# BRUKL Output Document

HM Government

## Compliance with England Building Regulations Part L 2013

**Project name** **Shell and Core**

# Highgate Road

As designed

**Date:** Wed Jun 23 14:01:22 2021

## Administrative information

### Building Details

**Address:** London,

### Certification tool

**Calculation engine:** SBEM

**Calculation engine version:** v5.6.b.0

**Interface to calculation engine:** DesignBuilder SBEM

**Interface to calculation engine version:** v6.1.8

**BRUKL compliance check version:** v5.6.b.0

### Certifier details

**Name:** George Farr

**Telephone number:**

**Address:** , ,

## Criterion 1: The calculated $CO_2$ emission rate for the building must not exceed the target

| | |
|---|---|
| $CO_2$ emission rate from the notional building, $kgCO_2/m^2$.annum | 14.2 |
| Target $CO_2$ emission rate (TER), $kgCO_2/m^2$.annum | 14.2 |
| Building $CO_2$ emission rate (BER), $kgCO_2/m^2$.annum | 11.9 |
| Are emissions from the building less than or equal to the target? | BER =< TER |
| Are as built details the same as used in the BER calculations? | Separate submission |

## Criterion 2: The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency

**Values which do not achieve the standards in the Non-Domestic Building Services Compliance Guide and Part L are displayed in red.**

**Building fabric**

| Element | $U_{a-Limit}$ | $U_{a-Calc}$ | $U_{i-Calc}$ | Surface where the maximum value occurs* |
|---|---|---|---|---|
| Wall** | 0.35 | 0.18 | 0.18 | "Ground Floor - Social Enterprise_P_6" |
| Floor | 0.25 | 0.13 | 0.13 | "Ground Floor - Social Enterprise_S_3" |
| Roof | 0.25 | 0.13 | 0.13 | "Ground Floor - Social Enterprise_R_5" |
| Windows***, roof windows, and rooflights | 2.2 | 1.4 | 1.4 | "Ground Floor - Social Enterprise_G_11" |
| Personnel doors | 2.2 | - | - | "No external personnel doors" |
| Vehicle access & similar large doors | 1.5 | - | - | "No external vehicle access doors" |
| High usage entrance doors | 3.5 | - | - | "No external high usage entrance doors" |

$U_{a-Limit}$ = Limiting area-weighted average U-values [W/(m²K)]
$U_{a-Calc}$ = Calculated area-weighted average U-values [W/(m²K)]
$U_{i-Calc}$ = Calculated maximum individual element U-values [W/(m²K)]

* There might be more than one surface where the maximum U-value occurs.
** Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.
*** Display windows and similar glazing are excluded from the U-value check.
N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

| Air Permeability | Worst acceptable standard | This building |
|---|---|---|
| $m^3/(h.m^2)$ at 50 Pa | 10 | 3 |

## Building services

**The standard values listed below are minimum values for efficiencies and maximum values for SFPs. Refer to the Non-Domestic Building Services Compliance Guide for details.**

| | |
|---|---|
| **Whole building lighting automatic monitoring & targeting with alarms for out-of-range values** | NO |
| **Whole building electric power factor achieved by power factor correction** | <0.9 |

### 1- VRF

| | Heating efficiency | Cooling efficiency | Radiant efficiency | SFP [W/(l/s)] | HR efficiency |
|---|---|---|---|---|---|
| **This system** | 4.35 | 3.2 | - | - | - |
| **Standard value** | 2.5* | N/A | N/A | N/A | N/A |
| **Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system** | | | | | NO |

* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types <=12 kW output, refer to EN 14825 for limiting standards.

### 1- POU

| | Water heating efficiency | Storage loss factor [kWh/litre per day] |
|---|---|---|
| **This building** | 1 | - |
| **Standard value** | 1 | N/A |

### Local mechanical ventilation, exhaust, and terminal units

| ID | System type in Non-domestic Building Services Compliance Guide |
|---|---|
| A | Local supply or extract ventilation units serving a single area |
| B | Zonal supply system where the fan is remote from the zone |
| C | Zonal extract system where the fan is remote from the zone |
| D | Zonal supply and extract ventilation units serving a single room or zone with heating and heat recovery |
| E | Local supply and extract ventilation system serving a single area with heating and heat recovery |
| F | Other local ventilation units |
| G | Fan-assisted terminal VAV unit |
| H | Fan coil units |
| I | Zonal extract system where the fan is remote from the zone with grease filter |

| Zone name | SFP [W/(l/s)] | | | | | | | | | HR efficiency | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **ID of system type** | A | B | C | D | E | F | G | H | I | | |
| **Standard value** | 0.3 | 1.1 | 0.5 | 1.9 | 1.6 | 0.5 | 1.1 | 0.5 | 1 | Zone | Standard |
| Ground Floor - Social Enterprise | - | - | - | 1 | - | - | - | - | - | 0.8 | 0.5 |

### Shell and core configuration

| Zone | Assumed shell? |
|---|---|
| Ground Floor - Store | NO |
| Ground Floor - Plant | NO |
| Ground Floor - Social Enterprise | NO |

### General lighting and display lighting

| | Luminous efficacy [lm/W] | | | |
|---|---|---|---|---|
| **Zone name** | **Luminaire** | **Lamp** | **Display lamp** | **General lighting [W]** |
| **Standard value** | 60 | 60 | 22 | |
| Ground Floor - Store | 110 | - | - | 10 |
| Ground Floor - Plant | 110 | - | - | 133 |
| Ground Floor - Social Enterprise | 110 | - | - | 552 |

## Criterion 3: The spaces in the building should have appropriate passive control measures to limit solar gains

| Zone | Solar gain limit exceeded? (%) | Internal blinds used? |
|---|---|---|
| Ground Floor - Social Enterprise | YES (+11.1%) | NO |

## Criterion 4: The performance of the building, as built, should be consistent with the calculated BER

Separate submission

## Criterion 5: The necessary provisions for enabling energy-efficient operation of the building should be in place

Separate submission

## EPBD (Recast): Consideration of alternative energy systems

| | |
|---|---|
| **Were alternative energy systems considered and analysed as part of the design process?** | NO |
| Is evidence of such assessment available as a separate submission? | NO |
| Are any such measures included in the proposed design? | NO |

# Technical Data Sheet (Actual vs. Notional Building)

## Building Global Parameters

| | Actual | Notional |
|---|---|---|
| Area [m²] | 156.3 | 156.3 |
| External area [m²] | 330.4 | 330.4 |
| Weather | LON | LON |
| Infiltration [m³/hm²@ 50Pa] | 3 | 5 |
| Average conductance [W/K] | 120.17 | 144.54 |
| Average U-value [W/m²K] | 0.36 | 0.44 |
| Alpha value* [%] | 19.16 | 12.38 |

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

## Building Use

| % Area | Building Type |
|---|---|
| | A1/A2 Retail/Financial and Professional services |
| | A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways |
| **100** | **B1 Offices and Workshop businesses** |
| | B2 to B7 General Industrial and Special Industrial Groups |
| | B8 Storage or Distribution |
| | C1 Hotels |
| | C2 Residential Institutions: Hospitals and Care Homes |
| | C2 Residential Institutions: Residential schools |
| | C2 Residential Institutions: Universities and colleges |
| | C2A Secure Residential Institutions |
| | Residential spaces |
| | D1 Non-residential Institutions: Community/Day Centre |
| | D1 Non-residential Institutions: Libraries, Museums, and Galleries |
| | D1 Non-residential Institutions: Education |
| | D1 Non-residential Institutions: Primary Health Care Building |
| | D1 Non-residential Institutions: Crown and County Courts |
| | D2 General Assembly and Leisure, Night Clubs, and Theatres |
| | Others: Passenger terminals |
| | Others: Emergency services |
| | Others: Miscellaneous 24hr activities |
| | Others: Car Parks 24 hrs |
| | Others: Stand alone utility block |

## Energy Consumption by End Use [kWh/m²]

| | Actual | Notional |
|---|---|---|
| Heating | 1.02 | 2 |
| Cooling | 6.53 | 5.39 |
| Auxiliary | 2.52 | 1.73 |
| Lighting | 11 | 17.58 |
| Hot water | 1.85 | 2.14 |
| Equipment* | 87.75 | 87.75 |
| **TOTAL**** | **22.92** | **28.84** |

* Energy used by equipment does not count towards the total for consumption or calculating emissions.
** Total is net of any electrical energy displaced by CHP generators, if applicable.

## Energy Production by Technology [kWh/m²]

| | Actual | Notional |
|---|---|---|
| Photovoltaic systems | 0 | 0 |
| Wind turbines | 0 | 0 |
| CHP generators | 0 | 0 |
| Solar thermal systems | 0 | 0 |

## Energy & $CO_2$ Emissions Summary

| | Actual | Notional |
|---|---|---|
| Heating + cooling demand [MJ/m²] | 126.56 | 99.35 |
| Primary energy* [kWh/m²] | 70.37 | 82.26 |
| Total emissions [kg/m²] | 11.9 | 14.2 |

* Primary energy is net of any electrical energy displaced by CHP generators, if applicable.

## HVAC Systems Performance

| System Type | | Heat dem MJ/m2 | Cool dem MJ/m2 | Heat con kWh/m2 | Cool con kWh/m2 | Aux con kWh/m2 | Heat SSEEF | Cool SSEER | Heat gen SEFF | Cool gen SEER |
|---|---|---|---|---|---|---|---|---|---|---|
| **[ST] No Heating or Cooling** | | | | | | | | | | |
| | **Actual** | 27.6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | **Notional** | 33.6 | 0.1 | 0 | 0 | 0 | 0 | 0 | ---- | ---- |
| **[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity** | | | | | | | | | | |
| | **Actual** | 23.2 | 158.6 | 1.6 | 10.2 | 3.9 | 4.05 | 4.33 | 4.35 | 6.1 |
| | **Notional** | 27.2 | 108.8 | 3.1 | 8.4 | 2.7 | 2.43 | 3.6 | ---- | ---- |

## Key to terms

| | |
|---|---|
| Heat dem [MJ/m2] | = Heating energy demand |
| Cool dem [MJ/m2] | = Cooling energy demand |
| Heat con [kWh/m2] | = Heating energy consumption |
| Cool con [kWh/m2] | = Cooling energy consumption |
| Aux con [kWh/m2] | = Auxiliary energy consumption |
| Heat SSEFF | = Heating system seasonal efficiency (for notional building, value depends on activity glazing class) |
| Cool SSEER | = Cooling system seasonal energy efficiency ratio |
| Heat gen SSEFF | = Heating generator seasonal efficiency |
| Cool gen SSEER | = Cooling generator seasonal energy efficiency ratio |
| ST | = System type |
| HS | = Heat source |
| HFT | = Heating fuel type |
| CFT | = Cooling fuel type |

# Key Features

**The Building Control Body is advised to give particular attention to items whose specifications are better than typically expected.**

**Building fabric**

| Element | $U_{i-Typ}$ | $U_{i-Min}$ | Surface where the minimum value occurs* |
|---|---|---|---|
| Wall | 0.23 | 0.18 | "Ground Floor - Social Enterprise_P_6" |
| Floor | 0.2 | 0.13 | "Ground Floor - Social Enterprise_S_3" |
| Roof | 0.15 | 0.13 | "Ground Floor - Social Enterprise_R_5" |
| Windows, roof windows, and rooflights | 1.5 | 1.4 | "Ground Floor - Social Enterprise_G_11" |
| Personnel doors | 1.5 | - | "No external personnel doors" |
| Vehicle access & similar large doors | 1.5 | - | "No external vehicle access doors" |
| High usage entrance doors | 1.5 | - | "No external high usage entrance doors" |

$U_{i-Typ}$ = Typical individual element U-values [W/(m²K)] $U_{i-Min}$ = Minimum individual element U-values [W/(m²K)]

* There might be more than one surface where the minimum U-value occurs.

| Air Permeability | Typical value | This building |
|---|---|---|
| $m^3/(h.m^2)$ at 50 Pa | 5 | 3 |

# Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.50
*Printed on 06 December 2021 at 11:02:03*

## Project Information:

**Assessed By:** Neil Ingham (STRO010943) **Building Type:** Flat

## Dwelling Details:

**NEW DWELLING DESIGN STAGE** Total Floor Area: 63.84m²

**Site Reference :** Highgate Road - GREEN **Plot Reference:** 00 - A

**Address :**

## Client Details:

**Name:**

**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 (c)
Fuel factor: 1.00 (mains gas (c))

| | | |
|---|---|---|
| Target Carbon Dioxide Emission Rate (TER) | 21.44 kg/m² | |
| Dwelling Carbon Dioxide Emission Rate (DER) | 18.52 kg/m² | OK |

## 1b TFEE and DFEE

| | | |
|---|---|---|
| Target Fabric Energy Efficiency (TFEE) | 63.3 kWh/m² | |
| Dwelling Fabric Energy Efficiency (DFEE) | 52.5 kWh/m² | |
| | | OK |

## 2 Fabric U-values

| Element | Average | Highest | |
|---|---|---|---|
| External wall | 0.17 (max. 0.30) | 0.18 (max. 0.70) | OK |
| Party wall | 0.00 (max. 0.20) | - | OK |
| Floor | 0.13 (max. 0.25) | 0.13 (max. 0.70) | OK |
| Roof | 0.13 (max. 0.20) | 0.13 (max. 0.35) | OK |
| Openings | 1.40 (max. 2.00) | 1.40 (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 | 3.00 (design value) | |
| Maximum | 10.0 | OK |

## 4 Heating efficiency

| | |
|---|---|
| Main Heating system: | Community heating schemes - mains gas |
| Secondary heating system: | None |

## 5 Cylinder insulation

| | |
|---|---|
| Hot water Storage: | No cylinder |

## 6 Controls

| | | |
|---|---|---|
| Space heating controls | Charging system linked to use of community heating, programmer and at least two room thermostats | OK |
| Hot water controls: | No cylinder thermostat<br>No cylinder | |

# Regulations Compliance Report

## 7 Low energy lights

| | | |
|---|---|---|
| Percentage of fixed lights with low-energy fittings | 100.0% | |
| Minimum | 75.0% | **OK** |

## 8 Mechanical ventilation

| | | |
|---|---|---|
| Continuous supply and extract system | | |
| Specific fan power: | 0.47 | |
| Maximum | 1.5 | **OK** |
| MVHR efficiency: | 89% | |
| Minimum | 70% | **OK** |

## 9 Summertime temperature

| | | |
|---|---|---|
| Overheating risk (Thames valley): | Medium | **OK** |
| Based on: | | |
| Overshading: | Average or unknown | |
| Windows facing: North East | 5.49m² | |
| Windows facing: South West | 5.49m² | |
| Ventilation rate: | 3.00 | |

## 10 Key features

| | |
|---|---|
| Air permeablility | 3.0 m³/m²h |
| Party Walls U-value | 0 W/m²K |
| Community heating, heat from boilers – mains gas | |

# DER WorkSheet: New dwelling design stage

User Details:

| | | | |
|---|---|---|---|
| **Assessor Name:** | Neil Ingham | **Stroma Number:** | STRO010943 |
| **Software Name:** | Stroma FSAP 2012 | **Software Version:** | Version: 1.0.5.50 |

Property Address: 00 - A

**Address :**

## 1. Overall dwelling dimensions:

| | Area(m²) | | Av. Height(m) | | Volume(m³) | |
|---|---|---|---|---|---|---|
| Ground floor | 63.84 | (1a) x | 2.65 | (2a) = | 169.18 | (3a) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n) | 63.84 | (4) | | | | |
| Dwelling volume | | | | (3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) = | 169.18 | (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 | | | | | | | 0 | x 10 = | 0 | (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) = | 0 | ÷ (5) = | 0 | (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 | | 3 | (17) |
| If based on air permeability value, then | (18) = [(17) ÷ 20]+(8), otherwise (18) = (16) | 0.15 | (18) |

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

| | | | |
|---|---|---|---|
| Number of sides sheltered | | 0 | (19) |
| Shelter factor | (20) = 1 - [0.075 x (19)] = | 1 | (20) |
| Infiltration rate incorporating shelter factor | (21) = (18) x (20) = | 0.15 | (21) |

Infiltration rate modified for monthly wind speed

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

# DER WorkSheet: New dwelling design stage

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

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.19 | 0.19 | 0.18 | 0.16 | 0.16 | 0.14 | 0.14 | 0.14 | 0.15 | 0.16 | 0.17 | 0.18 |

*Calculate effective air change rate for the applicable case*

| | | |
|---|---|---|
| If mechanical ventilation: | 0.5 | (23a) |
| If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) | 0.5 | (23b) |
| If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = | 75.65 | (23c) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24a)m= | 0.31 | 0.31 | 0.31 | 0.29 | 0.28 | 0.26 | 0.26 | 0.26 | 0.27 | 0.28 | 0.29 | 0.3 | (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 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24d) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (25)m= | 0.31 | 0.31 | 0.31 | 0.29 | 0.28 | 0.26 | 0.26 | 0.26 | 0.27 | 0.28 | 0.29 | 0.3 | (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 | | | 2.55 | x | 1.4 | = | 3.57 | | | (26) |
| Windows Type 1 | | | 5.49 | x1/[1/( 1.4 )+ 0.04] | | = | 7.28 | | | (27) |
| Windows Type 2 | | | 5.49 | x1/[1/( 1.4 )+ 0.04] | | = | 7.28 | | | (27) |
| Floor | | | 63.84 | x | 0.13 | = | 8.2992 | 110 | 7022.4 | (28) |
| Walls Type1 | 27.27 | 13.53 | 13.74 | x | 0.18 | = | 2.47 | 60 | 824.4 | (29) |
| Walls Type2 | 56.63 | 0 | 56.63 | x | 0.17 | = | 9.46 | 60 | 3397.8 | (29) |
| Roof | 3.74 | 0 | 3.74 | x | 0.13 | = | 0.49 | 9 | 33.66 | (30) |
| Total area of elements, m² | | | 151.48 | | | | | | | (31) |
| Party wall | | | 21.76 | x | 0 | = | 0 | 45 | 979.2 | (32) |
| Party ceiling | | | 60.09 | | | | | 30 | 1802.7 | (32b) |
| Internal wall ** | | | 89.09 | | | | | 9 | 801.8099 | (32c) |

** 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) = | 38.85 | (33) |
| Heat capacity Cm = S(A x k ) | ((28)…(30) + (32) + (32a)…(32e) = | 14861.97 | (34) |
| Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K | = (34) ÷ (4) = | 232.8 | (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 | | 11.14 | (36) |

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

| | | | |
|---|---|---|---|
| Total fabric heat loss | (33) + (36) = | 49.99 | (37) |

# DER WorkSheet: New dwelling design stage

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= | 17.47 | 17.26 | 17.06 | 16.01 | 15.8 | 14.75 | 14.75 | 14.54 | 15.17 | 15.8 | 16.22 | 16.64 | (38) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (39)m= | 67.46 | 67.25 | 67.04 | 65.99 | 65.79 | 64.74 | 64.74 | 64.53 | 65.16 | 65.79 | 66.2 | 66.62 | |

Average = Sum(39)$_{1...12}$ /12= 65.94 (39)

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (40)m= | 1.06 | 1.05 | 1.05 | 1.03 | 1.03 | 1.01 | 1.01 | 1.01 | 1.02 | 1.03 | 1.04 | 1.04 | |

Average = Sum(40)$_{1...12}$ /12= 1.03 (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 2.09 (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 83.79 (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= | 92.17 | 88.81 | 85.46 | 82.11 | 78.76 | 75.41 | 75.41 | 78.76 | 82.11 | 85.46 | 88.81 | 92.17 | |
| | | | | | | | | | | Total = Sum(44)$_{1...12}$ = | | 1005.44 | (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= | 136.68 | 119.54 | 123.35 | 107.54 | 103.19 | 89.05 | 82.51 | 94.69 | 95.82 | 111.67 | 121.89 | 132.37 | |
| | | | | | | | | | | Total = Sum(45)$_{1...12}$ = | | 1318.29 | (45) |
| *If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)* | | | | | | | | | | | | | |
| (46)m= | 20.5 | 17.93 | 18.5 | 16.13 | 15.48 | 13.36 | 12.38 | 14.2 | 14.37 | 16.75 | 18.28 | 19.85 | (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) = 110 (50)

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

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (56)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (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= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (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= | 23.26 | 21.01 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | (59) |

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 | (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= | 191.96 | 169.47 | 178.63 | 161.04 | 158.47 | 142.54 | 137.79 | 149.96 | 149.31 | 166.94 | 175.39 | 187.64 | (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= | 191.96 | 169.47 | 178.63 | 161.04 | 158.47 | 142.54 | 137.79 | 149.96 | 149.31 | 166.94 | 175.39 | 187.64 |

Output from water heater (annual)$_{1...12}$ | 1969.13 | (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= | 89.67 | 79.69 | 85.24 | 78.55 | 78.53 | 72.4 | 71.66 | 75.7 | 74.65 | 81.35 | 83.32 | 88.23 | (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= | 104.39 | 104.39 | 104.39 | 104.39 | 104.39 | 104.39 | 104.39 | 104.39 | 104.39 | 104.39 | 104.39 | 104.39 | (66) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (67)m= | 16.75 | 14.87 | 12.1 | 9.16 | 6.85 | 5.78 | 6.24 | 8.12 | 10.9 | 13.83 | 16.15 | 17.21 | (67) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (68)m= | 182.52 | 184.41 | 179.64 | 169.48 | 156.65 | 144.6 | 136.54 | 134.65 | 139.42 | 149.58 | 162.41 | 174.46 | (68) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (69)m= | 33.44 | 33.44 | 33.44 | 33.44 | 33.44 | 33.44 | 33.44 | 33.44 | 33.44 | 33.44 | 33.44 | 33.44 | (69) |

Pumps and fans gains (Table 5a)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (70)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (70) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (71)m= | -83.51 | -83.51 | -83.51 | -83.51 | -83.51 | -83.51 | -83.51 | -83.51 | -83.51 | -83.51 | -83.51 | -83.51 | (71) |

