | = | 256.17 | (268) |
| Total CO2, kg/year | | sum of (265)…(271) = | | 1515.69 | (272) |
| **CO2 emissions per m²** | | (272) ÷ (4) = | | 14.32 | (273) |
| EI rating (section 14) | | | | 87 | (274) |

## 13a. Primary Energy

| | **Energy** kWh/year | **Primary** factor | | **P. Energy** kWh/year | |
|---|---|---|---|---|---|
| Space heating (main system 1) | (211) x | 1.22 | = | 4498.11 | (261) |
| Space heating (secondary) | (215) x | 3.07 | = | 0 | (263) |
| Energy for water heating | (219) x | 1.22 | = | 2395.99 | (264) |
| Space and water heating | (261) + (262) + (263) + (264) = | | | 6894.1 | (265) |
| Electricity for pumps, fans and electric keep-hot | (231) x | 3.07 | = | 230.25 | (267) |
| Electricity for lighting | (232) x | 0 | = | 1515.33 | (268) |
| ‘Total Primary Energy | | sum of (265)…(271) = | | 8639.68 | (272) |
| **Primary energy kWh/m²/year** | | (272) ÷ (4) = | | 81.63 | (273) |

# SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 10 March 2021

## Property Details: 118 Tweed [End] DCC2

| | |
|---|---|
| **Dwelling type:** | End-terrace House |
| **Located in:** | England |
| **Region:** | South East England |
| **Cross ventilation possible:** | Yes |
| **Number of storeys:** | 2 |
| **Front of dwelling faces:** | North East |
| **Overshading:** | Average or unknown |
| **Overhangs:** | None |
| **Thermal mass parameter:** | Calculated 245.4 |
| **Night ventilation:** | False |
| **Blinds, curtains, shutters:** | Dark-coloured curtain or roller blind |
| **Ventilation rate during hot weather (ach):** | 4 ( Windows open half the time) |

## Overheating Details:

| | | |
|---|---|---|
| **Summer ventilation heat loss coefficient:** | 343.68 | **(P1)** |
| **Transmission heat loss coefficient:** | 60.2 | |
| **Summer heat loss coefficient:** | 403.87 | **(P2)** |

## Overhangs:

| **Orientation:** | **Ratio:** | **Z_overhangs:** |
|---|---|---|
| North East (W_133) | 0 | 1 |
| North East (W_134) | 0 | 1 |
| South West (W_135) | 0 | 1 |
| North East (W_136) | 0 | 1 |
| South West (W_137) | 0 | 1 |
| South West (W_138) | 0 | 1 |

## Solar shading:

| **Orientation:** | **Z blinds:** | **Solar access:** | **Overhangs:** | **Z summer:** | |
|---|---|---|---|---|---|
| North East (W_133) | 0.85 | 0.9 | 1 | 0.76 | **(P8)** |
| North East (W_134) | 0.85 | 0.9 | 1 | 0.76 | **(P8)** |
| South West (W_135) | 0.85 | 0.9 | 1 | 0.76 | **(P8)** |
| North East (W_136) | 0.85 | 0.9 | 1 | 0.76 | **(P8)** |
| South West (W_137) | 0.85 | 0.9 | 1 | 0.76 | **(P8)** |
| South West (W_138) | 0.85 | 0.9 | 1 | 0.76 | **(P8)** |

## Solar gains:

| **Orientation** | | **Area** | **Flux** | **g_** | **FF** | **Shading** | **Gains** | |
|---|---|---|---|---|---|---|---|---|
| North East (W_133) | 0.9 x | 1.84 | 105.45 | 0.72 | 0.7 | 0.76 | 67.33 | |
| North East (W_134) | 0.9 x | 1.28 | 105.45 | 0.72 | 0.7 | 0.76 | 46.84 | |
| South West (W_135) | 0.9 x | 1.31 | 126.97 | 0.72 | 0.7 | 0.76 | 57.72 | |
| North East (W_136) | 0.9 x | 2.43 | 105.45 | 0.72 | 0.7 | 0.76 | 88.92 | |
| South West (W_137) | 0.9 x | 1.31 | 126.97 | 0.72 | 0.7 | 0.76 | 57.72 | |
| South West (W_138) | 0.9 x | 1.31 | 126.97 | 0.72 | 0.7 | 0.76 | 57.72 | |
| | | | | | | **Total** | 376.24 | **(P3/P4)** |

## Internal gains:

| | **June** | **July** | **August** | |
|---|---|---|---|---|
| Internal gains | 502.22 | 481.59 | 491.82 | |
| Total summer gains | 903.48 | 857.83 | 815.5 | **(P5)** |

# SAP 2012 Overheating Assessment

| | | | | |
|---|---|---|---|---|
| Summer gain/loss ratio | 2.24 | 2.12 | 2.02 | **(P6)** |
| Mean summer external temperature (South East England) | 15.4 | 17.4 | 17.5 | |
| Thermal mass temperature increment | 0.28 | 0.28 | 0.28 | |
| Threshold temperature | 17.92 | 19.81 | 19.8 | **(P7)** |
| **Likelihood of high internal temperature** | **Not significant** | **Not significant** | **Not significant** | |

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