Water heating gains (Table 5)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (72)m= | 120.52 | 118.58 | 114.57 | 109.1 | 105.55 | 100.56 | 96.31 | 101.75 | 103.69 | 109.34 | 115.73 | 118.59 | (72) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (73)m= | 374.1 | 372.19 | 360.62 | 342.06 | 323.37 | 305.25 | 293.42 | 298.84 | 308.32 | 327.08 | 348.6 | 364.59 | (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 | 5.49 | x | 11.28 | x | 0.63 | x | 0.7 | = | 18.93 | (75) |
| Northeast | 0.9x | 0.77 | x | 5.49 | x | 22.97 | x | 0.63 | x | 0.7 | = | 38.53 | (75) |
| Northeast | 0.9x | 0.77 | x | 5.49 | x | 41.38 | x | 0.63 | x | 0.7 | = | 69.43 | (75) |
| Northeast | 0.9x | 0.77 | x | 5.49 | x | 67.96 | x | 0.63 | x | 0.7 | = | 114.02 | (75) |
| Northeast | 0.9x | 0.77 | x | 5.49 | x | 91.35 | x | 0.63 | x | 0.7 | = | 153.26 | (75) |
| Northeast | 0.9x | 0.77 | x | 5.49 | x | 97.38 | x | 0.63 | x | 0.7 | = | 163.39 | (75) |
| Northeast | 0.9x | 0.77 | x | 5.49 | x | 91.1 | x | 0.63 | x | 0.7 | = | 152.85 | (75) |
| Northeast | 0.9x | 0.77 | x | 5.49 | x | 72.63 | x | 0.63 | x | 0.7 | = | 121.85 | (75) |
| Northeast | 0.9x | 0.77 | x | 5.49 | x | 50.42 | x | 0.63 | x | 0.7 | = | 84.6 | (75) |
| Northeast | 0.9x | 0.77 | x | 5.49 | x | 28.07 | x | 0.63 | x | 0.7 | = | 47.09 | (75) |
| Northeast | 0.9x | 0.77 | x | 5.49 | x | 14.2 | x | 0.63 | x | 0.7 | = | 23.82 | (75) |
| Northeast | 0.9x | 0.77 | x | 5.49 | x | 9.21 | x | 0.63 | x | 0.7 | = | 15.46 | (75) |
| Southwest | 0.9x | 0.77 | x | 5.49 | x | 36.79 | | 0.63 | x | 0.7 | = | 61.73 | (79) |
| Southwest | 0.9x | 0.77 | x | 5.49 | x | 62.67 | | 0.63 | x | 0.7 | = | 105.15 | (79) |
| Southwest | 0.9x | 0.77 | x | 5.49 | x | 85.75 | | 0.63 | x | 0.7 | = | 143.88 | (79) |
| Southwest | 0.9x | 0.77 | x | 5.49 | x | 106.25 | | 0.63 | x | 0.7 | = | 178.27 | (79) |
| Southwest | 0.9x | 0.77 | x | 5.49 | x | 119.01 | | 0.63 | x | 0.7 | = | 199.68 | (79) |
| Southwest | 0.9x | 0.77 | x | 5.49 | x | 118.15 | | 0.63 | x | 0.7 | = | 198.23 | (79) |
| Southwest | 0.9x | 0.77 | x | 5.49 | x | 113.91 | | 0.63 | x | 0.7 | = | 191.12 | (79) |
| Southwest | 0.9x | 0.77 | x | 5.49 | x | 104.39 | | 0.63 | x | 0.7 | = | 175.15 | (79) |
| Southwest | 0.9x | 0.77 | x | 5.49 | x | 92.85 | | 0.63 | x | 0.7 | = | 155.79 | (79) |
| Southwest | 0.9x | 0.77 | x | 5.49 | x | 69.27 | | 0.63 | x | 0.7 | = | 116.22 | (79) |
| Southwest | 0.9x | 0.77 | x | 5.49 | x | 44.07 | | 0.63 | x | 0.7 | = | 73.94 | (79) |
| Southwest | 0.9x | 0.77 | x | 5.49 | x | 31.49 | | 0.63 | x | 0.7 | = | 52.83 | (79) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (83)m= | 80.66 | 143.69 | 213.3 | 292.29 | 352.94 | 361.63 | 343.97 | 297 | 240.38 | 163.31 | 97.76 | 68.29 | (83) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (84)m= | 454.77 | 515.88 | 573.92 | 634.34 | 676.31 | 666.88 | 637.39 | 595.84 | 548.71 | 490.39 | 446.36 | 432.88 | (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= | 0.99 | 0.99 | 0.97 | 0.92 | 0.79 | 0.6 | 0.44 | 0.49 | 0.75 | 0.94 | 0.99 | 1 | (86) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (87)m= | 19.93 | 20.09 | 20.34 | 20.66 | 20.88 | 20.98 | 21 | 20.99 | 20.94 | 20.65 | 20.24 | 19.91 | (87) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (88)m= | 20.04 | 20.04 | 20.04 | 20.06 | 20.06 | 20.07 | 20.07 | 20.07 | 20.07 | 20.06 | 20.05 | 20.05 | (88) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (89)m= | 0.99 | 0.98 | 0.96 | 0.89 | 0.74 | 0.52 | 0.35 | 0.4 | 0.67 | 0.92 | 0.98 | 0.99 | (89) |

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

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (90)m= | 18.62 | 18.85 | 19.22 | 19.66 | 19.94 | 20.06 | 20.07 | 20.07 | 20.02 | 19.66 | 19.08 | 18.59 | | (90) |
| | | | | | | | | | | fLA = Living area ÷ (4) = | | | 0.58 | (91) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (92)m= | 19.38 | 19.57 | 19.87 | 20.24 | 20.49 | 20.59 | 20.61 | 20.61 | 20.55 | 20.23 | 19.75 | 19.35 | (92) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (93)m= | 19.38 | 19.57 | 19.87 | 20.24 | 20.49 | 20.59 | 20.61 | 20.61 | 20.55 | 20.23 | 19.75 | 19.35 | (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 | 0.98 | 0.96 | 0.9 | 0.77 | 0.57 | 0.4 | 0.45 | 0.71 | 0.92 | 0.98 | 0.99 | (94) |
| Useful gains, hmGm , W = (94)m x (84)m | | | | | | | | | | | | | |
| (95)m= | 450.52 | 506.64 | 551.22 | 569.98 | 518.11 | 378.07 | 257.99 | 269.01 | 390.04 | 453.43 | 438.07 | 429.65 | (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= | 1017.25 | 986.6 | 896.2 | 748.15 | 578.01 | 387.82 | 259.37 | 271.38 | 420.18 | 633.55 | 837.42 | 1009.54 | (97) |
| Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m | | | | | | | | | | | | | |
| (98)m= | 421.65 | 322.54 | 256.66 | 128.28 | 44.56 | 0 | 0 | 0 | 0 | 134.01 | 287.53 | 431.44 | |

| | | |
|---|---|---|
| Total per year (kWh/year) = $Sum(98)_{1...5,9...12}$ = | 2026.67 | (98) |
| Space heating requirement in kWh/m²/year | 31.75 | (99) |

## 9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

| | | | |
|---|---|---|---|
| Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none | | 0 | (301) |
| Fraction of space heat from community system 1 – (301) = | | 1 | (302) |

*The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.*

| | | | |
|---|---|---|---|
| Fraction of heat from Community boilers | | 1 | (303a) |
| Fraction of total space heat from Community boilers | (302) x (303a) = | 1 | (304a) |
| Factor for control and charging method (Table 4c(3)) for community heating system | | 1 | (305) |
| Distribution loss factor (Table 12c) for community heating system | | 1.05 | (306) |
| **Space heating** | | **kWh/year** | |
| Annual space heating requirement | | 2026.67 | |
| Space heat from Community boilers | (98) x (304a) x (305) x (306) = | 2128.01 | (307a) |
| Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) | | 0 | (308 |
| Space heating requirement from secondary/supplementary system | (98) x (301) x 100 ÷ (308) = | 0 | (309) |
| **Water heating** | | | |
| Annual water heating requirement | | 1969.13 | |
| If DHW from community scheme: Water heat from Community boilers | (64) x (303a) x (305) x (306) = | 2067.59 | (310a) |
| Electricity used for heat distribution | 0.01 × [(307a)…(307e) + (310a)…(310e)] = | 41.96 | (313) |

# DER WorkSheet: New dwelling design stage

| | | | |
|---|---|---|---|
| Cooling System Energy Efficiency Ratio | | 0 | (314) |
| Space cooling (if there is a fixed cooling system, if not enter 0) | = (107) ÷ (314) = | 0 | (315) |
| Electricity for pumps and fans within dwelling (Table 4f):<br>mechanical ventilation - balanced, extract or positive input from outside | | 121.26 | (330a) |
| warm air heating system fans | | 0 | (330b) |
| pump for solar water heating | | 0 | (330g) |
| Total electricity for the above, kWh/year | =(330a) + (330b) + (330g) = | 121.26 | (331) |
| Energy for lighting (calculated in Appendix L) | | 295.76 | (332) |
| Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) = | | 4612.61 | (338) |

## 12b. CO2 Emissions – Community heating scheme

| | | Energy kWh/year | Emission factor kg CO2/kWh | | Emissions kg CO2/year | |
|---|---|---|---|---|---|---|
| CO2 from other sources of space and water heating (not CHP)<br>Efficiency of heat source 1 (%) | If there is CHP using two fuels repeat (363) to (366) for the second fuel | | | | 96 | (367a) |
| CO2 associated with heat source 1 | [(307b)+(310b)] x 100 ÷ (367b) x | | 0.22 | = | 944.01 | (367) |
| Electrical energy for heat distribution | [(313) x | | 0.52 | = | 21.78 | (372) |
| Total CO2 associated with community systems | (363)…(366) + (368)...(372) | | | = | 965.78 | (373) |
| CO2 associated with space heating (secondary) | (309) x | | 0 | = | 0 | (374) |
| CO2 associated with water from immersion heater or instantaneous heater | (312) x | | 0.22 | = | 0 | (375) |
| Total CO2 associated with space and water heating | (373) + (374) + (375) = | | | | 965.78 | (376) |
| CO2 associated with electricity for pumps and fans within dwelling | (331)) x | | 0.52 | = | 62.93 | (378) |
| CO2 associated with electricity for lighting | (332))) x | | 0.52 | = | 153.5 | (379) |

| | | | |
|---|---|---|---|
| **Total CO2, kg/year** | sum of (376)…(382) = | 1182.21 | (383) |
| **Dwelling CO2 Emission Rate** | (383) ÷ (4) = | 18.52 | (384) |
| **EI rating (section 14)** | | 85.44 | (385) |

# Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.50
*Printed on 06 December 2021 at 11:01:31*

## Project Information:

**Assessed By:** Neil Ingham (STRO010943) **Building Type:** Flat

## Dwelling Details:

**NEW DWELLING DESIGN STAGE** Total Floor Area: 60.42m²

**Site Reference :** Highgate Road - GREEN **Plot Reference:** 00 - B

**Address :**

## Client Details:

**Name:**

**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 (c) | | |
| Fuel factor: 1.00 (mains gas (c)) | | |
| Target Carbon Dioxide Emission Rate (TER) | 22.43 kg/m² | |
| Dwelling Carbon Dioxide Emission Rate (DER) | 19.42 kg/m² | OK |

## 1b TFEE and DFEE

| | | |
|---|---|---|
| Target Fabric Energy Efficiency (TFEE) | 65.2 kWh/m² | |
| Dwelling Fabric Energy Efficiency (DFEE) | 54.0 kWh/m² | |
| | | OK |

## 2 Fabric U-values

| Element | Average | Highest | |
|---|---|---|---|
| External wall | 0.17 (max. 0.30) | 0.18 (max. 0.70) | OK |
| Party wall | 0.00 (max. 0.20) | - | OK |
| Floor | 0.13 (max. 0.25) | 0.13 (max. 0.70) | OK |
| Roof | 0.13 (max. 0.20) | 0.13 (max. 0.35) | OK |
| Openings | 1.40 (max. 2.00) | 1.40 (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 | 3.00 (design value) | |
| Maximum | 10.0 | OK |

## 4 Heating efficiency

Main Heating system: Community heating schemes - mains gas

Secondary heating system: None

## 5 Cylinder insulation

Hot water Storage: No cylinder

## 6 Controls

| | | |
|---|---|---|
| Space heating controls | Charging system linked to use of community heating, programmer and at least two room thermostats | OK |
| Hot water controls: | No cylinder thermostat<br>No cylinder | |

# Regulations Compliance Report

| | | |
|---|---|---|
| **7 Low energy lights** | | |
| Percentage of fixed lights with low-energy fittings | 100.0% | |
| Minimum | 75.0% | **OK** |
| **8 Mechanical ventilation** | | |
| Continuous supply and extract system | | |
| Specific fan power: | 0.47 | |
| Maximum | 1.5 | **OK** |
| MVHR efficiency: | 89% | |
| Minimum | 70% | **OK** |
| **9 Summertime temperature** | | |
| Overheating risk (Thames valley): | Slight | **OK** |
| Based on: | | |
| Overshading: | Average or unknown | |
| Windows facing: North East | 6.56m² | |
| Ventilation rate: | 3.00 | |
| **10 Key features** | | |
| Air permeablility | 3.0 m³/m²h | |
| Party  Walls U-value | 0 W/m²K | |
| Community heating, heat from boilers – mains gas | | |

# DER WorkSheet: New dwelling design stage

## User Details:

**Assessor Name:** Neil Ingham | **Stroma Number:** STRO010943
**Software Name:** Stroma FSAP 2012 | **Software Version:** Version: 1.0.5.50

Property Address: 00 - B

**Address :**

## 1. Overall dwelling dimensions:

| | Area(m²) | | | Av. Height(m) | | | Volume(m³) | |
|---|---|---|---|---|---|---|---|---|
| Ground floor | 60.42 | (1a) | x | 2.65 | (2a) | = | 160.11 | (3a) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n) | 60.42 | (4) | | | | | | |
| Dwelling volume | | | | (3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) | | = | 160.11 | (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 | | | | | | | 0 | x 10 = | 0 | (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) = | 0 | ÷ (5) = | 0 | (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 | | 3 | (17) |
| If based on air permeability value, then | (18) = [(17) ÷ 20]+(8), otherwise (18) = (16) | 0.15 | (18) |
| *Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used* | | | |
| Number of sides sheltered | | 0 | (19) |
| Shelter factor | (20) = 1 - [0.075 x (19)] = | 1 | (20) |
| Infiltration rate incorporating shelter factor | (21) = (18) x (20) = | 0.15 | (21) |

Infiltration rate modified for monthly wind speed

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

# DER WorkSheet: New dwelling design stage

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

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.19 | 0.19 | 0.18 | 0.16 | 0.16 | 0.14 | 0.14 | 0.14 | 0.15 | 0.16 | 0.17 | 0.18 |

*Calculate effective air change rate for the applicable case*

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 75.65 (23c)

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24a)m= | 0.31 | 0.31 | 0.31 | 0.29 | 0.28 | 0.26 | 0.26 | 0.26 | 0.27 | 0.28 | 0.29 | 0.3 | (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 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24d) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (25)m= | 0.31 | 0.31 | 0.31 | 0.29 | 0.28 | 0.26 | 0.26 | 0.26 | 0.27 | 0.28 | 0.29 | 0.3 | (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 | | | 3.49 | x | 1.4 | = | 4.886 | | | (26) |
| Windows | | | 6.56 | x1/[1/( 1.4 )+ 0.04] | | = | 8.7 | | | (27) |
| Floor | | | 60.42 | x | 0.13 | = | 7.854599 | 110 | 6646.2 | (28) |
| Walls Type1 | 19.85 | 10.05 | 9.8 | x | 0.18 | = | 1.76 | 60 | 588 | (29) |
| Walls Type2 | 51.2 | 0 | 51.2 | x | 0.17 | = | 8.55 | 60 | 3072 | (29) |
| Roof | 5.68 | 0 | 5.68 | x | 0.13 | = | 0.74 | 9 | 51.12 | (30) |
| Total area of elements, m² | | | 137.15 | | | | | | | (31) |
| Party wall | | | 21.92 | x | 0 | = | 0 | 45 | 986.4 | (32) |
| Party ceiling | | | 54.74 | | | | | 30 | 1642.2 | (32b) |
| Internal wall ** | | | 85.22 | | | | | 9 | 766.98 | (32c) |

** 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) = 32.49 (33)

Heat capacity Cm = S(A x k ) ((28)…(30) + (32) + (32a)…(32e) = 13752.9 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 227.62 (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 10.25 (36)

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

Total fabric heat loss (33) + (36) = 42.75 (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= | 16.54 | 16.34 | 16.14 | 15.15 | 14.95 | 13.96 | 13.96 | 13.76 | 14.36 | 14.95 | 15.35 | 15.75 | (38) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (39)m= | 59.28 | 59.09 | 58.89 | 57.9 | 57.7 | 56.71 | 56.71 | 56.51 | 57.1 | 57.7 | 58.09 | 58.49 | |

Average = Sum(39)$_{1...12}$ /12= 57.85 (39)

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (40)m= | 0.98 | 0.98 | 0.97 | 0.96 | 0.95 | 0.94 | 0.94 | 0.94 | 0.95 | 0.95 | 0.96 | 0.97 | |

Average = Sum(40)$_{1...12}$ /12= 0.96 (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 1.99 (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 81.55 (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)*

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

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (44)m= | 89.7 | 86.44 | 83.18 | 79.91 | 76.65 | 73.39 | 73.39 | 76.65 | 79.91 | 83.18 | 86.44 | 89.7 | |

Total = Sum(44)$_{1...12}$ = 978.54 (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= | 133.02 | 116.34 | 120.05 | 104.67 | 100.43 | 86.66 | 80.31 | 92.15 | 93.25 | 108.68 | 118.63 | 128.82 | |

Total = Sum(45)$_{1...12}$ = 1283.02 (45)

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (46)m= | 19.95 | 17.45 | 18.01 | 15.7 | 15.06 | 13 | 12.05 | 13.82 | 13.99 | 16.3 | 17.79 | 19.32 | (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) = 110 (50)

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

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (56)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (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= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (57) |

# DER WorkSheet: New dwelling design stage

| | | |
|---|---|---|
| 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= | 23.26 | 21.01 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | (59) |

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 | (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= | 188.3 | 166.27 | 175.33 | 158.16 | 155.71 | 140.16 | 135.58 | 147.43 | 146.75 | 163.95 | 172.12 | 184.1 | (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= | 188.3 | 166.27 | 175.33 | 158.16 | 155.71 | 140.16 | 135.58 | 147.43 | 146.75 | 163.95 | 172.12 | 184.1 | |

| | | |
|---|---|---|
| Output from water heater (annual)$_{1...12}$ | 1933.86 | (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= | 88.45 | 78.63 | 84.14 | 77.6 | 77.61 | 71.61 | 70.92 | 74.86 | 73.8 | 80.36 | 82.24 | 87.06 | (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= | 99.67 | 99.67 | 99.67 | 99.67 | 99.67 | 99.67 | 99.67 | 99.67 | 99.67 | 99.67 | 99.67 | 99.67 | (66) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (67)m= | 17.6 | 15.63 | 12.71 | 9.62 | 7.19 | 6.07 | 6.56 | 8.53 | 11.45 | 14.54 | 16.97 | 18.09 | (67) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (68)m= | 174 | 175.81 | 171.26 | 161.57 | 149.35 | 137.85 | 130.18 | 128.37 | 132.92 | 142.61 | 154.84 | 166.33 | (68) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (69)m= | 32.97 | 32.97 | 32.97 | 32.97 | 32.97 | 32.97 | 32.97 | 32.97 | 32.97 | 32.97 | 32.97 | 32.97 | (69) |

Pumps and fans gains (Table 5a)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (70)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (70) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (71)m= | -79.74 | -79.74 | -79.74 | -79.74 | -79.74 | -79.74 | -79.74 | -79.74 | -79.74 | -79.74 | -79.74 | -79.74 | (71) |

Water heating gains (Table 5)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (72)m= | 118.89 | 117 | 113.09 | 107.77 | 104.32 | 99.46 | 95.33 | 100.62 | 102.5 | 108.01 | 114.22 | 117.01 | (72) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (73)m= | 363.39 | 361.35 | 349.97 | 331.87 | 313.76 | 296.29 | 284.97 | 290.43 | 299.78 | 318.06 | 338.93 | 354.33 | (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 | 6.56 | x | 11.28 | x | 0.63 | x | 0.7 | = | 22.62 | (75) |
| Northeast | 0.9x | 0.77 | x | 6.56 | x | 22.97 | x | 0.63 | x | 0.7 | = | 46.04 | (75) |

# DER WorkSheet: New dwelling design stage

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Northeast 0.9x | 0.77 | x | 6.56 | x | 41.38 | x | 0.63 | x | 0.7 | = | 82.96 | (75) |
| Northeast 0.9x | 0.77 | x | 6.56 | x | 67.96 | x | 0.63 | x | 0.7 | = | 136.24 | (75) |
| Northeast 0.9x | 0.77 | x | 6.56 | x | 91.35 | x | 0.63 | x | 0.7 | = | 183.13 | (75) |
| Northeast 0.9x | 0.77 | x | 6.56 | x | 97.38 | x | 0.63 | x | 0.7 | = | 195.24 | (75) |
| Northeast 0.9x | 0.77 | x | 6.56 | x | 91.1 | x | 0.63 | x | 0.7 | = | 182.64 | (75) |
| Northeast 0.9x | 0.77 | x | 6.56 | x | 72.63 | x | 0.63 | x | 0.7 | = | 145.6 | (75) |
| Northeast 0.9x | 0.77 | x | 6.56 | x | 50.42 | x | 0.63 | x | 0.7 | = | 101.08 | (75) |
| Northeast 0.9x | 0.77 | x | 6.56 | x | 28.07 | x | 0.63 | x | 0.7 | = | 56.27 | (75) |
| Northeast 0.9x | 0.77 | x | 6.56 | x | 14.2 | x | 0.63 | x | 0.7 | = | 28.46 | (75) |
| Northeast 0.9x | 0.77 | x | 6.56 | x | 9.21 | x | 0.63 | x | 0.7 | = | 18.47 | (75) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (83)m= | 22.62 | 46.04 | 82.96 | 136.24 | 183.13 | 195.24 | 182.64 | 145.6 | 101.08 | 56.27 | 28.46 | 18.47 | (83) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (84)m= | 386.01 | 407.39 | 432.92 | 468.11 | 496.9 | 491.53 | 467.61 | 436.03 | 400.86 | 374.32 | 367.39 | 372.8 | (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 | 0.87 | 0.7 | 0.53 | 0.58 | 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= | 19.95 | 20.05 | 20.26 | 20.56 | 20.82 | 20.96 | 20.99 | 20.99 | 20.9 | 20.59 | 20.23 | 19.94 | (87) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (88)m= | 20.1 | 20.1 | 20.1 | 20.12 | 20.12 | 20.13 | 20.13 | 20.14 | 20.13 | 20.12 | 20.12 | 20.11 | (88) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (89)m= | 0.99 | 0.99 | 0.98 | 0.95 | 0.83 | 0.62 | 0.43 | 0.48 | 0.77 | 0.96 | 0.99 | 1 | (89) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (90)m= | 18.7 | 18.85 | 19.15 | 19.59 | 19.94 | 20.11 | 20.13 | 20.13 | 20.04 | 19.63 | 19.12 | 18.69 | (90) |

fLA = Living area ÷ (4) = 0.6 (91)

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (92)m= | 19.45 | 19.57 | 19.82 | 20.18 | 20.47 | 20.62 | 20.65 | 20.65 | 20.56 | 20.21 | 19.79 | 19.44 | (92) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (93)m= | 19.45 | 19.57 | 19.82 | 20.18 | 20.47 | 20.62 | 20.65 | 20.65 | 20.56 | 20.21 | 19.79 | 19.44 | (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 | 0.95 | 0.85 | 0.66 | 0.49 | 0.54 | 0.81 | 0.96 | 0.99 | 0.99 | (94) |
| Useful gains, hmGm , W = (94)m x (84)m | | | | | | | | | | | | | |
| (95)m= | 383.49 | 403.45 | 424.54 | 443.16 | 423.22 | 325.98 | 227.32 | 235.95 | 323.86 | 358.55 | 363 | 370.76 | (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= | 898.35 | 867.05 | 784.33 | 652.87 | 506.09 | 341.58 | 229.71 | 240.06 | 368.79 | 554.36 | 737.07 | 891.52 | (97) |

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (98)m= | 383.06 | 311.54 | 267.69 | 150.99 | 61.66 | 0 | 0 | 0 | 0 | 145.68 | 269.33 | 387.45 |

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1977.39 (98)

Space heating requirement in kWh/m²/year 32.73 (99)

## 9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

| | | | |
|---|---|---|---|
| Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none | | 0 | (301) |
| Fraction of space heat from community system 1 – (301) = | | 1 | (302) |

*The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.*

| | | | |
|---|---|---|---|
| Fraction of heat from Community boilers | | 1 | (303a) |
| Fraction of total space heat from Community boilers | (302) x (303a) = | 1 | (304a) |
| Factor for control and charging method (Table 4c(3)) for community heating system | | 1 | (305) |
| Distribution loss factor (Table 12c) for community heating system | | 1.05 | (306) |
| **Space heating** | | **kWh/year** | |
| Annual space heating requirement | | 1977.39 | |
| Space heat from Community boilers | (98) x (304a) x (305) x (306) = | 2076.26 | (307a) |
| Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) | | 0 | (308 |
| Space heating requirement from secondary/supplementary system | (98) x (301) x 100 ÷ (308) = | 0 | (309) |
| **Water heating** | | | |
| Annual water heating requirement | | 1933.86 | |
| If DHW from community scheme:<br>Water heat from Community boilers | (64) x (303a) x (305) x (306) = | 2030.56 | (310a) |
| Electricity used for heat distribution | 0.01 × [(307a)…(307e) + (310a)…(310e)] = | 41.07 | (313) |
| Cooling System Energy Efficiency Ratio | | 0 | (314) |
| Space cooling (if there is a fixed cooling system, if not enter 0) | = (107) ÷ (314) = | 0 | (315) |
| Electricity for pumps and fans within dwelling (Table 4f):<br>mechanical ventilation - balanced, extract or positive input from outside | | 128.53 | (330a) |
| warm air heating system fans | | 0 | (330b) |
| pump for solar water heating | | 0 | (330g) |
| Total electricity for the above, kWh/year | =(330a) + (330b) + (330g) = | 128.53 | (331) |
| Energy for lighting (calculated in Appendix L) | | 310.83 | (332) |
| Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) = | | 4546.18 | (338) |

## 12b. CO2 Emissions – Community heating scheme

| | Energy kWh/year | Emission factor kg CO2/kWh | Emissions kg CO2/year |
|---|---|---|---|

# DER WorkSheet: New dwelling design stage

| | | | | | |
|---|---|---|---|---|---|
| CO2 from other sources of space and water heating (not CHP)<br>Efficiency of heat source 1 (%) | If there is CHP using two fuels repeat (363) to (366) for the second fuel | | | 96 | (367a) |
| CO2 associated with heat source 1 | [(307b)+(310b)] x 100 ÷ (367b) x | 0.22 | = | 924.03 | (367) |
| Electrical energy for heat distribution | [(313) x | 0.52 | = | 21.31 | (372) |
| Total CO2 associated with community systems | (363)…(366) + (368)...(372) | | = | 945.35 | (373) |
| CO2 associated with space heating (secondary) | (309) x | 0 | = | 0 | (374) |
| CO2 associated with water from immersion heater or instantaneous heater | (312) x | 0.22 | = | 0 | (375) |
| Total CO2 associated with space and water heating | (373) + (374) + (375) = | | | 945.35 | (376) |
| CO2 associated with electricity for pumps and fans within dwelling | (331)) x | 0.52 | = | 66.71 | (378) |
| CO2 associated with electricity for lighting | (332))) x | 0.52 | = | 161.32 | (379) |
| **Total CO2, kg/year** | sum of (376)…(382) = | | | 1173.38 | (383) |
| **Dwelling CO2 Emission Rate** | (383) ÷ (4) = | | | 19.42 | (384) |
| **EI rating (section 14)** | | | | 85.09 | (385) |

# Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.50
*Printed on 06 December 2021 at 11:00:58*

## Project Information:

**Assessed By:** Neil Ingham (STRO010943) **Building Type:** Flat

## Dwelling Details:

**NEW DWELLING DESIGN STAGE** Total Floor Area: 59.22m²

**Site Reference :** Highgate Road - GREEN **Plot Reference:** 00 - C

**Address :**

## Client Details:

**Name:**

**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 (c) | | |
| Fuel factor: 1.00 (mains gas (c)) | | |
| Target Carbon Dioxide Emission Rate (TER) | 21.78 kg/m² | |
| Dwelling Carbon Dioxide Emission Rate (DER) | 18.95 kg/m² | **OK** |

## 1b TFEE and DFEE

| | | |
|---|---|---|
| Target Fabric Energy Efficiency (TFEE) | 63.0 kWh/m² | |
| Dwelling Fabric Energy Efficiency (DFEE) | 52.3 kWh/m² | |
| | | **OK** |

## 2 Fabric U-values

| Element | Average | Highest | |
|---|---|---|---|
| External wall | 0.17 (max. 0.30) | 0.18 (max. 0.70) | **OK** |
| Party wall | 0.00 (max. 0.20) | - | **OK** |
| Floor | 0.13 (max. 0.25) | 0.13 (max. 0.70) | **OK** |
| Roof | 0.13 (max. 0.20) | 0.13 (max. 0.35) | **OK** |
| Openings | 1.40 (max. 2.00) | 1.40 (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 | 3.00 (design value) | |
| Maximum | 10.0 | **OK** |

## 4 Heating efficiency

| | |
|---|---|
| Main Heating system: | Community heating schemes - mains gas |
| Secondary heating system: | None |

## 5 Cylinder insulation

| | |
|---|---|
| Hot water Storage: | No cylinder |

## 6 Controls

| | | |
|---|---|---|
| Space heating controls | Charging system linked to use of community heating, programmer and at least two room thermostats | **OK** |
| Hot water controls: | No cylinder thermostat<br>No cylinder | |

# Regulations Compliance Report

## 7 Low energy lights

| | | |
|---|---|---|
| Percentage of fixed lights with low-energy fittings | 100.0% | |
| Minimum | 75.0% | **OK** |

## 8 Mechanical ventilation

| | | |
|---|---|---|
| Continuous supply and extract system | | |
| Specific fan power: | 0.47 | |
| Maximum | 1.5 | **OK** |
| MVHR efficiency: | 89% | |
| Minimum | 70% | **OK** |

## 9 Summertime temperature

| | | |
|---|---|---|
| Overheating risk (Thames valley): | Medium | **OK** |
| Based on: | | |
| Overshading: | Average or unknown | |
| Windows facing: North East | 9.01m² | |
| Ventilation rate: | 2.00 | |

## 10 Key features

| | |
|---|---|
| Air permeablility | 3.0 m³/m²h |
| Party  Walls U-value | 0 W/m²K |
| Community heating, heat from boilers – mains gas | |

# DER WorkSheet: New dwelling design stage

User Details:

| | | | |
|---|---|---|---|
| **Assessor Name:** | Neil Ingham | **Stroma Number:** | STRO010943 |
| **Software Name:** | Stroma FSAP 2012 | **Software Version:** | Version: 1.0.5.50 |

Property Address: 00 - C

**Address :**

## 1. Overall dwelling dimensions:

| | Area(m²) | | Av. Height(m) | | Volume(m³) | |
|---|---|---|---|---|---|---|
| Ground floor | 59.22 | (1a) x | 2.65 | (2a) = | 156.93 | (3a) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n) | 59.22 | (4) | | | | |
| Dwelling volume | | | | (3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) = | 156.93 | (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 | | | | | | | 0 | x 10 = | 0 | (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) = | 0 | ÷ (5) = | 0 | (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 | | 3 | (17) |
| If based on air permeability value, then | (18) = [(17) ÷ 20]+(8), otherwise (18) = (16) | 0.15 | (18) |

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

| | | | |
|---|---|---|---|
| Number of sides sheltered | | 0 | (19) |
| Shelter factor | (20) = 1 - [0.075 x (19)] = | 1 | (20) |
| Infiltration rate incorporating shelter factor | (21) = (18) x (20) = | 0.15 | (21) |

Infiltration rate modified for monthly wind speed

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|

Monthly average wind speed from Table 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 |

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 |

# DER WorkSheet: New dwelling design stage

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

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.19 | 0.19 | 0.18 | 0.16 | 0.16 | 0.14 | 0.14 | 0.14 | 0.15 | 0.16 | 0.17 | 0.18 |

*Calculate effective air change rate for the applicable case*

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 75.65 (23c)

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24a)m= | 0.31 | 0.31 | 0.31 | 0.29 | 0.28 | 0.26 | 0.26 | 0.26 | 0.27 | 0.28 | 0.29 | 0.3 | (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 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24d) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (25)m= | 0.31 | 0.31 | 0.31 | 0.29 | 0.28 | 0.26 | 0.26 | 0.26 | 0.27 | 0.28 | 0.29 | 0.3 | (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 | | | 2.94 | x | 1.4 | = | 4.116 | | | (26) |
| Windows | | | 9.01 | x1/[1/( 1.4 )+ 0.04] | | = | 11.95 | | | (27) |
| Floor | | | 59.22 | x | 0.13 | = | 7.6986 | 110 | 6514.2 | (28) |
| Walls Type1 | 23.47 | 11.95 | 11.52 | x | 0.18 | = | 2.07 | 60 | 691.2 | (29) |
| Walls Type2 | 35.26 | 0 | 35.26 | x | 0.17 | = | 5.89 | 60 | 2115.6 | (29) |
| Roof | 6.91 | 0 | 6.91 | x | 0.13 | = | 0.9 | 9 | 62.19 | (30) |
| Total area of elements, m² | | | 124.86 | | | | | | | (31) |
| Party wall | | | 26 | x | 0 | = | 0 | 45 | 1170 | (32) |
| Party ceiling | | | 52.3 | | | | | 30 | 1569 | (32b) |
| Internal wall ** | | | 101.81 | | | | | 9 | 916.29 | (32c) |

** 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) = 32.62 (33)

Heat capacity Cm = S(A x k ) ((28)…(30) + (32) + (32a)…(32e) = 13038.48 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 220.17 (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 10.34 (36)

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

Total fabric heat loss (33) + (36) = 42.96 (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 |
|---|---|---|---|---|---|---|---|---|---|---|---|

# DER WorkSheet: New dwelling design stage

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (38)m= | 16.21 | 16.02 | 15.82 | 14.85 | 14.66 | 13.68 | 13.68 | 13.49 | 14.07 | 14.66 | 15.04 | 15.43 | | (38) |

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

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (39)m= | 59.17 | 58.98 | 58.78 | 57.81 | 57.62 | 56.65 | 56.65 | 56.45 | 57.04 | 57.62 | 58.01 | 58.4 | | |

Average = Sum(39)$_{1...12}$ /12= 57.77 (39)

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

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (40)m= | 1 | 1 | 0.99 | 0.98 | 0.97 | 0.96 | 0.96 | 0.95 | 0.96 | 0.97 | 0.98 | 0.99 |

Average = Sum(40)$_{1...12}$ /12= 0.98 (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 1.96 (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 80.74 (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)*

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

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (44)m= | 88.81 | 85.58 | 82.35 | 79.12 | 75.89 | 72.66 | 72.66 | 75.89 | 79.12 | 82.35 | 85.58 | 88.81 |

Total = Sum(44)$_{1...12}$ = 968.86 (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= | 131.71 | 115.19 | 118.87 | 103.63 | 99.44 | 85.81 | 79.51 | 91.24 | 92.33 | 107.6 | 117.46 | 127.55 |

Total = Sum(45)$_{1...12}$ = 1270.32 (45)

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (46)m= | 19.76 | 17.28 | 17.83 | 15.54 | 14.92 | 12.87 | 11.93 | 13.69 | 13.85 | 16.14 | 17.62 | 19.13 | (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) = 110 (50)

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

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (56)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (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= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (57) |

# DER WorkSheet: New dwelling design stage

| | | |
|---|---|---|
| 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= | 23.26 | 21.01 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | (59) |

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 | (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= | 186.98 | 165.12 | 174.14 | 157.12 | 154.71 | 139.3 | 134.79 | 146.52 | 145.82 | 162.88 | 170.95 | 182.83 | (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= | 186.98 | 165.12 | 174.14 | 157.12 | 154.71 | 139.3 | 134.79 | 146.52 | 145.82 | 162.88 | 170.95 | 182.83 | |

| | | |
|---|---|---|
| Output from water heater (annual)$_{1...12}$ | 1921.16 | (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= | 88.01 | 78.24 | 83.74 | 77.25 | 77.28 | 71.33 | 70.66 | 74.56 | 73.49 | 80 | 81.85 | 86.63 | (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= | 97.97 | 97.97 | 97.97 | 97.97 | 97.97 | 97.97 | 97.97 | 97.97 | 97.97 | 97.97 | 97.97 | 97.97 | (66) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (67)m= | 16.07 | 14.27 | 11.6 | 8.79 | 6.57 | 5.54 | 5.99 | 7.79 | 10.45 | 13.27 | 15.49 | 16.51 | (67) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (68)m= | 170.98 | 172.75 | 168.28 | 158.76 | 146.75 | 135.45 | 127.91 | 126.14 | 130.61 | 140.12 | 152.14 | 163.43 | (68) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (69)m= | 32.8 | 32.8 | 32.8 | 32.8 | 32.8 | 32.8 | 32.8 | 32.8 | 32.8 | 32.8 | 32.8 | 32.8 | (69) |

Pumps and fans gains (Table 5a)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (70)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (70) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (71)m= | -78.38 | -78.38 | -78.38 | -78.38 | -78.38 | -78.38 | -78.38 | -78.38 | -78.38 | -78.38 | -78.38 | -78.38 | (71) |

Water heating gains (Table 5)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (72)m= | 118.3 | 116.43 | 112.56 | 107.29 | 103.88 | 99.06 | 94.97 | 100.21 | 102.08 | 107.53 | 113.68 | 116.44 | (72) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (73)m= | 357.73 | 355.84 | 344.84 | 327.23 | 309.58 | 292.45 | 281.26 | 286.53 | 295.53 | 313.31 | 333.7 | 348.78 | (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 | 9.01 | x | 11.28 | x | 0.63 | x | 0.7 | = | 31.07 | (75) |
| Northeast 0.9x | 0.77 | x | 9.01 | x | 22.97 | x | 0.63 | x | 0.7 | = | 63.24 | (75) |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Northeast 0.9x | 0.77 | x | 9.01 | x | 41.38 | x | 0.63 | x | 0.7 | = | 113.94 | (75) |
| Northeast 0.9x | 0.77 | x | 9.01 | x | 67.96 | x | 0.63 | x | 0.7 | = | 187.12 | (75) |
| Northeast 0.9x | 0.77 | x | 9.01 | x | 91.35 | x | 0.63 | x | 0.7 | = | 251.53 | (75) |
| Northeast 0.9x | 0.77 | x | 9.01 | x | 97.38 | x | 0.63 | x | 0.7 | = | 268.16 | (75) |
| Northeast 0.9x | 0.77 | x | 9.01 | x | 91.1 | x | 0.63 | x | 0.7 | = | 250.85 | (75) |
| Northeast 0.9x | 0.77 | x | 9.01 | x | 72.63 | x | 0.63 | x | 0.7 | = | 199.98 | (75) |
| Northeast 0.9x | 0.77 | x | 9.01 | x | 50.42 | x | 0.63 | x | 0.7 | = | 138.84 | (75) |
| Northeast 0.9x | 0.77 | x | 9.01 | x | 28.07 | x | 0.63 | x | 0.7 | = | 77.29 | (75) |
| Northeast 0.9x | 0.77 | x | 9.01 | x | 14.2 | x | 0.63 | x | 0.7 | = | 39.09 | (75) |
| Northeast 0.9x | 0.77 | x | 9.01 | x | 9.21 | x | 0.63 | x | 0.7 | = | 25.37 | (75) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (83)m= | 31.07 | 63.24 | 113.94 | 187.12 | 251.53 | 268.16 | 250.85 | 199.98 | 138.84 | 77.29 | 39.09 | 25.37 | (83) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (84)m= | 388.8 | 419.08 | 458.77 | 514.35 | 561.11 | 560.61 | 532.12 | 486.51 | 434.36 | 390.6 | 372.79 | 374.15 | (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= | 0.99 | 0.99 | 0.98 | 0.94 | 0.82 | 0.62 | 0.46 | 0.52 | 0.8 | 0.96 | 0.99 | 1 | (86) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (87)m= | 19.91 | 20.03 | 20.27 | 20.6 | 20.86 | 20.97 | 21 | 20.99 | 20.91 | 20.59 | 20.21 | 19.9 | (87) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (88)m= | 20.08 | 20.09 | 20.09 | 20.1 | 20.11 | 20.12 | 20.12 | 20.12 | 20.11 | 20.11 | 20.1 | 20.09 | (88) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (89)m= | 0.99 | 0.99 | 0.97 | 0.92 | 0.77 | 0.55 | 0.37 | 0.43 | 0.73 | 0.94 | 0.99 | 0.99 | (89) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (90)m= | 18.64 | 18.81 | 19.16 | 19.64 | 19.97 | 20.1 | 20.12 | 20.12 | 20.04 | 19.63 | 19.07 | 18.62 | (90) |

fLA = Living area ÷ (4) = | 0.45 | (91)

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (92)m= | 19.21 | 19.36 | 19.66 | 20.07 | 20.37 | 20.49 | 20.51 | 20.51 | 20.43 | 20.06 | 19.58 | 19.2 | (92) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (93)m= | 19.21 | 19.36 | 19.66 | 20.07 | 20.37 | 20.49 | 20.51 | 20.51 | 20.43 | 20.06 | 19.58 | 19.2 | (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 | 0.97 | 0.92 | 0.79 | 0.58 | 0.41 | 0.47 | 0.75 | 0.94 | 0.98 | 0.99 | (94) |
| Useful gains, hmGm , W = (94)m x (84)m | | | | | | | | | | | | | |
| (95)m= | 385.39 | 413.3 | 445.27 | 471.67 | 441.11 | 324.74 | 220.37 | 229.66 | 327.32 | 368.13 | 366.82 | 371.41 | (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) |

# DER WorkSheet: New dwelling design stage

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m ]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (97)m= | 882.32 | 853.01 | 773.55 | 645.92 | 499.58 | 333.94 | 221.66 | 232.12 | 361.26 | 545.24 | 724.19 | 875.67 | (97) |

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (98)m= | 369.71 | 295.49 | 244.24 | 125.45 | 43.5 | 0 | 0 | 0 | 0 | 131.77 | 257.3 | 375.17 |

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1842.63 (98)

Space heating requirement in kWh/m²/year 31.12 (99)

## 9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

| | | | |
|---|---|---|---|
| Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none | | 0 | (301) |
| Fraction of space heat from community system 1 – (301) = | | 1 | (302) |

*The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.*

| | | | |
|---|---|---|---|
| Fraction of heat from Community boilers | | 1 | (303a) |
| Fraction of total space heat from Community boilers | (302) x (303a) = | 1 | (304a) |
| Factor for control and charging method (Table 4c(3)) for community heating system | | 1 | (305) |
| Distribution loss factor (Table 12c) for community heating system | | 1.05 | (306) |
| **Space heating** | | **kWh/year** | |
| Annual space heating requirement | | 1842.63 | |
| Space heat from Community boilers | (98) x (304a) x (305) x (306) = | 1934.76 | (307a) |
| Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) | | 0 | (308 |
| Space heating requirement from secondary/supplementary system | (98) x (301) x 100 ÷ (308) = | 0 | (309) |
| **Water heating** | | | |
| Annual water heating requirement | | 1921.16 | |
| If DHW from community scheme:<br>Water heat from Community boilers | (64) x (303a) x (305) x (306) = | 2017.22 | (310a) |
| Electricity used for heat distribution | 0.01 × [(307a)…(307e) + (310a)…(310e)] = | 39.52 | (313) |
| Cooling System Energy Efficiency Ratio | | 0 | (314) |
| Space cooling (if there is a fixed cooling system, if not enter 0) | = (107) ÷ (314) = | 0 | (315) |
| Electricity for pumps and fans within dwelling (Table 4f):<br>mechanical ventilation - balanced, extract or positive input from outside | | 125.98 | (330a) |
| warm air heating system fans | | 0 | (330b) |
| pump for solar water heating | | 0 | (330g) |
| Total electricity for the above, kWh/year | =(330a) + (330b) + (330g) = | 125.98 | (331) |
| Energy for lighting (calculated in Appendix L) | | 283.72 | (332) |
| Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) = | | 4361.68 | (338) |

## 12b. CO2 Emissions – Community heating scheme

| | Energy<br>kWh/year | Emission factor<br>kg CO2/kWh | Emissions<br>kg CO2/year |
|---|---|---|---|

# DER WorkSheet: New dwelling design stage

| | | | | | |
|---|---|---|---|---|---|
| CO2 from other sources of space and water heating (not CHP) | | | | | |
| Efficiency of heat source 1 (%) | If there is CHP using two fuels repeat (363) to (366) for the second fuel | | | 96 | (367a) |
| CO2 associated with heat source 1 | [(307b)+(310b)] x 100 ÷ (367b) x | 0.22 | = | 889.2 | (367) |
| Electrical energy for heat distribution | [(313) x | 0.52 | = | 20.51 | (372) |
| Total CO2 associated with community systems | (363)…(366) + (368)...(372) | | = | 909.71 | (373) |
| CO2 associated with space heating (secondary) | (309) x | 0 | = | 0 | (374) |
| CO2 associated with water from immersion heater or instantaneous heater | (312) x | 0.22 | = | 0 | (375) |
| Total CO2 associated with space and water heating | (373) + (374) + (375) = | | | 909.71 | (376) |
| CO2 associated with electricity for pumps and fans within dwelling | (331)) x | 0.52 | = | 65.38 | (378) |
| CO2 associated with electricity for lighting | (332))) x | 0.52 | = | 147.25 | (379) |
| **Total CO2, kg/year** | sum of (376)…(382) = | | | 1122.34 | (383) |
| **Dwelling CO2 Emission Rate** | (383) ÷ (4) = | | | 18.95 | (384) |
| **EI rating (section 14)** | | | | 85.57 | (385) |

# Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.50
*Printed on 06 December 2021 at 11:00:23*

## Project Information:

**Assessed By:** Neil Ingham (STRO010943) **Building Type:** Flat

## Dwelling Details:

**NEW DWELLING DESIGN STAGE** Total Floor Area: 64.41m²

**Site Reference :** Highgate Road - GREEN **Plot Reference:** 00 - D

**Address :**

## Client Details:

**Name:**

**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 (c) | | |
| Fuel factor: 1.00 (mains gas (c)) | | |
| Target Carbon Dioxide Emission Rate (TER) | 20.27 kg/m² | |
| Dwelling Carbon Dioxide Emission Rate (DER) | 17.58 kg/m² | OK |

## 1b TFEE and DFEE

| | | |
|---|---|---|
| Target Fabric Energy Efficiency (TFEE) | 57.7 kWh/m² | |
| Dwelling Fabric Energy Efficiency (DFEE) | 48.2 kWh/m² | |
| | | OK |

## 2 Fabric U-values

| Element | Average | Highest | |
|---|---|---|---|
| External wall | 0.18 (max. 0.30) | 0.18 (max. 0.70) | OK |
| Party wall | 0.00 (max. 0.20) | - | OK |
| Floor | 0.13 (max. 0.25) | 0.13 (max. 0.70) | OK |
| Roof | 0.13 (max. 0.20) | 0.13 (max. 0.35) | OK |
| Openings | 1.40 (max. 2.00) | 1.40 (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 | 3.00 (design value) | |
| Maximum | 10.0 | OK |

## 4 Heating efficiency

| | |
|---|---|
| Main Heating system: | Community heating schemes - mains gas |
| Secondary heating system: | None |

## 5 Cylinder insulation

| | |
|---|---|
| Hot water Storage: | No cylinder |

## 6 Controls

| | | |
|---|---|---|
| Space heating controls | Charging system linked to use of community heating, programmer and at least two room thermostats | OK |
| Hot water controls: | No cylinder thermostat<br>No cylinder | |

# Regulations Compliance Report

| | | |
|---|---|---|
| **7 Low energy lights** | | |
| Percentage of fixed lights with low-energy fittings | 100.0% | |
| Minimum | 75.0% | **OK** |
| **8 Mechanical ventilation** | | |
| Continuous supply and extract system | | |
| Specific fan power: | 0.47 | |
| Maximum | 1.5 | **OK** |
| MVHR efficiency: | 89% | |
| Minimum | 70% | **OK** |
| **9 Summertime temperature** | | |
| Overheating risk (Thames valley): | Medium | **OK** |
| Based on: | | |
| Overshading: | Average or unknown | |
| Windows facing: North East | 5.09m² | |
| Windows facing: South East | 6.72m² | |
| Ventilation rate: | 3.00 | |
| **10 Key features** | | |
| Air permeablility | 3.0 m³/m²h | |
| Party Walls U-value | 0 W/m²K | |
| Community heating, heat from boilers – mains gas | | |

# DER WorkSheet: New dwelling design stage

User Details:

| | | | |
|---|---|---|---|
| **Assessor Name:** | Neil Ingham | **Stroma Number:** | STRO010943 |
| **Software Name:** | Stroma FSAP 2012 | **Software Version:** | Version: 1.0.5.50 |

Property Address: 00 - D

**Address :**

## 1. Overall dwelling dimensions:

| | Area(m²) | | Av. Height(m) | | Volume(m³) | |
|---|---|---|---|---|---|---|
| Ground floor | 64.41 | (1a) x | 2.65 | (2a) = | 170.69 | (3a) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n) | 64.41 | (4) | | | | |
| Dwelling volume | | | (3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) = | | 170.69 | (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 | | | | | | | 0 | x 10 = | 0 | (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) = | 0 | ÷ (5) = | 0 | (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 | | 3 | (17) |
| If based on air permeability value, then | (18) = [(17) ÷ 20]+(8), otherwise (18) = (16) | 0.15 | (18) |

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

| | | | |
|---|---|---|---|
| Number of sides sheltered | | 0 | (19) |
| Shelter factor | (20) = 1 - [0.075 x (19)] = | 1 | (20) |
| Infiltration rate incorporating shelter factor | (21) = (18) x (20) = | 0.15 | (21) |

Infiltration rate modified for monthly wind speed

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

# DER WorkSheet: New dwelling design stage

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

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.19 | 0.19 | 0.18 | 0.16 | 0.16 | 0.14 | 0.14 | 0.14 | 0.15 | 0.16 | 0.17 | 0.18 |

*Calculate effective air change rate for the applicable case*

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 75.65 (23c)

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24a)m= | 0.31 | 0.31 | 0.31 | 0.29 | 0.28 | 0.26 | 0.26 | 0.26 | 0.27 | 0.28 | 0.29 | 0.3 | (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 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24d) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (25)m= | 0.31 | 0.31 | 0.31 | 0.29 | 0.28 | 0.26 | 0.26 | 0.26 | 0.27 | 0.28 | 0.29 | 0.3 | (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 | | | 2.61 | x | 1.4 | = | 3.654 | | | (26) |
| Windows Type 1 | | | 5.09 | x1/[1/( 1.4 )+ 0.04] | | = | 6.75 | | | (27) |
| Windows Type 2 | | | 6.72 | x1/[1/( 1.4 )+ 0.04] | | = | 8.91 | | | (27) |
| Floor | | | 64.41 | x | 0.13 | = | 8.373301 | 110 | 7085.101 | (28) |
| Walls Type1 | 45.34 | 14.42 | 30.92 | x | 0.18 | = | 5.57 | 60 | 1855.2 | (29) |
| Walls Type2 | 4.69 | 0 | 4.69 | x | 0.18 | = | 0.84 | 60 | 281.4 | (29) |
| Roof | 6.8 | 0 | 6.8 | x | 0.13 | = | 0.88 | 9 | 61.2 | (30) |
| Total area of elements, m² | | | 121.24 | | | | | | | (31) |
| Party wall | | | 47.16 | x | 0 | = | 0 | 45 | 2122.2 | (32) |
| Party ceiling | | | 57.61 | | | | | 30 | 1728.3 | (32b) |
| Internal wall ** | | | 91.05 | | | | | 9 | 819.45 | (32c) |

** 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) = 34.98 (33)

Heat capacity Cm = S(A x k ) ((28)…(30) + (32) + (32a)…(32e) = 13952.85 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 216.63 (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 11.69 (36)

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

Total fabric heat loss (33) + (36) = 46.66 (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= | 17.63 | 17.42 | 17.21 | 16.15 | 15.94 | 14.88 | 14.88 | 14.67 | 15.31 | 15.94 | 16.36 | 16.79 | (38) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (39)m= | 64.29 | 64.08 | 63.87 | 62.82 | 62.6 | 61.55 | 61.55 | 61.34 | 61.97 | 62.6 | 63.03 | 63.45 | |

Average = Sum(39)$_{1…12}$ /12= 62.76 (39)

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (40)m= | 1 | 0.99 | 0.99 | 0.98 | 0.97 | 0.96 | 0.96 | 0.95 | 0.96 | 0.97 | 0.98 | 0.99 | |

Average = Sum(40)$_{1…12}$ /12= 0.97 (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 2.1 (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 84.15 (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)*

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

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (44)m= | 92.57 | 89.2 | 85.83 | 82.47 | 79.1 | 75.74 | 75.74 | 79.1 | 82.47 | 85.83 | 89.2 | 92.57 | |

Total = Sum(44)$_{1…12}$ = 1009.81 (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= | 137.27 | 120.06 | 123.89 | 108.01 | 103.64 | 89.43 | 82.87 | 95.1 | 96.23 | 112.15 | 122.42 | 132.94 | |

Total = Sum(45)$_{1…12}$ = 1324.02 (45)

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (46)m= | 20.59 | 18.01 | 18.58 | 16.2 | 15.55 | 13.41 | 12.43 | 14.26 | 14.43 | 16.82 | 18.36 | 19.94 | (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) = 110 (50)

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

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (56)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (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= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (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= | 23.26 | 21.01 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | (59) |

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 | (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= | 192.55 | 169.99 | 179.17 | 161.5 | 158.92 | 142.93 | 138.15 | 150.37 | 149.73 | 167.43 | 175.91 | 188.22 | (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= | 192.55 | 169.99 | 179.17 | 161.5 | 158.92 | 142.93 | 138.15 | 150.37 | 149.73 | 167.43 | 175.91 | 188.22 |

Output from water heater (annual)$_{1…12}$ — 1974.86 (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= | 89.86 | 79.86 | 85.42 | 78.71 | 78.68 | 72.53 | 71.78 | 75.84 | 74.79 | 81.51 | 83.5 | 88.42 | (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= | 105.16 | 105.16 | 105.16 | 105.16 | 105.16 | 105.16 | 105.16 | 105.16 | 105.16 | 105.16 | 105.16 | 105.16 | (66) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (67)m= | 16.7 | 14.83 | 12.06 | 9.13 | 6.83 | 5.76 | 6.23 | 8.09 | 10.86 | 13.79 | 16.1 | 17.16 | (67) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (68)m= | 183.92 | 185.83 | 181.02 | 170.78 | 157.85 | 145.71 | 137.59 | 135.68 | 140.49 | 150.73 | 163.65 | 175.8 | (68) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (69)m= | 33.52 | 33.52 | 33.52 | 33.52 | 33.52 | 33.52 | 33.52 | 33.52 | 33.52 | 33.52 | 33.52 | 33.52 | (69) |

Pumps and fans gains (Table 5a)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (70)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (70) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (71)m= | -84.13 | -84.13 | -84.13 | -84.13 | -84.13 | -84.13 | -84.13 | -84.13 | -84.13 | -84.13 | -84.13 | -84.13 | (71) |

Water heating gains (Table 5)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (72)m= | 120.79 | 118.84 | 114.81 | 109.32 | 105.75 | 100.74 | 96.47 | 101.94 | 103.88 | 109.56 | 115.97 | 118.85 | (72) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (73)m= | 375.95 | 374.05 | 362.43 | 343.77 | 324.98 | 306.75 | 294.84 | 300.26 | 309.78 | 328.63 | 350.27 | 366.36 | (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 | 5.09 | x | 11.28 | x | 0.63 | x | 0.7 | = | 17.55 | (75) |
| Northeast 0.9x | 0.77 | x | 5.09 | x | 22.97 | x | 0.63 | x | 0.7 | = | 35.73 | (75) |
| Northeast 0.9x | 0.77 | x | 5.09 | x | 41.38 | x | 0.63 | x | 0.7 | = | 64.37 | (75) |
| Northeast 0.9x | 0.77 | x | 5.09 | x | 67.96 | x | 0.63 | x | 0.7 | = | 105.71 | (75) |
| Northeast 0.9x | 0.77 | x | 5.09 | x | 91.35 | x | 0.63 | x | 0.7 | = | 142.1 | (75) |
| Northeast 0.9x | 0.77 | x | 5.09 | x | 97.38 | x | 0.63 | x | 0.7 | = | 151.49 | (75) |
| Northeast 0.9x | 0.77 | x | 5.09 | x | 91.1 | x | 0.63 | x | 0.7 | = | 141.71 | (75) |
| Northeast 0.9x | 0.77 | x | 5.09 | x | 72.63 | x | 0.63 | x | 0.7 | = | 112.98 | (75) |
| Northeast 0.9x | 0.77 | x | 5.09 | x | 50.42 | x | 0.63 | x | 0.7 | = | 78.43 | (75) |
| Northeast 0.9x | 0.77 | x | 5.09 | x | 28.07 | x | 0.63 | x | 0.7 | = | 43.66 | (75) |
| Northeast 0.9x | 0.77 | x | 5.09 | x | 14.2 | x | 0.63 | x | 0.7 | = | 22.08 | (75) |
| Northeast 0.9x | 0.77 | x | 5.09 | x | 9.21 | x | 0.63 | x | 0.7 | = | 14.33 | (75) |
| Southeast 0.9x | 0.77 | x | 6.72 | x | 36.79 | x | 0.63 | x | 0.7 | = | 75.56 | (77) |
| Southeast 0.9x | 0.77 | x | 6.72 | x | 62.67 | x | 0.63 | x | 0.7 | = | 128.71 | (77) |
| Southeast 0.9x | 0.77 | x | 6.72 | x | 85.75 | x | 0.63 | x | 0.7 | = | 176.11 | (77) |
| Southeast 0.9x | 0.77 | x | 6.72 | x | 106.25 | x | 0.63 | x | 0.7 | = | 218.21 | (77) |
| Southeast 0.9x | 0.77 | x | 6.72 | x | 119.01 | x | 0.63 | x | 0.7 | = | 244.41 | (77) |
| Southeast 0.9x | 0.77 | x | 6.72 | x | 118.15 | x | 0.63 | x | 0.7 | = | 242.65 | (77) |
| Southeast 0.9x | 0.77 | x | 6.72 | x | 113.91 | x | 0.63 | x | 0.7 | = | 233.94 | (77) |
| Southeast 0.9x | 0.77 | x | 6.72 | x | 104.39 | x | 0.63 | x | 0.7 | = | 214.39 | (77) |
| Southeast 0.9x | 0.77 | x | 6.72 | x | 92.85 | x | 0.63 | x | 0.7 | = | 190.69 | (77) |
| Southeast 0.9x | 0.77 | x | 6.72 | x | 69.27 | x | 0.63 | x | 0.7 | = | 142.26 | (77) |
| Southeast 0.9x | 0.77 | x | 6.72 | x | 44.07 | x | 0.63 | x | 0.7 | = | 90.51 | (77) |
| Southeast 0.9x | 0.77 | x | 6.72 | x | 31.49 | x | 0.63 | x | 0.7 | = | 64.67 | (77) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (83)m= | 93.12 | 164.44 | 240.48 | 323.92 | 386.51 | 394.14 | 375.65 | 327.36 | 269.12 | 185.92 | 112.59 | 79 | (83) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (84)m= | 469.06 | 538.49 | 602.91 | 667.7 | 711.49 | 700.89 | 670.49 | 627.63 | 578.91 | 514.55 | 462.87 | 445.36 | (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= | 0.99 | 0.98 | 0.96 | 0.89 | 0.74 | 0.55 | 0.4 | 0.45 | 0.69 | 0.92 | 0.98 | 0.99 | (86) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (87)m= | 19.98 | 20.15 | 20.41 | 20.71 | 20.91 | 20.98 | 21 | 21 | 20.95 | 20.7 | 20.29 | 19.95 | (87) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (88)m= | 20.08 | 20.09 | 20.09 | 20.1 | 20.11 | 20.12 | 20.12 | 20.12 | 20.12 | 20.11 | 20.1 | 20.1 | (88) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (89)m= | 0.99 | 0.98 | 0.95 | 0.86 | 0.69 | 0.48 | 0.32 | 0.36 | 0.62 | 0.89 | 0.98 | 0.99 | (89) |

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

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (90)m= | 18.73 | 18.98 | 19.35 | 19.78 | 20.02 | 20.11 | 20.12 | 20.12 | 20.08 | 19.77 | 19.19 | 18.69 | | (90) |

fLA = Living area ÷ (4) = 0.63 (91)

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (92)m= | 19.52 | 19.72 | 20.02 | 20.37 | 20.58 | 20.66 | 20.67 | 20.67 | 20.63 | 20.35 | 19.88 | 19.49 | (92) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (93)m= | 19.52 | 19.72 | 20.02 | 20.37 | 20.58 | 20.66 | 20.67 | 20.67 | 20.63 | 20.35 | 19.88 | 19.49 | (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 | 0.97 | 0.94 | 0.87 | 0.72 | 0.52 | 0.37 | 0.42 | 0.66 | 0.9 | 0.97 | 0.99 | (94) |
| Useful gains, hmGm , W = (94)m x (84)m | | | | | | | | | | | | | |
| (95)m= | 462.89 | 524.62 | 569.41 | 578.57 | 511.99 | 366.41 | 249.79 | 260.5 | 383.22 | 462.76 | 450.79 | 440.67 | (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= | 978.27 | 949.85 | 863.68 | 720.48 | 556.05 | 373.13 | 250.74 | 262.12 | 404.72 | 610.7 | 805.69 | 969.88 | (97) |
| Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m | | | | | | | | | | | | | |
| (98)m= | 383.44 | 285.75 | 218.94 | 102.18 | 32.77 | 0 | 0 | 0 | 0 | 110.07 | 255.53 | 393.73 | |

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1782.41 (98)

Space heating requirement in kWh/m²/year 27.67 (99)

## 9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

| | | | |
|---|---|---|---|
| Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none | | 0 | (301) |
| Fraction of space heat from community system 1 – (301) = | | 1 | (302) |

*The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.*

| | | | |
|---|---|---|---|
| Fraction of heat from Community boilers | | 1 | (303a) |
| Fraction of total space heat from Community boilers | (302) x (303a) = | 1 | (304a) |
| Factor for control and charging method (Table 4c(3)) for community heating system | | 1 | (305) |
| Distribution loss factor (Table 12c) for community heating system | | 1.05 | (306) |
| **Space heating** | | **kWh/year** | |
| Annual space heating requirement | | 1782.41 | |
| Space heat from Community boilers | (98) x (304a) x (305) x (306) = | 1871.53 | (307a) |
| Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) | | 0 | (308 |
| Space heating requirement from secondary/supplementary system | (98) x (301) x 100 ÷ (308) = | 0 | (309) |
| **Water heating** | | | |
| Annual water heating requirement | | 1974.86 | |
| If DHW from community scheme:<br>Water heat from Community boilers | (64) x (303a) x (305) x (306) = | 2073.6 | (310a) |
| Electricity used for heat distribution | 0.01 × [(307a)…(307e) + (310a)…(310e)] = | 39.45 | (313) |

# DER WorkSheet: New dwelling design stage

| | | | |
|---|---|---|---|
| Cooling System Energy Efficiency Ratio | | 0 | (314) |
| Space cooling (if there is a fixed cooling system, if not enter 0) | = (107) ÷ (314) = | 0 | (315) |
| Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside | | 137.02 | (330a) |
| warm air heating system fans | | 0 | (330b) |
| pump for solar water heating | | 0 | (330g) |
| Total electricity for the above, kWh/year | =(330a) + (330b) + (330g) = | 137.02 | (331) |
| Energy for lighting (calculated in Appendix L) | | 294.9 | (332) |
| Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) = | | 4377.05 | (338) |

## 12b. CO2 Emissions – Community heating scheme

| | | Energy kWh/year | Emission factor kg CO2/kWh | | Emissions kg CO2/year | |
|---|---|---|---|---|---|---|
| CO2 from other sources of space and water heating (not CHP) Efficiency of heat source 1 (%) | If there is CHP using two fuels repeat (363) to (366) for the second fuel | | | | 96 | (367a) |
| CO2 associated with heat source 1 | [(307b)+(310b)] x 100 ÷ (367b) x | | 0.22 | = | 887.66 | (367) |
| Electrical energy for heat distribution | [(313) x | | 0.52 | = | 20.48 | (372) |
| Total CO2 associated with community systems | (363)…(366) + (368)...(372) | | | = | 908.13 | (373) |
| CO2 associated with space heating (secondary) | (309) x | | 0 | = | 0 | (374) |
| CO2 associated with water from immersion heater or instantaneous heater | (312) x | | 0.22 | = | 0 | (375) |
| Total CO2 associated with space and water heating | (373) + (374) + (375) = | | | | 908.13 | (376) |
| CO2 associated with electricity for pumps and fans within dwelling | (331)) x | | 0.52 | = | 71.11 | (378) |
| CO2 associated with electricity for lighting | (332))) x | | 0.52 | = | 153.05 | (379) |
| **Total CO2, kg/year** | sum of (376)…(382) = | | | | 1132.3 | (383) |
| **Dwelling CO2 Emission Rate** | (383) ÷ (4) = | | | | 17.58 | (384) |
| **EI rating (section 14)** | | | | | 86.13 | (385) |

# Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.50
*Printed on 06 December 2021 at 10:59:59*

## Project Information:

**Assessed By:** Neil Ingham (STRO010943) **Building Type:** Flat

## Dwelling Details:

**NEW DWELLING DESIGN STAGE** Total Floor Area: 61.88m²

**Site Reference :** Highgate Road - GREEN **Plot Reference:** 00 - E

**Address :**

## Client Details:

**Name:**

**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 (c) | | |
| Fuel factor: 1.00 (mains gas (c)) | | |
| Target Carbon Dioxide Emission Rate (TER) | 20.45 kg/m² | |
| Dwelling Carbon Dioxide Emission Rate (DER) | 17.55 kg/m² | OK |

## 1b TFEE and DFEE

| | | |
|---|---|---|
| Target Fabric Energy Efficiency (TFEE) | 56.9 kWh/m² | |
| Dwelling Fabric Energy Efficiency (DFEE) | 46.8 kWh/m² | |
| | | OK |

## 2 Fabric U-values

| Element | Average | Highest | |
|---|---|---|---|
| External wall | 0.16 (max. 0.30) | 0.18 (max. 0.70) | OK |
| Party wall | 0.00 (max. 0.20) | - | OK |
| Floor | 0.13 (max. 0.25) | 0.13 (max. 0.70) | OK |
| Roof | 0.13 (max. 0.20) | 0.13 (max. 0.35) | OK |
| Openings | 1.40 (max. 2.00) | 1.40 (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 | 3.00 (design value) | |
| Maximum | 10.0 | OK |

## 4 Heating efficiency

| | | |
|---|---|---|
| Main Heating system: | Community heating schemes - mains gas | |
| Secondary heating system: | None | |

## 5 Cylinder insulation

| | | |
|---|---|---|
| Hot water Storage: | No cylinder | |

## 6 Controls

| | | |
|---|---|---|
| Space heating controls | Charging system linked to use of community heating, programmer and at least two room thermostats | OK |
| Hot water controls: | No cylinder thermostat<br>No cylinder | |

# Regulations Compliance Report

## 7 Low energy lights

| | | |
|---|---|---|
| Percentage of fixed lights with low-energy fittings | 100.0% | |
| Minimum | 75.0% | **OK** |

## 8 Mechanical ventilation

| | | |
|---|---|---|
| Continuous supply and extract system | | |
| Specific fan power: | 0.47 | |
| Maximum | 1.5 | **OK** |
| MVHR efficiency: | 89% | |
| Minimum | 70% | **OK** |

## 9 Summertime temperature

| | | |
|---|---|---|
| Overheating risk (Thames valley): | Medium | **OK** |
| Based on: | | |
| Overshading: | Average or unknown | |
| Windows facing: South East | 9.14m² | |
| Ventilation rate: | 3.00 | |

## 10 Key features

| | |
|---|---|
| Air permeablility | 3.0 m³/m²h |
| Party  Walls U-value | 0 W/m²K |
| Community heating, heat from boilers – mains gas | |

# DER WorkSheet: New dwelling design stage

User Details:

| | | | |
|---|---|---|---|
| **Assessor Name:** | Neil Ingham | **Stroma Number:** | STRO010943 |
| **Software Name:** | Stroma FSAP 2012 | **Software Version:** | Version: 1.0.5.50 |

Property Address: 00 - E

**Address :**

1. Overall dwelling dimensions:

| | Area(m²) | | Av. Height(m) | | Volume(m³) | |
|---|---|---|---|---|---|---|
| Ground floor | 61.88 | (1a) x | 2.65 | (2a) = | 163.98 | (3a) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n) | 61.88 | (4) | | | | |
| Dwelling volume | | | | (3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) = | 163.98 | (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 | | | | | | | 0 | x 10 = | 0 | (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) = | 0 | ÷ (5) = | 0 | (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 | | 3 | (17) |
| If based on air permeability value, then | (18) = [(17) ÷ 20]+(8), otherwise (18) = (16) | 0.15 | (18) |

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

| | | | |
|---|---|---|---|
| Number of sides sheltered | | 0 | (19) |
| Shelter factor | (20) = 1 - [0.075 x (19)] = | 1 | (20) |
| Infiltration rate incorporating shelter factor | (21) = (18) x (20) = | 0.15 | (21) |

Infiltration rate modified for monthly wind speed

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

# DER WorkSheet: New dwelling design stage

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

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.19 | 0.19 | 0.18 | 0.16 | 0.16 | 0.14 | 0.14 | 0.14 | 0.15 | 0.16 | 0.17 | 0.18 |

*Calculate effective air change rate for the applicable case*

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 75.65 (23c)

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24a)m= | 0.31 | 0.31 | 0.31 | 0.29 | 0.28 | 0.26 | 0.26 | 0.26 | 0.27 | 0.28 | 0.29 | 0.3 | (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 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24d) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (25)m= | 0.31 | 0.31 | 0.31 | 0.29 | 0.28 | 0.26 | 0.26 | 0.26 | 0.27 | 0.28 | 0.29 | 0.3 | (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 | | | 2.61 | x | 1.4 | = | 3.654 | | | (26) |
| Windows | | | 9.14 | x1/[1/( 1.4 )+ 0.04] | | = | 12.12 | | | (27) |
| Floor | | | 61.88 | x | 0.13 | = | 8.0444 | 110 | 6806.8 | (28) |
| Walls Type1 | 21.92 | 11.75 | 10.17 | x | 0.18 | = | 1.83 | 60 | 610.2 | (29) |
| Walls Type2 | 27.99 | 0 | 27.99 | x | 0.15 | = | 4.34 | 60 | 1679.4 | (29) |
| Roof | 24.98 | 0 | 24.98 | x | 0.13 | = | 3.25 | 9 | 224.82 | (30) |
| Total area of elements, m² | | | 136.77 | | | | | | | (31) |
| Party wall | | | 42.78 | x | 0 | = | 0 | 45 | 1925.1 | (32) |
| Party ceiling | | | 36.89 | | | | | 30 | 1106.7 | (32b) |
| Internal wall ** | | | 120.68 | | | | | 9 | 1086.12 | (32c) |

** 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) = 33.23 (33)

Heat capacity Cm = S(A x k ) ((28)…(30) + (32) + (32a)…(32e) = 13439.14 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 217.18 (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 11.41 (36)

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

Total fabric heat loss (33) + (36) = 44.64 (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 |
|---|---|---|---|---|---|---|---|---|---|---|---|

# DER WorkSheet: New dwelling design stage

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (38)m= | 16.94 | 16.73 | 16.53 | 15.52 | 15.31 | 14.3 | 14.3 | 14.1 | 14.71 | 15.31 | 15.72 | 16.13 | (38) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (39)m= | 61.58 | 61.37 | 61.17 | 60.16 | 59.95 | 58.94 | 58.94 | 58.74 | 59.35 | 59.95 | 60.36 | 60.77 | |

Average = Sum(39)$_{1...12}$ /12= 60.11 (39)

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (40)m= | 1 | 0.99 | 0.99 | 0.97 | 0.97 | 0.95 | 0.95 | 0.95 | 0.96 | 0.97 | 0.98 | 0.98 | |

Average = Sum(40)$_{1...12}$ /12= 0.97 (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 2.03 (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 82.51 (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= | 90.77 | 87.46 | 84.16 | 80.86 | 77.56 | 74.26 | 74.26 | 77.56 | 80.86 | 84.16 | 87.46 | 90.77 | |

Total = Sum(44)$_{1...12}$ = 990.16 (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= | 134.6 | 117.72 | 121.48 | 105.91 | 101.62 | 87.69 | 81.26 | 93.25 | 94.36 | 109.97 | 120.04 | 130.35 | |

Total = Sum(45)$_{1...12}$ = 1298.26 (45)

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (46)m= | 20.19 | 17.66 | 18.22 | 15.89 | 15.24 | 13.15 | 12.19 | 13.99 | 14.15 | 16.5 | 18.01 | 19.55 | (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) = 110 (50)

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

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (56)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (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= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (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= | 23.26 | 21.01 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | (59) |

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 | (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= | 189.88 | 167.65 | 176.76 | 159.4 | 156.9 | 141.19 | 136.54 | 148.52 | 147.85 | 165.25 | 173.53 | 185.63 | (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= | 189.88 | 167.65 | 176.76 | 159.4 | 156.9 | 141.19 | 136.54 | 148.52 | 147.85 | 165.25 | 173.53 | 185.63 |

Output from water heater (annual)$_{1...12}$ | 1949.1 | (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= | 88.98 | 79.09 | 84.61 | 78.01 | 78.01 | 71.95 | 71.24 | 75.23 | 74.17 | 80.79 | 82.71 | 87.56 | (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= | 101.71 | 101.71 | 101.71 | 101.71 | 101.71 | 101.71 | 101.71 | 101.71 | 101.71 | 101.71 | 101.71 | 101.71 | (66) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (67)m= | 16.8 | 14.92 | 12.13 | 9.19 | 6.87 | 5.8 | 6.26 | 8.14 | 10.93 | 13.88 | 16.19 | 17.26 | (67) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (68)m= | 177.66 | 179.51 | 174.86 | 164.97 | 152.49 | 140.75 | 132.91 | 131.07 | 135.71 | 145.6 | 158.09 | 169.82 | (68) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (69)m= | 33.17 | 33.17 | 33.17 | 33.17 | 33.17 | 33.17 | 33.17 | 33.17 | 33.17 | 33.17 | 33.17 | 33.17 | (69) |

Pumps and fans gains (Table 5a)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (70)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (70) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (71)m= | -81.37 | -81.37 | -81.37 | -81.37 | -81.37 | -81.37 | -81.37 | -81.37 | -81.37 | -81.37 | -81.37 | -81.37 | (71) |

Water heating gains (Table 5)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (72)m= | 119.59 | 117.69 | 113.73 | 108.35 | 104.85 | 99.93 | 95.75 | 101.11 | 103.01 | 108.58 | 114.87 | 117.69 | (72) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (73)m= | 367.57 | 365.63 | 354.24 | 336.02 | 317.72 | 300 | 288.44 | 293.83 | 303.17 | 321.58 | 342.67 | 358.3 | (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) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Southeast 0.9x | 0.77 | x | 9.14 | x | 36.79 | x | 0.63 | x | 0.7 | = | 102.78 | (77) |
| Southeast 0.9x | 0.77 | x | 9.14 | x | 62.67 | x | 0.63 | x | 0.7 | = | 175.07 | (77) |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Southeast 0.9x | 0.77 | x | 9.14 | x | 85.75 | x | 0.63 | x | 0.7 | = | 239.53 | (77) |
| Southeast 0.9x | 0.77 | x | 9.14 | x | 106.25 | x | 0.63 | x | 0.7 | = | 296.79 | (77) |
| Southeast 0.9x | 0.77 | x | 9.14 | x | 119.01 | x | 0.63 | x | 0.7 | = | 332.43 | (77) |
| Southeast 0.9x | 0.77 | x | 9.14 | x | 118.15 | x | 0.63 | x | 0.7 | = | 330.03 | (77) |
| Southeast 0.9x | 0.77 | x | 9.14 | x | 113.91 | x | 0.63 | x | 0.7 | = | 318.18 | (77) |
| Southeast 0.9x | 0.77 | x | 9.14 | x | 104.39 | x | 0.63 | x | 0.7 | = | 291.59 | (77) |
| Southeast 0.9x | 0.77 | x | 9.14 | x | 92.85 | x | 0.63 | x | 0.7 | = | 259.36 | (77) |
| Southeast 0.9x | 0.77 | x | 9.14 | x | 69.27 | x | 0.63 | x | 0.7 | = | 193.49 | (77) |
| Southeast 0.9x | 0.77 | x | 9.14 | x | 44.07 | x | 0.63 | x | 0.7 | = | 123.1 | (77) |
| Southeast 0.9x | 0.77 | x | 9.14 | x | 31.49 | x | 0.63 | x | 0.7 | = | 87.96 | (77) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (83)m= | 102.78 | 175.07 | 239.53 | 296.79 | 332.43 | 330.03 | 318.18 | 291.59 | 259.36 | 193.49 | 123.1 | 87.96 | (83) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (84)m= | 470.34 | 540.69 | 593.77 | 632.81 | 650.15 | 630.03 | 606.63 | 585.43 | 562.53 | 515.06 | 465.77 | 446.25 | (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= | 0.99 | 0.98 | 0.95 | 0.89 | 0.77 | 0.58 | 0.42 | 0.46 | 0.68 | 0.91 | 0.98 | 0.99 | (86) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (87)m= | 20.02 | 20.2 | 20.44 | 20.71 | 20.9 | 20.98 | 21 | 21 | 20.96 | 20.72 | 20.33 | 19.99 | (87) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (88)m= | 20.09 | 20.09 | 20.09 | 20.11 | 20.11 | 20.12 | 20.12 | 20.13 | 20.12 | 20.11 | 20.1 | 20.1 | (88) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (89)m= | 0.99 | 0.97 | 0.94 | 0.86 | 0.72 | 0.51 | 0.34 | 0.37 | 0.61 | 0.88 | 0.97 | 0.99 | (89) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (90)m= | 18.79 | 19.05 | 19.39 | 19.78 | 20.01 | 20.11 | 20.12 | 20.12 | 20.08 | 19.8 | 19.25 | 18.75 | (90) |

fLA = Living area ÷ (4) = 0.56 (91)

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (92)m= | 19.47 | 19.69 | 19.98 | 20.3 | 20.51 | 20.6 | 20.61 | 20.61 | 20.57 | 20.32 | 19.85 | 19.44 | (92) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (93)m= | 19.47 | 19.69 | 19.98 | 20.3 | 20.51 | 20.6 | 20.61 | 20.61 | 20.57 | 20.32 | 19.85 | 19.44 | (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= | 0.98 | 0.97 | 0.94 | 0.87 | 0.74 | 0.55 | 0.39 | 0.42 | 0.65 | 0.88 | 0.97 | 0.99 | (94) |
| Useful gains, hmGm , W = (94)m x (84)m | | | | | | | | | | | | | |
| (95)m= | 462.89 | 524.04 | 557.31 | 549.73 | 480.93 | 345.68 | 235.37 | 245.79 | 365.54 | 455.52 | 451.06 | 440.59 | (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) |

# DER WorkSheet: New dwelling design stage

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m ]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (97)m= | 934.38 | 907.76 | 824.41 | 685.71 | 527.95 | 353.47 | 236.43 | 247.37 | 384.07 | 582.69 | 769.67 | 926.2 | (97) |

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (98)m= | 350.79 | 257.86 | 198.72 | 97.9 | 34.98 | 0 | 0 | 0 | 0 | 94.61 | 229.4 | 361.29 | |

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1625.56 (98)

Space heating requirement in kWh/m²/year 26.27 (99)

## 9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

| | | | |
|---|---|---|---|
| Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none | | 0 | (301) |
| Fraction of space heat from community system 1 – (301) = | | 1 | (302) |

*The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.*

| | | | |
|---|---|---|---|
| Fraction of heat from Community boilers | | 1 | (303a) |
| Fraction of total space heat from Community boilers | (302) x (303a) = | 1 | (304a) |
| Factor for control and charging method (Table 4c(3)) for community heating system | | 1 | (305) |
| Distribution loss factor (Table 12c) for community heating system | | 1.05 | (306) |
| **Space heating** | | **kWh/year** | |
| Annual space heating requirement | | 1625.56 | |
| Space heat from Community boilers | (98) x (304a) x (305) x (306) = | 1706.84 | (307a) |
| Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) | | 0 | (308 |
| Space heating requirement from secondary/supplementary system | (98) x (301) x 100 ÷ (308) = | 0 | (309) |
| **Water heating** | | | |
| Annual water heating requirement | | 1949.1 | |
| If DHW from community scheme:<br>Water heat from Community boilers | (64) x (303a) x (305) x (306) = | 2046.56 | (310a) |
| Electricity used for heat distribution | 0.01 × [(307a)…(307e) + (310a)…(310e)] = | 37.53 | (313) |
| Cooling System Energy Efficiency Ratio | | 0 | (314) |
| Space cooling (if there is a fixed cooling system, if not enter 0) | = (107) ÷ (314) = | 0 | (315) |
| Electricity for pumps and fans within dwelling (Table 4f):<br>mechanical ventilation - balanced, extract or positive input from outside | | 131.64 | (330a) |
| warm air heating system fans | | 0 | (330b) |
| pump for solar water heating | | 0 | (330g) |
| Total electricity for the above, kWh/year | =(330a) + (330b) + (330g) = | 131.64 | (331) |
| Energy for lighting (calculated in Appendix L) | | 296.65 | (332) |
| Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) = | | 4181.68 | (338) |

## 12b. CO2 Emissions – Community heating scheme

| | Energy<br>kWh/year | Emission factor<br>kg CO2/kWh | Emissions<br>kg CO2/year |
|---|---|---|---|

# DER WorkSheet: New dwelling design stage

| | | | | | |
|---|---|---|---|---|---|
| CO2 from other sources of space and water heating (not CHP) | | | | | |
| Efficiency of heat source 1 (%) | If there is CHP using two fuels repeat (363) to (366) for the second fuel | | | 96 | (367a) |
| CO2 associated with heat source 1 | [(307b)+(310b)] x 100 ÷ (367b) x | 0.22 | = | 844.51 | (367) |
| Electrical energy for heat distribution | [(313) x | 0.52 | = | 19.48 | (372) |
| Total CO2 associated with community systems | (363)…(366) + (368)...(372) | | = | 863.99 | (373) |
| CO2 associated with space heating (secondary) | (309) x | 0 | = | 0 | (374) |
| CO2 associated with water from immersion heater or instantaneous heater | (312) x | 0.22 | = | 0 | (375) |
| Total CO2 associated with space and water heating | (373) + (374) + (375) = | | | 863.99 | (376) |
| CO2 associated with electricity for pumps and fans within dwelling | (331)) x | 0.52 | = | 68.32 | (378) |
| CO2 associated with electricity for lighting | (332))) x | 0.52 | = | 153.96 | (379) |
| **Total CO2, kg/year** | sum of (376)…(382) = | | | 1086.28 | (383) |
| **Dwelling CO2 Emission Rate** | (383) ÷ (4) = | | | 17.55 | (384) |
| **EI rating (section 14)** | | | | 86.38 | (385) |

# Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.50
*Printed on 06 December 2021 at 10:59:32*

## Project Information:

**Assessed By:** Neil Ingham (STRO010943) **Building Type:** Flat

## Dwelling Details:

**NEW DWELLING DESIGN STAGE** Total Floor Area: 48.96m²

**Site Reference :** Highgate Road - GREEN **Plot Reference:** 01 - A

**Address :**

## Client Details:

**Name:**

**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 (c)
Fuel factor: 1.00 (mains gas (c))

| | | |
|---|---|---|
| Target Carbon Dioxide Emission Rate (TER) | 21.58 kg/m² | |
| Dwelling Carbon Dioxide Emission Rate (DER) | 18.58 kg/m² | OK |

## 1b TFEE and DFEE

| | | |
|---|---|---|
| Target Fabric Energy Efficiency (TFEE) | 57.7 kWh/m² | |
| Dwelling Fabric Energy Efficiency (DFEE) | 47.3 kWh/m² | |
| | | OK |

## 2 Fabric U-values

| Element | Average | Highest | |
|---|---|---|---|
| External wall | 0.17 (max. 0.30) | 0.18 (max. 0.70) | OK |
| Party wall | 0.00 (max. 0.20) | - | OK |
| Floor | 0.13 (max. 0.25) | 0.13 (max. 0.70) | OK |
| Roof | (no roof) | | |
| Openings | 1.40 (max. 2.00) | 1.40 (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 | 3.00 (design value) | |
| Maximum | 10.0 | OK |

## 4 Heating efficiency

| | |
|---|---|
| Main Heating system: | Community heating schemes - mains gas |
| Secondary heating system: | None |

## 5 Cylinder insulation

| | |
|---|---|
| Hot water Storage: | No cylinder |

## 6 Controls

| | | |
|---|---|---|
| Space heating controls | Charging system linked to use of community heating, programmer and at least two room thermostats | OK |
| Hot water controls: | No cylinder thermostat<br>No cylinder | |

# Regulations Compliance Report

## 7 Low energy lights

| | | |
|---|---|---|
| Percentage of fixed lights with low-energy fittings | 100.0% | |
| Minimum | 75.0% | **OK** |

## 8 Mechanical ventilation

| | | |
|---|---|---|
| Continuous supply and extract system | | |
| Specific fan power: | 0.47 | |
| Maximum | 1.5 | **OK** |
| MVHR efficiency: | 89% | |
| Minimum | 70% | **OK** |

## 9 Summertime temperature

| | | |
|---|---|---|
| Overheating risk (Thames valley): | Slight | **OK** |
| Based on: | | |
| Overshading: | Average or unknown | |
| Windows facing: South West | 5.45m² | |
| Windows facing: South East | 6.09m² | |
| Ventilation rate: | 6.00 | |

## 10 Key features

| | |
|---|---|
| Air permeablility | 3.0 m³/m²h |
| Party Walls U-value | 0 W/m²K |
| Community heating, heat from boilers – mains gas | |

# DER WorkSheet: New dwelling design stage

User Details:

| | | | |
|---|---|---|---|
| **Assessor Name:** | Neil Ingham | **Stroma Number:** | STRO010943 |
| **Software Name:** | Stroma FSAP 2012 | **Software Version:** | Version: 1.0.5.50 |

Property Address: 01 - A

**Address :**

## 1. Overall dwelling dimensions:

| | Area(m²) | | Av. Height(m) | | Volume(m³) | |
|---|---|---|---|---|---|---|
| Ground floor | 48.96 | (1a) x | 2.65 | (2a) = | 129.74 | (3a) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n) | 48.96 | (4) | | | | |
| Dwelling volume | | | | (3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) = | 129.74 | (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 | | | | | | | 0 | x 10 = | 0 | (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) = | 0 | ÷ (5) = | 0 | (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 | | 3 | (17) |
| If based on air permeability value, then | (18) = [(17) ÷ 20]+(8), otherwise (18) = (16) | 0.15 | (18) |

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

| | | | |
|---|---|---|---|
| Number of sides sheltered | | 0 | (19) |
| Shelter factor | (20) = 1 - [0.075 x (19)] = | 1 | (20) |
| Infiltration rate incorporating shelter factor | (21) = (18) x (20) = | 0.15 | (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 |

Wind Factor (22a)m = (22)m ÷ 4

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (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

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.19 | 0.19 | 0.18 | 0.16 | 0.16 | 0.14 | 0.14 | 0.14 | 0.15 | 0.16 | 0.17 | 0.18 |

*Calculate effective air change rate for the applicable case*

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 75.65 (23c)

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24a)m= | 0.31 | 0.31 | 0.31 | 0.29 | 0.28 | 0.26 | 0.26 | 0.26 | 0.27 | 0.28 | 0.29 | 0.3 | (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 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24d) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (25)m= | 0.31 | 0.31 | 0.31 | 0.29 | 0.28 | 0.26 | 0.26 | 0.26 | 0.27 | 0.28 | 0.29 | 0.3 | (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 | |
|---|---|---|---|---|---|---|---|---|---|---|
| Windows Type 1 | | | 5.45 | x1/[1/( 1.4 )+ 0.04] | | = | 7.23 | | | (27) |
| Windows Type 2 | | | 6.09 | x1/[1/( 1.4 )+ 0.04] | | = | 8.07 | | | (27) |
| Floor | | | 48.96 | x | 0.13 | = | 6.364799 | 75 | 3672 | (28) |
| Walls Type1 | 35.3 | 11.54 | 23.76 | x | 0.18 | = | 4.28 | 60 | 1425.6 | (29) |
| Walls Type2 | 35.99 | 0 | 35.99 | x | 0.17 | = | 6.04 | 60 | 2159.4 | (29) |
| Total area of elements, m² | | | 120.25 | | | | | | | (31) |
| Party wall | | | 14.89 | x | 0 | = | 0 | 45 | 670.05 | (32) |
| Party ceiling | | | 48.96 | | | | | 30 | 1468.8 | (32b) |
| Internal wall ** | | | 96.46 | | | | | 9 | 868.14 | (32c) |

** 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) = 31.98 (33)

Heat capacity Cm = S(A x k ) ((28)…(30) + (32) + (32a)…(32e) = 10263.99 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 209.64 (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 9.02 (36)

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

Total fabric heat loss (33) + (36) = 41 (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= | 13.4 | 13.24 | 13.08 | 12.28 | 12.12 | 11.31 | 11.31 | 11.15 | 11.64 | 12.12 | 12.44 | 12.76 | (38) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (39)m= | 54.4 | 54.24 | 54.08 | 53.28 | 53.12 | 52.32 | 52.32 | 52.16 | 52.64 | 53.12 | 53.44 | 53.76 | |

Average = Sum(39)$_{1…12}$ /12= 53.24 (39)

# DER WorkSheet: New dwelling design stage

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (40)m= | 1.11 | 1.11 | 1.1 | 1.09 | 1.08 | 1.07 | 1.07 | 1.07 | 1.08 | 1.08 | 1.09 | 1.1 | |

Average = Sum(40)1…12 /12= 1.09 (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 1.66 (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 73.61 (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= | 80.98 | 78.03 | 75.09 | 72.14 | 69.2 | 66.25 | 66.25 | 69.2 | 72.14 | 75.09 | 78.03 | 80.98 | |

Total = Sum(44)1…12 = 883.37 (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= | 120.08 | 105.03 | 108.38 | 94.49 | 90.66 | 78.23 | 72.5 | 83.19 | 84.18 | 98.11 | 107.09 | 116.29 | |

Total = Sum(45)1…12 = 1158.23 (45)

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (46)m= | 18.01 | 15.75 | 16.26 | 14.17 | 13.6 | 11.74 | 10.87 | 12.48 | 12.63 | 14.72 | 16.06 | 17.44 | (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) = 110 (50)

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

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (56)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (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= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (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= | 23.26 | 21.01 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | (59) |

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 | (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= | 175.36 | 154.95 | 163.65 | 147.98 | 145.94 | 131.73 | 127.77 | 138.47 | 137.68 | 153.38 | 160.59 | 171.57 | (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= | 175.36 | 154.95 | 163.65 | 147.98 | 145.94 | 131.73 | 127.77 | 138.47 | 137.68 | 153.38 | 160.59 | 171.57 | |

Output from water heater (annual)$_{1...12}$ 1809.07 (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= | 84.15 | 74.86 | 80.26 | 74.21 | 74.37 | 68.81 | 68.33 | 71.88 | 70.79 | 76.84 | 78.4 | 82.89 | (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= | 82.98 | 82.98 | 82.98 | 82.98 | 82.98 | 82.98 | 82.98 | 82.98 | 82.98 | 82.98 | 82.98 | 82.98 | (66) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (67)m= | 12.89 | 11.44 | 9.31 | 7.05 | 5.27 | 4.45 | 4.8 | 6.25 | 8.38 | 10.64 | 12.42 | 13.24 | (67) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (68)m= | 144.53 | 146.03 | 142.25 | 134.21 | 124.05 | 114.51 | 108.13 | 106.63 | 110.41 | 118.45 | 128.61 | 138.16 | (68) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (69)m= | 31.3 | 31.3 | 31.3 | 31.3 | 31.3 | 31.3 | 31.3 | 31.3 | 31.3 | 31.3 | 31.3 | 31.3 | (69) |

Pumps and fans gains (Table 5a)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (70)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (70) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (71)m= | -66.38 | -66.38 | -66.38 | -66.38 | -66.38 | -66.38 | -66.38 | -66.38 | -66.38 | -66.38 | -66.38 | -66.38 | (71) |

Water heating gains (Table 5)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (72)m= | 113.1 | 111.4 | 107.87 | 103.07 | 99.95 | 95.57 | 91.84 | 96.62 | 98.31 | 103.28 | 108.89 | 111.41 | (72) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (73)m= | 318.42 | 316.77 | 307.33 | 292.22 | 277.17 | 262.41 | 252.66 | 257.38 | 265 | 280.27 | 297.82 | 310.7 | (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) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Southeast 0.9x | 0.77 | x | 6.09 | x | 36.79 | x | 0.63 | x | 0.7 | = | 68.48 | (77) |
| Southeast 0.9x | 0.77 | x | 6.09 | x | 62.67 | x | 0.63 | x | 0.7 | = | 116.65 | (77) |
| Southeast 0.9x | 0.77 | x | 6.09 | x | 85.75 | x | 0.63 | x | 0.7 | = | 159.6 | (77) |
| Southeast 0.9x | 0.77 | x | 6.09 | x | 106.25 | x | 0.63 | x | 0.7 | = | 197.75 | (77) |
| Southeast 0.9x | 0.77 | x | 6.09 | x | 119.01 | x | 0.63 | x | 0.7 | = | 221.5 | (77) |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Southeast | 0.9x | 0.77 | x | 6.09 | x | 118.15 | x | 0.63 | x | 0.7 | = | 219.9 | (77) |
| Southeast | 0.9x | 0.77 | x | 6.09 | x | 113.91 | x | 0.63 | x | 0.7 | = | 212.01 | (77) |
| Southeast | 0.9x | 0.77 | x | 6.09 | x | 104.39 | x | 0.63 | x | 0.7 | = | 194.29 | (77) |
| Southeast | 0.9x | 0.77 | x | 6.09 | x | 92.85 | x | 0.63 | x | 0.7 | = | 172.81 | (77) |
| Southeast | 0.9x | 0.77 | x | 6.09 | x | 69.27 | x | 0.63 | x | 0.7 | = | 128.92 | (77) |
| Southeast | 0.9x | 0.77 | x | 6.09 | x | 44.07 | x | 0.63 | x | 0.7 | = | 82.02 | (77) |
| Southeast | 0.9x | 0.77 | x | 6.09 | x | 31.49 | x | 0.63 | x | 0.7 | = | 58.6 | (77) |
| Southwest | 0.9x | 0.77 | x | 5.45 | x | 36.79 | | 0.63 | x | 0.7 | = | 61.28 | (79) |
| Southwest | 0.9x | 0.77 | x | 5.45 | x | 62.67 | | 0.63 | x | 0.7 | = | 104.39 | (79) |
| Southwest | 0.9x | 0.77 | x | 5.45 | x | 85.75 | | 0.63 | x | 0.7 | = | 142.83 | (79) |
| Southwest | 0.9x | 0.77 | x | 5.45 | x | 106.25 | | 0.63 | x | 0.7 | = | 176.97 | (79) |
| Southwest | 0.9x | 0.77 | x | 5.45 | x | 119.01 | | 0.63 | x | 0.7 | = | 198.22 | (79) |
| Southwest | 0.9x | 0.77 | x | 5.45 | x | 118.15 | | 0.63 | x | 0.7 | = | 196.79 | (79) |
| Southwest | 0.9x | 0.77 | x | 5.45 | x | 113.91 | | 0.63 | x | 0.7 | = | 189.73 | (79) |
| Southwest | 0.9x | 0.77 | x | 5.45 | x | 104.39 | | 0.63 | x | 0.7 | = | 173.87 | (79) |
| Southwest | 0.9x | 0.77 | x | 5.45 | x | 92.85 | | 0.63 | x | 0.7 | = | 154.65 | (79) |
| Southwest | 0.9x | 0.77 | x | 5.45 | x | 69.27 | | 0.63 | x | 0.7 | = | 115.37 | (79) |
| Southwest | 0.9x | 0.77 | x | 5.45 | x | 44.07 | | 0.63 | x | 0.7 | = | 73.4 | (79) |
| Southwest | 0.9x | 0.77 | x | 5.45 | x | 31.49 | | 0.63 | x | 0.7 | = | 52.45 | (79) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (83)m= | 129.76 | 221.04 | 302.43 | 374.73 | 419.72 | 416.69 | 401.73 | 368.16 | 327.47 | 244.29 | 155.43 | 111.05 | (83) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (84)m= | 448.18 | 537.81 | 609.76 | 666.94 | 696.89 | 679.1 | 654.39 | 625.54 | 592.46 | 524.56 | 453.25 | 421.75 | (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= | 0.98 | 0.95 | 0.9 | 0.81 | 0.66 | 0.48 | 0.35 | 0.38 | 0.59 | 0.84 | 0.96 | 0.98 | (86) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (87)m= | 19.96 | 20.2 | 20.48 | 20.76 | 20.92 | 20.99 | 21 | 21 | 20.96 | 20.75 | 20.31 | 19.91 | (87) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (88)m= | 19.99 | 19.99 | 20 | 20.01 | 20.01 | 20.03 | 20.03 | 20.03 | 20.02 | 20.01 | 20.01 | 20 | (88) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (89)m= | 0.97 | 0.94 | 0.88 | 0.77 | 0.6 | 0.41 | 0.27 | 0.3 | 0.51 | 0.8 | 0.94 | 0.98 | (89) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (90)m= | 18.64 | 18.98 | 19.38 | 19.75 | 19.94 | 20.02 | 20.03 | 20.03 | 20 | 19.75 | 19.15 | 18.58 | (90) |

fLA = Living area ÷ (4) = 0.5 (91)

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (92)m= | 19.29 | 19.59 | 19.93 | 20.25 | 20.43 | 20.5 | 20.51 | 20.51 | 20.48 | 20.25 | 19.73 | 19.24 | (92) |

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

# DER WorkSheet: New dwelling design stage

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (93)m= | 19.29 | 19.59 | 19.93 | 20.25 | 20.43 | 20.5 | 20.51 | 20.51 | 20.48 | 20.25 | 19.73 | 19.24 | (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= | 0.97 | 0.94 | 0.88 | 0.78 | 0.63 | 0.45 | 0.31 | 0.34 | 0.55 | 0.81 | 0.94 | 0.97 | (94) |
| Useful gains, hmGm , W = (94)m x (84)m | | | | | | | | | | | | | |
| (95)m= | 433.95 | 504.17 | 537.92 | 518.98 | 436.88 | 304.14 | 203.81 | 213.3 | 324.61 | 425.46 | 426 | 410.92 | (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= | 815.63 | 796.64 | 726.12 | 604.87 | 463.67 | 308.55 | 204.45 | 214.28 | 335.66 | 512.52 | 674.87 | 808.69 | (97) |
| Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m | | | | | | | | | | | | | |
| (98)m= | 283.97 | 196.55 | 140.02 | 61.84 | 19.93 | 0 | 0 | 0 | 0 | 64.77 | 179.18 | 295.94 | |

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1242.21 (98)

Space heating requirement in kWh/m²/year 25.37 (99)

## 9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

| | | | |
|---|---|---|---|
| Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none | | 0 | (301) |
| Fraction of space heat from community system 1 – (301) = | | 1 | (302) |

*The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.*

| | | | |
|---|---|---|---|
| Fraction of heat from Community boilers | | 1 | (303a) |
| Fraction of total space heat from Community boilers | (302) x (303a) = | 1 | (304a) |
| Factor for control and charging method (Table 4c(3)) for community heating system | | 1 | (305) |
| Distribution loss factor (Table 12c) for community heating system | | 1.05 | (306) |
| **Space heating** | | **kWh/year** | |
| Annual space heating requirement | | 1242.21 | |
| Space heat from Community boilers | (98) x (304a) x (305) x (306) = | 1304.32 | (307a) |
| Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) | | 0 | (308 |
| Space heating requirement from secondary/supplementary system | (98) x (301) x 100 ÷ (308) = | 0 | (309) |
| **Water heating** | | | |
| Annual water heating requirement | | 1809.07 | |
| If DHW from community scheme: Water heat from Community boilers | (64) x (303a) x (305) x (306) = | 1899.52 | (310a) |
| Electricity used for heat distribution | 0.01 × [(307a)…(307e) + (310a)…(310e)] = | 32.04 | (313) |
| Cooling System Energy Efficiency Ratio | | 0 | (314) |
| Space cooling (if there is a fixed cooling system, if not enter 0) | = (107) ÷ (314) = | 0 | (315) |
| Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside | | 104.15 | (330a) |

# DER WorkSheet: New dwelling design stage

| | | | | | |
|---|---|---|---|---|---|
| warm air heating system fans | | | | 0 | (330b) |
| pump for solar water heating | | | | 0 | (330g) |
| Total electricity for the above, kWh/year | =(330a) + (330b) + (330g) = | | | 104.15 | (331) |
| Energy for lighting (calculated in Appendix L) | | | | 227.56 | (332) |
| Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) = | | | | 3535.55 | (338) |

## 12b. CO2 Emissions – Community heating scheme

| | | Energy kWh/year | Emission factor kg CO2/kWh | | Emissions kg CO2/year | |
|---|---|---|---|---|---|---|
| CO2 from other sources of space and water heating (not CHP) | | | | | | |
| Efficiency of heat source 1 (%) | If there is CHP using two fuels repeat (363) to (366) for the second fuel | | | | 96 | (367a) |
| CO2 associated with heat source 1 | [(307b)+(310b)] x 100 ÷ (367b) x | | 0.22 | = | 720.86 | (367) |
| Electrical energy for heat distribution | [(313) x | | 0.52 | = | 16.63 | (372) |
| Total CO2 associated with community systems | (363)…(366) + (368)...(372) | | | = | 737.49 | (373) |
| CO2 associated with space heating (secondary) | (309) x | | 0 | = | 0 | (374) |
| CO2 associated with water from immersion heater or instantaneous heater | (312) x | | 0.22 | = | 0 | (375) |
| Total CO2 associated with space and water heating | (373) + (374) + (375) = | | | | 737.49 | (376) |
| CO2 associated with electricity for pumps and fans within dwelling | (331)) x | | 0.52 | = | 54.06 | (378) |
| CO2 associated with electricity for lighting | (332))) x | | 0.52 | = | 118.1 | (379) |
| **Total CO2, kg/year** | sum of (376)…(382) = | | | | 909.65 | (383) |
| **Dwelling CO2 Emission Rate** | (383) ÷ (4) = | | | | 18.58 | (384) |
| **EI rating (section 14)** | | | | | 87.03 | (385) |

# Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.50
*Printed on 06 December 2021 at 10:59:09*

## Project Information:

**Assessed By:** Neil Ingham (STRO010943) **Building Type:** Flat

## Dwelling Details:

**NEW DWELLING DESIGN STAGE** Total Floor Area: 53.46m²

**Site Reference :** Highgate Road - GREEN **Plot Reference:** 01 - B

**Address :**

## Client Details:

**Name:**

**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 (c) | | |
| Fuel factor: 1.00 (mains gas (c)) | | |
| Target Carbon Dioxide Emission Rate (TER) | 20.26 kg/m² | |
| Dwelling Carbon Dioxide Emission Rate (DER) | 17.51 kg/m² | OK |

## 1b TFEE and DFEE

| | | |
|---|---|---|
| Target Fabric Energy Efficiency (TFEE) | 53.8 kWh/m² | |
| Dwelling Fabric Energy Efficiency (DFEE) | 44.5 kWh/m² | |
| | | OK |

## 2 Fabric U-values

| Element | Average | Highest | |
|---|---|---|---|
| External wall | 0.18 (max. 0.30) | 0.18 (max. 0.70) | OK |
| Party wall | 0.00 (max. 0.20) | - | OK |
| Floor | 0.13 (max. 0.25) | 0.13 (max. 0.70) | OK |
| Roof | (no roof) | | |
| Openings | 1.40 (max. 2.00) | 1.40 (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 | 3.00 (design value) | |
| Maximum | 10.0 | OK |

## 4 Heating efficiency

| | |
|---|---|
| Main Heating system: | Community heating schemes - mains gas |
| Secondary heating system: | None |

## 5 Cylinder insulation

| | |
|---|---|
| Hot water Storage: | No cylinder |

## 6 Controls

| | | |
|---|---|---|
| Space heating controls | Charging system linked to use of community heating, programmer and at least two room thermostats | OK |
| Hot water controls: | No cylinder thermostat<br>No cylinder | |

# Regulations Compliance Report

| 7 Low energy lights | | |
|---|---|---|
| Percentage of fixed lights with low-energy fittings | 100.0% | |
| Minimum | 75.0% | **OK** |

| 8 Mechanical ventilation | | |
|---|---|---|
| Continuous supply and extract system | | |
| Specific fan power: | 0.47 | |
| Maximum | 1.5 | **OK** |
| MVHR efficiency: | 89% | |
| Minimum | 70% | **OK** |

| 9 Summertime temperature | | |
|---|---|---|
| Overheating risk (Thames valley): | Slight | **OK** |
| Based on: | | |
| Overshading: | Average or unknown | |
| Windows facing: South West | 9.56m² | |
| Windows facing: North West | 3.98m² | |
| Ventilation rate: | 6.00 | |

| 10 Key features | |
|---|---|
| Air permeablility | 3.0 m³/m²h |
| Party  Walls U-value | 0 W/m²K |
| Community heating, heat from boilers – mains gas | |

# DER WorkSheet: New dwelling design stage

User Details:

| | | | |
|---|---|---|---|
| **Assessor Name:** | Neil Ingham | **Stroma Number:** | STRO010943 |
| **Software Name:** | Stroma FSAP 2012 | **Software Version:** | Version: 1.0.5.50 |

Property Address: 01 - B

**Address :**

## 1. Overall dwelling dimensions:

| | Area(m²) | | | Av. Height(m) | | | Volume(m³) | |
|---|---|---|---|---|---|---|---|---|
| Ground floor | 53.46 | (1a) | x | 2.65 | (2a) | = | 141.67 | (3a) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n) | 53.46 | (4) | | | | | | |
| Dwelling volume | | | | (3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) = | | | 141.67 | (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 | | | | | | | 0 | x 10 = | 0 | (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) = | 0 | ÷ (5) = | 0 | (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 | | 3 | (17) |
| If based on air permeability value, then | (18) = [(17) ÷ 20]+(8), otherwise (18) = (16) | 0.15 | (18) |

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

| | | | |
|---|---|---|---|
| Number of sides sheltered | | 0 | (19) |
| Shelter factor | (20) = 1 - [0.075 x (19)] = | 1 | (20) |
| Infiltration rate incorporating shelter factor | (21) = (18) x (20) = | 0.15 | (21) |

Infiltration rate modified for monthly wind speed

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

# DER WorkSheet: New dwelling design stage

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

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 0.19 | 0.19 | 0.18 | 0.16 | 0.16 | 0.14 | 0.14 | 0.14 | 0.15 | 0.16 | 0.17 | 0.18 |

*Calculate effective air change rate for the applicable case*

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 75.65 (23c)

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24a)m= | 0.31 | 0.31 | 0.31 | 0.29 | 0.28 | 0.26 | 0.26 | 0.26 | 0.27 | 0.28 | 0.29 | 0.3 | (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 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24d) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (25)m= | 0.31 | 0.31 | 0.31 | 0.29 | 0.28 | 0.26 | 0.26 | 0.26 | 0.27 | 0.28 | 0.29 | 0.3 | (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 | |
|---|---|---|---|---|---|---|---|---|---|---|
| Windows Type 1 | | | 9.56 | x1/[1/( 1.4 )+ 0.04] | | = | 12.67 | | | (27) |
| Windows Type 2 | | | 3.98 | x1/[1/( 1.4 )+ 0.04] | | = | 5.28 | | | (27) |
| Floor | | | 53.46 | x | 0.13 | = | 6.9498 | 75 | 4009.5 | (28) |
| Walls Type1 | 40.04 | 13.54 | 26.5 | x | 0.18 | = | 4.77 | 60 | 1590 | (29) |
| Walls Type2 | 12.16 | 0 | 12.16 | x | 0.17 | = | 2.04 | 60 | 729.6 | (29) |
| Total area of elements, m² | | | 105.66 | | | | | | | (31) |
| Party wall | | | 27.88 | x | 0 | = | 0 | 45 | 1254.6 | (32) |
| Party ceiling | | | 53.46 | | | | | 30 | 1603.8 | (32b) |
| Internal wall ** | | | 102.03 | | | | | 9 | 918.27 | (32c) |

** 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) = 31.71 (33)

Heat capacity Cm = S(A x k ) ((28)…(30) + (32) + (32a)…(32e) = 10105.77 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 189.03 (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 8.81 (36)

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

Total fabric heat loss (33) + (36) = 40.52 (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= | 14.63 | 14.46 | 14.28 | 13.41 | 13.23 | 12.35 | 12.35 | 12.18 | 12.7 | 13.23 | 13.58 | 13.93 | (38) |

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

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (39)m= | 55.16 | 54.98 | 54.8 | 53.93 | 53.75 | 52.88 | 52.88 | 52.7 | 53.23 | 53.75 | 54.1 | 54.45 |

Average = $Sum(39)_{1…12}$ /12= 53.88 (39)

# DER WorkSheet: New dwelling design stage

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

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (40)m= | 1.03 | 1.03 | 1.03 | 1.01 | 1.01 | 0.99 | 0.99 | 0.99 | 1 | 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 — 1.79 (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 — 76.76 (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)*

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

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (44)m= | 84.44 | 81.37 | 78.3 | 75.23 | 72.16 | 69.09 | 69.09 | 72.16 | 75.23 | 78.3 | 81.37 | 84.44 | | |
| | | | | | | | | | | Total = Sum(44)$_{1…12}$ = | | | 921.15 | (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)*

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (45)m= | 125.22 | 109.52 | 113.01 | 98.53 | 94.54 | 81.58 | 75.6 | 86.75 | 87.78 | 102.3 | 111.67 | 121.27 | | |
| | | | | | | | | | | Total = Sum(45)$_{1…12}$ = | | | 1207.78 | (45) |

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

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (46)m= | 18.78 | 16.43 | 16.95 | 14.78 | 14.18 | 12.24 | 11.34 | 13.01 | 13.17 | 15.35 | 16.75 | 18.19 | (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) = | 110 | (50) |
| b) If manufacturer’s declared cylinder loss factor is not known: | | | |
| Hot water storage loss factor from Table 2 (kWh/litre/day) | | 0.02 | (51) |
| If community heating see section 4.3 | | | |
| Volume factor from Table 2a | | 1.03 | (52) |
| Temperature factor from Table 2b | | 0.6 | (53) |
| Energy lost from water storage, kWh/year | (47) x (51) x (52) x (53) = | 1.03 | (54) |
| Enter (50) or (54) in (55) | | 1.03 | (55) |
| Water storage loss calculated for each month | ((56)m = (55) × (41)m | | |

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (56)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (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

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (57)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (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)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (59)m= | 23.26 | 21.01 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | (59) |

# DER WorkSheet: New dwelling design stage

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 | (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= | 180.5 | 159.45 | 168.29 | 152.02 | 149.82 | 135.07 | 130.87 | 142.02 | 141.28 | 157.58 | 165.17 | 176.55 | (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= | 180.5 | 159.45 | 168.29 | 152.02 | 149.82 | 135.07 | 130.87 | 142.02 | 141.28 | 157.58 | 165.17 | 176.55 | |

Output from water heater (annual)$_{1...12}$ 1858.62 (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= | 85.86 | 76.36 | 81.8 | 75.56 | 75.66 | 69.92 | 69.36 | 73.07 | 71.98 | 78.24 | 79.93 | 84.54 | (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= | 89.61 | 89.61 | 89.61 | 89.61 | 89.61 | 89.61 | 89.61 | 89.61 | 89.61 | 89.61 | 89.61 | 89.61 | (66) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (67)m= | 13.93 | 12.37 | 10.06 | 7.62 | 5.69 | 4.81 | 5.19 | 6.75 | 9.06 | 11.5 | 13.43 | 14.31 | (67) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (68)m= | 156.21 | 157.83 | 153.74 | 145.05 | 134.07 | 123.75 | 116.86 | 115.24 | 119.33 | 128.02 | 139 | 149.32 | (68) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (69)m= | 31.96 | 31.96 | 31.96 | 31.96 | 31.96 | 31.96 | 31.96 | 31.96 | 31.96 | 31.96 | 31.96 | 31.96 | (69) |

Pumps and fans gains (Table 5a)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (70)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (70) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (71)m= | -71.68 | -71.68 | -71.68 | -71.68 | -71.68 | -71.68 | -71.68 | -71.68 | -71.68 | -71.68 | -71.68 | -71.68 | (71) |

Water heating gains (Table 5)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (72)m= | 115.4 | 113.63 | 109.94 | 104.94 | 101.69 | 97.11 | 93.22 | 98.21 | 99.98 | 105.16 | 111.01 | 113.63 | (72) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (73)m= | 335.42 | 333.71 | 323.63 | 307.48 | 291.33 | 275.55 | 265.16 | 270.08 | 278.24 | 294.57 | 313.32 | 327.14 | (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) | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Southwest 0.9x | 0.77 | x | 9.56 | x | 36.79 | 0.63 | x | 0.7 | = | 107.5 | (79) |
| Southwest 0.9x | 0.77 | x | 9.56 | x | 62.67 | 0.63 | x | 0.7 | = | 183.11 | (79) |
| Southwest 0.9x | 0.77 | x | 9.56 | x | 85.75 | 0.63 | x | 0.7 | = | 250.54 | (79) |
| Southwest 0.9x | 0.77 | x | 9.56 | x | 106.25 | 0.63 | x | 0.7 | = | 310.43 | (79) |
| Southwest 0.9x | 0.77 | x | 9.56 | x | 119.01 | 0.63 | x | 0.7 | = | 347.71 | (79) |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Southwest | 0.9x | 0.77 | x | 9.56 | x | 118.15 | | 0.63 | x | 0.7 | = | 345.19 | (79) |
| Southwest | 0.9x | 0.77 | x | 9.56 | x | 113.91 | | 0.63 | x | 0.7 | = | 332.8 | (79) |
| Southwest | 0.9x | 0.77 | x | 9.56 | x | 104.39 | | 0.63 | x | 0.7 | = | 304.99 | (79) |
| Southwest | 0.9x | 0.77 | x | 9.56 | x | 92.85 | | 0.63 | x | 0.7 | = | 271.28 | (79) |
| Southwest | 0.9x | 0.77 | x | 9.56 | x | 69.27 | | 0.63 | x | 0.7 | = | 202.38 | (79) |
| Southwest | 0.9x | 0.77 | x | 9.56 | x | 44.07 | | 0.63 | x | 0.7 | = | 128.76 | (79) |
| Southwest | 0.9x | 0.77 | x | 9.56 | x | 31.49 | | 0.63 | x | 0.7 | = | 92 | (79) |
| Northwest | 0.9x | 0.77 | x | 3.98 | x | 11.28 | x | 0.63 | x | 0.7 | = | 13.72 | (81) |
| Northwest | 0.9x | 0.77 | x | 3.98 | x | 22.97 | x | 0.63 | x | 0.7 | = | 27.94 | (81) |
| Northwest | 0.9x | 0.77 | x | 3.98 | x | 41.38 | x | 0.63 | x | 0.7 | = | 50.33 | (81) |
| Northwest | 0.9x | 0.77 | x | 3.98 | x | 67.96 | x | 0.63 | x | 0.7 | = | 82.66 | (81) |
| Northwest | 0.9x | 0.77 | x | 3.98 | x | 91.35 | x | 0.63 | x | 0.7 | = | 111.11 | (81) |
| Northwest | 0.9x | 0.77 | x | 3.98 | x | 97.38 | x | 0.63 | x | 0.7 | = | 118.45 | (81) |
| Northwest | 0.9x | 0.77 | x | 3.98 | x | 91.1 | x | 0.63 | x | 0.7 | = | 110.81 | (81) |
| Northwest | 0.9x | 0.77 | x | 3.98 | x | 72.63 | x | 0.63 | x | 0.7 | = | 88.34 | (81) |
| Northwest | 0.9x | 0.77 | x | 3.98 | x | 50.42 | x | 0.63 | x | 0.7 | = | 61.33 | (81) |
| Northwest | 0.9x | 0.77 | x | 3.98 | x | 28.07 | x | 0.63 | x | 0.7 | = | 34.14 | (81) |
| Northwest | 0.9x | 0.77 | x | 3.98 | x | 14.2 | x | 0.63 | x | 0.7 | = | 17.27 | (81) |
| Northwest | 0.9x | 0.77 | x | 3.98 | x | 9.21 | x | 0.63 | x | 0.7 | = | 11.21 | (81) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (83)m= | 121.22 | 211.05 | 300.87 | 393.09 | 458.82 | 463.65 | 443.61 | 393.33 | 332.61 | 236.52 | 146.03 | 103.2 | (83) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (84)m= | 456.64 | 544.75 | 624.5 | 700.57 | 750.15 | 739.2 | 708.77 | 663.41 | 610.85 | 531.08 | 459.34 | 430.35 | (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= | 0.98 | 0.95 | 0.9 | 0.79 | 0.63 | 0.45 | 0.33 | 0.36 | 0.58 | 0.84 | 0.95 | 0.98 | (86) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (87)m= | 19.94 | 20.18 | 20.48 | 20.77 | 20.93 | 20.99 | 21 | 21 | 20.96 | 20.74 | 20.29 | 19.9 | (87) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (88)m= | 20.06 | 20.06 | 20.06 | 20.08 | 20.08 | 20.09 | 20.09 | 20.1 | 20.09 | 20.08 | 20.07 | 20.07 | (88) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (89)m= | 0.97 | 0.94 | 0.88 | 0.75 | 0.57 | 0.39 | 0.26 | 0.29 | 0.51 | 0.8 | 0.94 | 0.98 | (89) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (90)m= | 18.66 | 19.01 | 19.42 | 19.82 | 20.01 | 20.08 | 20.09 | 20.09 | 20.06 | 19.8 | 19.19 | 18.61 | (90) |

fLA = Living area ÷ (4) = | 0.45 | (91)

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (92)m= | 19.24 | 19.54 | 19.9 | 20.25 | 20.43 | 20.49 | 20.5 | 20.5 | 20.47 | 20.23 | 19.69 | 19.19 | (92) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (93)m= | 19.24 | 19.54 | 19.9 | 20.25 | 20.43 | 20.49 | 20.5 | 20.5 | 20.47 | 20.23 | 19.69 | 19.19 | (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= | 0.97 | 0.93 | 0.87 | 0.76 | 0.59 | 0.42 | 0.29 | 0.32 | 0.54 | 0.81 | 0.94 | 0.97 | (94) |
| Useful gains, hmGm , W = (94)m x (84)m | | | | | | | | | | | | | |
| (95)m= | 440.75 | 508.82 | 546.29 | 531.19 | 445.95 | 307.94 | 205.7 | 215.23 | 327.97 | 428.45 | 430.11 | 418.09 | (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= | 823.91 | 804.69 | 734.34 | 612.19 | 469.18 | 311.54 | 206.24 | 216.12 | 338.95 | 517.41 | 681.01 | 816.26 | (97) |
| Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m | | | | | | | | | | | | | |
| (98)m= | 285.07 | 198.83 | 139.91 | 58.32 | 17.28 | 0 | 0 | 0 | 0 | 66.19 | 180.65 | 296.24 | |

| | | |
|---|---|---|
| Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = | 1242.49 | (98) |
| Space heating requirement in kWh/m²/year | 23.24 | (99) |

## 9b. Energy requirements – Community heating scheme

| | | | |
|---|---|---|---|
| This part is used for space heating, space cooling or water heating provided by a community scheme.<br>Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none | | 0 | (301) |
| Fraction of space heat from community system 1 – (301) = | | 1 | (302) |

*The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.*

| | | | |
|---|---|---|---|
| Fraction of heat from Community boilers | | 1 | (303a) |
| Fraction of total space heat from Community boilers | (302) x (303a) = | 1 | (304a) |
| Factor for control and charging method (Table 4c(3)) for community heating system | | 1 | (305) |
| Distribution loss factor (Table 12c) for community heating system | | 1.05 | (306) |
| **Space heating** | | **kWh/year** | |
| Annual space heating requirement | | 1242.49 | |
| Space heat from Community boilers | (98) x (304a) x (305) x (306) = | 1304.62 | (307a) |
| Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) | | 0 | (308 |
| Space heating requirement from secondary/supplementary system | (98) x (301) x 100 ÷ (308) = | 0 | (309) |
| **Water heating** | | | |
| Annual water heating requirement | | 1858.62 | |
| If DHW from community scheme:<br>Water heat from Community boilers | (64) x (303a) x (305) x (306) = | 1951.55 | (310a) |
| Electricity used for heat distribution | 0.01 × [(307a)…(307e) + (310a)…(310e)] = | 32.56 | (313) |
| Cooling System Energy Efficiency Ratio | | 0 | (314) |
| Space cooling (if there is a fixed cooling system, if not enter 0) | = (107) ÷ (314) = | 0 | (315) |
| Electricity for pumps and fans within dwelling (Table 4f):<br>mechanical ventilation - balanced, extract or positive input from outside | | 113.73 | (330a) |

| | | | | | |
|---|---|---|---|---|---|
| warm air heating system fans | | | | 0 | (330b) |
| pump for solar water heating | | | | 0 | (330g) |
| Total electricity for the above, kWh/year | =(330a) + (330b) + (330g) = | | | 113.73 | (331) |
| Energy for lighting (calculated in Appendix L) | | | | 245.94 | (332) |
| Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) = | | | | 3615.83 | (338) |

## 12b. CO2 Emissions – Community heating scheme

| | | Energy kWh/year | Emission factor kg CO2/kWh | | Emissions kg CO2/year | |
|---|---|---|---|---|---|---|
| CO2 from other sources of space and water heating (not CHP) | | | | | | |
| Efficiency of heat source 1 (%) | If there is CHP using two fuels repeat (363) to (366) for the second fuel | | | | 96 | (367a) |
| CO2 associated with heat source 1 | [(307b)+(310b)] x 100 ÷ (367b) x | | 0.22 | = | 732.64 | (367) |
| Electrical energy for heat distribution | [(313) x | | 0.52 | = | 16.9 | (372) |
| Total CO2 associated with community systems | (363)…(366) + (368)...(372) | | | = | 749.54 | (373) |
| CO2 associated with space heating (secondary) | (309) x | | 0 | = | 0 | (374) |
| CO2 associated with water from immersion heater or instantaneous heater | (312) x | | 0.22 | = | 0 | (375) |
| Total CO2 associated with space and water heating | (373) + (374) + (375) = | | | | 749.54 | (376) |
| CO2 associated with electricity for pumps and fans within dwelling | (331)) x | | 0.52 | = | 59.02 | (378) |
| CO2 associated with electricity for lighting | (332))) x | | 0.52 | = | 127.64 | (379) |
| **Total CO2, kg/year** | sum of (376)…(382) = | | | | 936.2 | (383) |
| **Dwelling CO2 Emission Rate** | (383) ÷ (4) = | | | | 17.51 | (384) |
| **EI rating (section 14)** | | | | | 87.26 | (385) |

# Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.50
*Printed on 06 December 2021 at 10:58:43*

## Project Information:

**Assessed By:** Neil Ingham (STRO010943) **Building Type:** Flat

## Dwelling Details:

**NEW DWELLING DESIGN STAGE** Total Floor Area: 60.89m²

**Site Reference :** Highgate Road - GREEN **Plot Reference:** 01 - C

**Address :**

## Client Details:

**Name:**

**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 (c)
Fuel factor: 1.00 (mains gas (c))

| | | |
|---|---|---|
| Target Carbon Dioxide Emission Rate (TER) | 20.63 kg/m² | |
| Dwelling Carbon Dioxide Emission Rate (DER) | 18.18 kg/m² | OK |

## 1b TFEE and DFEE

| | | |
|---|---|---|
| Target Fabric Energy Efficiency (TFEE) | 59.3 kWh/m² | |
| Dwelling Fabric Energy Efficiency (DFEE) | 50.4 kWh/m² | |
| | | OK |

## 2 Fabric U-values

| Element | Average | Highest | |
|---|---|---|---|
| External wall | 0.18 (max. 0.30) | 0.18 (max. 0.70) | OK |
| Party wall | 0.00 (max. 0.20) | - | OK |
| Floor | 0.13 (max. 0.25) | 0.13 (max. 0.70) | OK |
| Roof | (no roof) | | |
| Openings | 1.40 (max. 2.00) | 1.40 (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 | 3.00 (design value) | |
| Maximum | 10.0 | OK |

## 4 Heating efficiency

| | |
|---|---|
| Main Heating system: | Community heating schemes - mains gas |
| Secondary heating system: | None |

## 5 Cylinder insulation

| | |
|---|---|
| Hot water Storage: | No cylinder |

## 6 Controls

| | | |
|---|---|---|
| Space heating controls | Charging system linked to use of community heating, programmer and at least two room thermostats | OK |
| Hot water controls: | No cylinder thermostat<br>No cylinder | |

# Regulations Compliance Report

| 7 Low energy lights | | |
|---|---|---|
| Percentage of fixed lights with low-energy fittings | 100.0% | |
| Minimum | 75.0% | **OK** |

| 8 Mechanical ventilation | | |
|---|---|---|
| Continuous supply and extract system | | |
| Specific fan power: | 0.54 | |
| Maximum | 1.5 | **OK** |
| MVHR efficiency: | 88% | |
| Minimum | 70% | **OK** |

| 9 Summertime temperature | | |
|---|---|---|
| Overheating risk (Thames valley): | Slight | **OK** |
| Based on: | | |
| Overshading: | Average or unknown | |
| Windows facing: North East | 12.71m² | |
| Windows facing: North West | 3.46m² | |
| Ventilation rate: | 6.00 | |

| 10 Key features | |
|---|---|
| Air permeablility | 3.0 m³/m²h |
| Party  Walls U-value | 0 W/m²K |
| Community heating, heat from boilers – mains gas | |

# DER WorkSheet: New dwelling design stage

User Details:

| | | | |
|---|---|---|---|
| **Assessor Name:** | Neil Ingham | **Stroma Number:** | STRO010943 |
| **Software Name:** | Stroma FSAP 2012 | **Software Version:** | Version: 1.0.5.50 |

Property Address: 01 - C

**Address :**

## 1. Overall dwelling dimensions:

| | Area(m²) | | Av. Height(m) | | Volume(m³) | |
|---|---|---|---|---|---|---|
| Ground floor | 60.89 | (1a) x | 2.65 | (2a) = | 161.36 | (3a) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n) | 60.89 | (4) | | | | |
| Dwelling volume | | | | (3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) = | 161.36 | (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 | | | | | | | 0 | x 10 = | 0 | (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) = | 0 | ÷ (5) = | 0 | (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 | | 3 | (17) |
| If based on air permeability value, then | (18) = [(17) ÷ 20]+(8), otherwise (18) = (16) | 0.15 | (18) |

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

| | | | |
|---|---|---|---|
| Number of sides sheltered | | 0 | (19) |
| Shelter factor | (20) = 1 - [0.075 x (19)] = | 1 | (20) |
| Infiltration rate incorporating shelter factor | (21) = (18) x (20) = | 0.15 | (21) |

Infiltration rate modified for monthly wind speed

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

# DER WorkSheet: New dwelling design stage

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

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.19 | 0.19 | 0.18 | 0.16 | 0.16 | 0.14 | 0.14 | 0.14 | 0.15 | 0.16 | 0.17 | 0.18 |

*Calculate effective air change rate for the applicable case*

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 74.8 (23c)

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24a)m= | 0.32 | 0.31 | 0.31 | 0.29 | 0.29 | 0.27 | 0.27 | 0.26 | 0.28 | 0.29 | 0.29 | 0.3 | (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 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24d) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (25)m= | 0.32 | 0.31 | 0.31 | 0.29 | 0.29 | 0.27 | 0.27 | 0.26 | 0.28 | 0.29 | 0.29 | 0.3 | (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 | |
|---|---|---|---|---|---|---|---|---|
| Windows Type 1 | | | 12.71 | x1/[1/( 1.4 )+ 0.04] = | 16.85 | | | (27) |
| Windows Type 2 | | | 3.46 | x1/[1/( 1.4 )+ 0.04] = | 4.59 | | | (27) |
| Floor | | | 60.89 | x 0.13 = | 7.915699 | 75 | 4566.75 | (28) |
| Walls Type1 | 29.71 | 16.17 | 13.54 | x 0.18 = | 2.44 | 60 | 812.4 | (29) |
| Walls Type2 | 13.52 | 0 | 13.52 | x 0.17 = | 2.27 | 60 | 811.2 | (29) |
| Total area of elements, m² | | | 104.12 | | | | | (31) |
| Party wall | | | 29.71 | x 0 = | 0 | 45 | 1336.95 | (32) |
| Party ceiling | | | 60.89 | | | 30 | 1826.7 | (32b) |
| Internal wall ** | | | 146.17 | | | 9 | 1315.53 | (32c) |

** 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) = 34.06 (33)

Heat capacity Cm = S(A x k ) ((28)…(30) + (32) + (32a)…(32e) = 10669.53 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 175.23 (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 10.47 (36)

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

Total fabric heat loss (33) + (36) = 44.53 (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= | 16.89 | 16.69 | 16.49 | 15.5 | 15.3 | 14.3 | 14.3 | 14.1 | 14.7 | 15.3 | 15.69 | 16.09 | (38) |

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

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (39)m= | 61.42 | 61.22 | 61.02 | 60.02 | 59.82 | 58.82 | 58.82 | 58.62 | 59.22 | 59.82 | 60.22 | 60.62 |

Average = Sum(39)$_{1…12}$ /12= 59.97 (39)

# DER WorkSheet: New dwelling design stage

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

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (40)m= | 1.01 | 1.01 | 1 | 0.99 | 0.98 | 0.97 | 0.97 | 0.96 | 0.97 | 0.98 | 0.99 | 1 |

Average = Sum(40)$_{1…12}$ /12= 0.98 (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 2.01 (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 81.86 (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= | 90.04 | 86.77 | 83.5 | 80.22 | 76.95 | 73.67 | 73.67 | 76.95 | 80.22 | 83.5 | 86.77 | 90.04 |

Total = Sum(44)$_{1…12}$ = 982.3 (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= | 133.53 | 116.79 | 120.52 | 105.07 | 100.82 | 87 | 80.62 | 92.51 | 93.61 | 109.1 | 119.09 | 129.32 |

Total = Sum(45)$_{1…12}$ = 1287.96 (45)

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (46)m= | 20.03 | 17.52 | 18.08 | 15.76 | 15.12 | 13.05 | 12.09 | 13.88 | 14.04 | 16.36 | 17.86 | 19.4 | (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) = 110 (50)

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

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (56)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (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= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (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= | 23.26 | 21.01 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | (59) |

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 | (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= | 188.81 | 166.72 | 175.79 | 158.56 | 156.09 | 140.49 | 135.89 | 147.78 | 147.11 | 164.37 | 172.58 | 184.6 | (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= | 188.81 | 166.72 | 175.79 | 158.56 | 156.09 | 140.49 | 135.89 | 147.78 | 147.11 | 164.37 | 172.58 | 184.6 |

Output from water heater (annual)$_{1...12}$ | 1938.8 | (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= | 88.62 | 78.77 | 84.29 | 77.73 | 77.74 | 71.72 | 71.03 | 74.98 | 73.92 | 80.5 | 82.39 | 87.22 | (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= | 100.33 | 100.33 | 100.33 | 100.33 | 100.33 | 100.33 | 100.33 | 100.33 | 100.33 | 100.33 | 100.33 | 100.33 | (66) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (67)m= | 15.62 | 13.87 | 11.28 | 8.54 | 6.38 | 5.39 | 5.82 | 7.57 | 10.16 | 12.9 | 15.06 | 16.05 | (67) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (68)m= | 175.19 | 177 | 172.42 | 162.67 | 150.36 | 138.79 | 131.06 | 129.24 | 133.82 | 143.58 | 155.89 | 167.46 | (68) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (69)m= | 33.03 | 33.03 | 33.03 | 33.03 | 33.03 | 33.03 | 33.03 | 33.03 | 33.03 | 33.03 | 33.03 | 33.03 | (69) |

Pumps and fans gains (Table 5a)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (70)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (70) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (71)m= | -80.27 | -80.27 | -80.27 | -80.27 | -80.27 | -80.27 | -80.27 | -80.27 | -80.27 | -80.27 | -80.27 | -80.27 | (71) |

Water heating gains (Table 5)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (72)m= | 119.11 | 117.22 | 113.3 | 107.96 | 104.49 | 99.61 | 95.47 | 100.78 | 102.67 | 108.19 | 114.43 | 117.23 | (72) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (73)m= | 363.02 | 361.2 | 350.1 | 332.27 | 314.34 | 296.89 | 285.45 | 290.69 | 299.75 | 317.77 | 338.48 | 353.84 | (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 | 12.71 | x | 11.28 | x | 0.63 | x | 0.7 | = | 43.83 | (75) |
| Northeast | 0.9x | 0.77 | x | 12.71 | x | 22.97 | x | 0.63 | x | 0.7 | = | 89.21 | (75) |
| Northeast | 0.9x | 0.77 | x | 12.71 | x | 41.38 | x | 0.63 | x | 0.7 | = | 160.73 | (75) |
| Northeast | 0.9x | 0.77 | x | 12.71 | x | 67.96 | x | 0.63 | x | 0.7 | = | 263.96 | (75) |
| Northeast | 0.9x | 0.77 | x | 12.71 | x | 91.35 | x | 0.63 | x | 0.7 | = | 354.82 | (75) |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Northeast | 0.9x | 0.77 | x | 12.71 | x | 97.38 | x | 0.63 | x | 0.7 | = | 378.27 | (75) |
| Northeast | 0.9x | 0.77 | x | 12.71 | x | 91.1 | x | 0.63 | x | 0.7 | = | 353.87 | (75) |
| Northeast | 0.9x | 0.77 | x | 12.71 | x | 72.63 | x | 0.63 | x | 0.7 | = | 282.11 | (75) |
| Northeast | 0.9x | 0.77 | x | 12.71 | x | 50.42 | x | 0.63 | x | 0.7 | = | 195.85 | (75) |
| Northeast | 0.9x | 0.77 | x | 12.71 | x | 28.07 | x | 0.63 | x | 0.7 | = | 109.02 | (75) |
| Northeast | 0.9x | 0.77 | x | 12.71 | x | 14.2 | x | 0.63 | x | 0.7 | = | 55.15 | (75) |
| Northeast | 0.9x | 0.77 | x | 12.71 | x | 9.21 | x | 0.63 | x | 0.7 | = | 35.79 | (75) |
| Northwest | 0.9x | 0.77 | x | 3.46 | x | 11.28 | x | 0.63 | x | 0.7 | = | 11.93 | (81) |
| Northwest | 0.9x | 0.77 | x | 3.46 | x | 22.97 | x | 0.63 | x | 0.7 | = | 24.29 | (81) |
| Northwest | 0.9x | 0.77 | x | 3.46 | x | 41.38 | x | 0.63 | x | 0.7 | = | 43.75 | (81) |
| Northwest | 0.9x | 0.77 | x | 3.46 | x | 67.96 | x | 0.63 | x | 0.7 | = | 71.86 | (81) |
| Northwest | 0.9x | 0.77 | x | 3.46 | x | 91.35 | x | 0.63 | x | 0.7 | = | 96.59 | (81) |
| Northwest | 0.9x | 0.77 | x | 3.46 | x | 97.38 | x | 0.63 | x | 0.7 | = | 102.98 | (81) |
| Northwest | 0.9x | 0.77 | x | 3.46 | x | 91.1 | x | 0.63 | x | 0.7 | = | 96.33 | (81) |
| Northwest | 0.9x | 0.77 | x | 3.46 | x | 72.63 | x | 0.63 | x | 0.7 | = | 76.8 | (81) |
| Northwest | 0.9x | 0.77 | x | 3.46 | x | 50.42 | x | 0.63 | x | 0.7 | = | 53.32 | (81) |
| Northwest | 0.9x | 0.77 | x | 3.46 | x | 28.07 | x | 0.63 | x | 0.7 | = | 29.68 | (81) |
| Northwest | 0.9x | 0.77 | x | 3.46 | x | 14.2 | x | 0.63 | x | 0.7 | = | 15.01 | (81) |
| Northwest | 0.9x | 0.77 | x | 3.46 | x | 9.21 | x | 0.63 | x | 0.7 | = | 9.74 | (81) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (83)m= | 55.76 | 113.5 | 204.48 | 335.82 | 451.41 | 481.25 | 450.2 | 358.9 | 249.17 | 138.7 | 70.16 | 45.53 | (83) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (84)m= | 418.78 | 474.7 | 554.59 | 668.09 | 765.75 | 778.14 | 735.65 | 649.6 | 548.92 | 456.47 | 408.63 | 399.37 | (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= | 0.99 | 0.98 | 0.94 | 0.84 | 0.66 | 0.47 | 0.35 | 0.41 | 0.68 | 0.91 | 0.98 | 0.99 | (86) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (87)m= | 19.72 | 19.91 | 20.24 | 20.66 | 20.9 | 20.98 | 21 | 20.99 | 20.92 | 20.57 | 20.08 | 19.69 | (87) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (88)m= | 20.08 | 20.08 | 20.08 | 20.1 | 20.1 | 20.11 | 20.11 | 20.11 | 20.11 | 20.1 | 20.09 | 20.09 | (88) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (89)m= | 0.98 | 0.97 | 0.93 | 0.81 | 0.61 | 0.41 | 0.28 | 0.33 | 0.61 | 0.89 | 0.97 | 0.99 | (89) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (90)m= | 18.37 | 18.64 | 19.12 | 19.7 | 20 | 20.1 | 20.11 | 20.11 | 20.04 | 19.6 | 18.9 | 18.34 | (90) |

fLA = Living area ÷ (4) = | 0.46 | (91)

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (92)m= | 18.99 | 19.22 | 19.64 | 20.14 | 20.41 | 20.5 | 20.52 | 20.52 | 20.45 | 20.04 | 19.44 | 18.96 | (92) |

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

# DER WorkSheet: New dwelling design stage

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (93)m= | 18.99 | 19.22 | 19.64 | 20.14 | 20.41 | 20.5 | 20.52 | 20.52 | 20.45 | 20.04 | 19.44 | 18.96 | (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= | 0.98 | 0.96 | 0.92 | 0.81 | 0.63 | 0.44 | 0.31 | 0.37 | 0.64 | 0.89 | 0.96 | 0.98 | (94) |
| Useful gains, hmGm , W = (94)m x (84)m | | | | | | | | | | | | | |
| (95)m= | 409.79 | 457.75 | 512.63 | 544.45 | 484.7 | 341.51 | 229.38 | 239.25 | 349.38 | 404.73 | 393.8 | 392.15 | (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= | 902.19 | 876.84 | 801.64 | 674.58 | 521.27 | 347.3 | 230.39 | 241.26 | 375.79 | 564.85 | 743.31 | 894.73 | (97) |
| Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m | | | | | | | | | | | | | |
| (98)m= | 366.34 | 281.63 | 215.02 | 93.69 | 27.2 | 0 | 0 | 0 | 0 | 119.13 | 251.65 | 373.92 | |

| | | |
|---|---|---|
| Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = | 1728.59 | (98) |
| Space heating requirement in kWh/m²/year | 28.39 | (99) |

## 9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

| | | | |
|---|---|---|---|
| Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none | | 0 | (301) |
| Fraction of space heat from community system 1 – (301) = | | 1 | (302) |

*The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.*

| | | | |
|---|---|---|---|
| Fraction of heat from Community boilers | | 1 | (303a) |
| Fraction of total space heat from Community boilers | (302) x (303a) = | 1 | (304a) |
| Factor for control and charging method (Table 4c(3)) for community heating system | | 1 | (305) |
| Distribution loss factor (Table 12c) for community heating system | | 1.05 | (306) |
| **Space heating** | | **kWh/year** | |
| Annual space heating requirement | | 1728.59 | |
| Space heat from Community boilers | (98) x (304a) x (305) x (306) = | 1815.02 | (307a) |
| Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) | | 0 | (308 |
| Space heating requirement from secondary/supplementary system | (98) x (301) x 100 ÷ (308) = | 0 | (309) |
| **Water heating** | | | |
| Annual water heating requirement | | 1938.8 | |
| If DHW from community scheme:<br>Water heat from Community boilers | (64) x (303a) x (305) x (306) = | 2035.74 | (310a) |
| Electricity used for heat distribution | 0.01 × [(307a)…(307e) + (310a)…(310e)] = | 38.51 | (313) |
| Cooling System Energy Efficiency Ratio | | 0 | (314) |
| Space cooling (if there is a fixed cooling system, if not enter 0) | = (107) ÷ (314) = | 0 | (315) |
| Electricity for pumps and fans within dwelling (Table 4f):<br>mechanical ventilation - balanced, extract or positive input from outside | | 148.82 | (330a) |

# DER WorkSheet: New dwelling design stage

| | | | | |
|---|---|---|---|---|
| warm air heating system fans | | | 0 | (330b) |
| pump for solar water heating | | | 0 | (330g) |
| Total electricity for the above, kWh/year | =(330a) + (330b) + (330g) = | | 148.82 | (331) |
| Energy for lighting (calculated in Appendix L) | | | 275.82 | (332) |
| Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) = | | | 4275.4 | (338) |

## 12b. CO2 Emissions – Community heating scheme

| | | Energy kWh/year | Emission factor kg CO2/kWh | | Emissions kg CO2/year | |
|---|---|---|---|---|---|---|
| CO2 from other sources of space and water heating (not CHP) | | | | | | |
| Efficiency of heat source 1 (%) | If there is CHP using two fuels repeat (363) to (366) for the second fuel | | | | 96 | (367a) |
| CO2 associated with heat source 1 | [(307b)+(310b)] x 100 ÷ (367b) x | | 0.22 | = | 866.42 | (367) |
| Electrical energy for heat distribution | [(313) x | | 0.52 | = | 19.99 | (372) |
| Total CO2 associated with community systems | (363)…(366) + (368)...(372) | | | = | 886.41 | (373) |
| CO2 associated with space heating (secondary) | (309) x | | 0 | = | 0 | (374) |
| CO2 associated with water from immersion heater or instantaneous heater | (312) x | | 0.22 | = | 0 | (375) |
| Total CO2 associated with space and water heating | (373) + (374) + (375) = | | | | 886.41 | (376) |
| CO2 associated with electricity for pumps and fans within dwelling | (331)) x | | 0.52 | = | 77.24 | (378) |
| CO2 associated with electricity for lighting | (332))) x | | 0.52 | = | 143.15 | (379) |
| **Total CO2, kg/year** | sum of (376)…(382) = | | | | 1106.79 | (383) |
| **Dwelling CO2 Emission Rate** | (383) ÷ (4) = | | | | 18.18 | (384) |
| **EI rating (section 14)** | | | | | 85.99 | (385) |

# Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.50
*Printed on 06 December 2021 at 10:58:20*

## Project Information:

**Assessed By:** Neil Ingham (STRO010943) **Building Type:** Flat

## Dwelling Details:

**NEW DWELLING DESIGN STAGE** Total Floor Area: 61.98m²

**Site Reference :** Highgate Road - GREEN **Plot Reference:** 01 - D

**Address :**

## Client Details:

**Name:**

**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 (c)
Fuel factor: 1.00 (mains gas (c))

| | | |
|---|---|---|
| Target Carbon Dioxide Emission Rate (TER) | 20.41 kg/m² | |
| Dwelling Carbon Dioxide Emission Rate (DER) | 17.53 kg/m² | OK |

## 1b TFEE and DFEE

| | | |
|---|---|---|
| Target Fabric Energy Efficiency (TFEE) | 58.1 kWh/m² | |
| Dwelling Fabric Energy Efficiency (DFEE) | 47.3 kWh/m² | |
| | | OK |

## 2 Fabric U-values

| Element | Average | Highest | |
|---|---|---|---|
| External wall | 0.17 (max. 0.30) | 0.18 (max. 0.70) | OK |
| Party wall | 0.00 (max. 0.20) | - | OK |
| Floor | 0.13 (max. 0.25) | 0.13 (max. 0.70) | OK |
| Roof | (no roof) | | |
| Openings | 1.40 (max. 2.00) | 1.40 (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 | 3.00 (design value) | |
| Maximum | 10.0 | OK |

## 4 Heating efficiency

Main Heating system: Community heating schemes - mains gas

Secondary heating system: None

## 5 Cylinder insulation

Hot water Storage: No cylinder

## 6 Controls

| | | |
|---|---|---|
| Space heating controls | Charging system linked to use of community heating, programmer and at least two room thermostats | OK |
| Hot water controls: | No cylinder thermostat<br>No cylinder | |

# Regulations Compliance Report

## 7 Low energy lights

| | | |
|---|---|---|
| Percentage of fixed lights with low-energy fittings | 100.0% | |
| Minimum | 75.0% | **OK** |

## 8 Mechanical ventilation

| | | |
|---|---|---|
| Continuous supply and extract system | | |
| Specific fan power: | 0.47 | |
| Maximum | 1.5 | **OK** |
| MVHR efficiency: | 89% | |
| Minimum | 70% | **OK** |

## 9 Summertime temperature

| | | |
|---|---|---|
| Overheating risk (Thames valley): | Slight | **OK** |
| Based on: | | |
| Overshading: | Average or unknown | |
| Windows facing: North East | 12.07m² | |
| Ventilation rate: | 4.00 | |

## 10 Key features

| | |
|---|---|
| Air permeablility | 3.0 m³/m²h |
| Party  Walls U-value | 0 W/m²K |
| Community heating, heat from boilers – mains gas | |

# DER WorkSheet: New dwelling design stage

User Details:

| | | | |
|---|---|---|---|
| **Assessor Name:** | Neil Ingham | **Stroma Number:** | STRO010943 |
| **Software Name:** | Stroma FSAP 2012 | **Software Version:** | Version: 1.0.5.50 |

Property Address: 01 - D

**Address :**

1. Overall dwelling dimensions:

| | Area(m²) | | Av. Height(m) | | Volume(m³) | |
|---|---|---|---|---|---|---|
| Ground floor | 61.98 | (1a) x | 2.65 | (2a) = | 164.25 | (3a) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n) | 61.98 | (4) | | | | |
| Dwelling volume | | | | (3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) = | 164.25 | (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 | | | | | | | 0 | x 10 = | 0 | (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) = | 0 | ÷ (5) = | 0 | (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 | | 3 | (17) |
| If based on air permeability value, then | (18) = [(17) ÷ 20]+(8), otherwise (18) = (16) | 0.15 | (18) |

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

| | | | |
|---|---|---|---|
| Number of sides sheltered | | 0 | (19) |
| Shelter factor | (20) = 1 - [0.075 x (19)] = | 1 | (20) |
| Infiltration rate incorporating shelter factor | (21) = (18) x (20) = | 0.15 | (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 |

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 |

# DER WorkSheet: New dwelling design stage

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

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.19 | 0.19 | 0.18 | 0.16 | 0.16 | 0.14 | 0.14 | 0.14 | 0.15 | 0.16 | 0.17 | 0.18 |

*Calculate effective air change rate for the applicable case*

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 75.65 (23c)

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24a)m= | 0.31 | 0.31 | 0.31 | 0.29 | 0.28 | 0.26 | 0.26 | 0.26 | 0.27 | 0.28 | 0.29 | 0.3 | (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 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24d) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (25)m= | 0.31 | 0.31 | 0.31 | 0.29 | 0.28 | 0.26 | 0.26 | 0.26 | 0.27 | 0.28 | 0.29 | 0.3 | (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 | |
|---|---|---|---|---|---|---|---|---|
| Windows | | | 12.07 | x1/[1/( 1.4 )+ 0.04] = | 16 | | | (27) |
| Floor | | | 61.98 | x 0.13 = | 8.0574 | 75 | 4648.5 | (28) |
| Walls Type1 | 30.87 | 12.07 | 18.8 | x 0.18 = | 3.38 | 60 | 1128 | (29) |
| Walls Type2 | 27.45 | 0 | 27.45 | x 0.17 = | 4.61 | 60 | 1647 | (29) |
| Total area of elements, m² | | | 120.3 | | | | | (31) |
| Party wall | | | 31.67 | x 0 = | 0 | 45 | 1425.15 | (32) |
| Party ceiling | | | 61.89 | | | 30 | 1856.7 | (32b) |
| Internal wall ** | | | 95.03 | | | 9 | 855.27 | (32c) |

* *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) = 32.05 (33)

Heat capacity Cm = S(A x k ) ((28)…(30) + (32) + (32a)…(32e) = 11560.62 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 186.52 (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 9.43 (36)

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

Total fabric heat loss (33) + (36) = 41.48 (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= | 16.97 | 16.76 | 16.56 | 15.54 | 15.34 | 14.32 | 14.32 | 14.12 | 14.73 | 15.34 | 15.75 | 16.15 | (38) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (39)m= | 58.45 | 58.25 | 58.04 | 57.03 | 56.82 | 55.81 | 55.81 | 55.6 | 56.21 | 56.82 | 57.23 | 57.64 | |

Average = Sum(39)$_{1…12}$ /12= 56.98 (39)

# DER WorkSheet: New dwelling design stage

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

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (40)m= | 0.94 | 0.94 | 0.94 | 0.92 | 0.92 | 0.9 | 0.9 | 0.9 | 0.91 | 0.92 | 0.92 | 0.93 |

Average = Sum(40)$_{1\ldots12}$ /12= 0.92 (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 2.04 (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 82.58 (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= | 90.84 | 87.53 | 84.23 | 80.93 | 77.62 | 74.32 | 74.32 | 77.62 | 80.93 | 84.23 | 87.53 | 90.84 |

Total = Sum(44)$_{1\ldots12}$ = 990.95 (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= | 134.71 | 117.82 | 121.58 | 105.99 | 101.7 | 87.76 | 81.32 | 93.32 | 94.44 | 110.06 | 120.13 | 130.46 |

Total = Sum(45)$_{1\ldots12}$ = 1299.3 (45)

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (46)m= | 20.21 | 17.67 | 18.24 | 15.9 | 15.26 | 13.16 | 12.2 | 14 | 14.17 | 16.51 | 18.02 | 19.57 | (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) = 110 (50)

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

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (56)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (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= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (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= | 23.26 | 21.01 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | (59) |

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 | (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= | 189.99 | 167.74 | 176.85 | 159.49 | 156.98 | 141.26 | 136.6 | 148.6 | 147.93 | 165.33 | 173.63 | 185.74 | (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= | 189.99 | 167.74 | 176.85 | 159.49 | 156.98 | 141.26 | 136.6 | 148.6 | 147.93 | 165.33 | 173.63 | 185.74 | |

Output from water heater (annual)1…12 | 1950.14 | (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= | 89.01 | 79.12 | 84.65 | 78.04 | 78.04 | 71.98 | 71.26 | 75.25 | 74.19 | 80.82 | 82.74 | 87.6 | (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= | 101.85 | 101.85 | 101.85 | 101.85 | 101.85 | 101.85 | 101.85 | 101.85 | 101.85 | 101.85 | 101.85 | 101.85 | (66) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (67)m= | 16.02 | 14.23 | 11.57 | 8.76 | 6.55 | 5.53 | 5.97 | 7.77 | 10.42 | 13.23 | 15.45 | 16.47 | (67) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (68)m= | 177.91 | 179.76 | 175.11 | 165.2 | 152.7 | 140.95 | 133.1 | 131.25 | 135.9 | 145.81 | 158.31 | 170.06 | (68) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (69)m= | 33.19 | 33.19 | 33.19 | 33.19 | 33.19 | 33.19 | 33.19 | 33.19 | 33.19 | 33.19 | 33.19 | 33.19 | (69) |

Pumps and fans gains (Table 5a)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (70)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (70) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (71)m= | -81.48 | -81.48 | -81.48 | -81.48 | -81.48 | -81.48 | -81.48 | -81.48 | -81.48 | -81.48 | -81.48 | -81.48 | (71) |

Water heating gains (Table 5)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (72)m= | 119.64 | 117.73 | 113.77 | 108.39 | 104.89 | 99.97 | 95.78 | 101.14 | 103.05 | 108.62 | 114.92 | 117.74 | (72) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (73)m= | 367.13 | 365.28 | 354 | 335.9 | 317.69 | 300 | 288.41 | 293.72 | 302.93 | 321.22 | 342.23 | 357.82 | (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 | 12.07 | x | 11.28 | x | 0.63 | x | 0.7 | = | 41.62 | (75) |
| Northeast 0.9x | 0.77 | x | 12.07 | x | 22.97 | x | 0.63 | x | 0.7 | = | 84.72 | (75) |
| Northeast 0.9x | 0.77 | x | 12.07 | x | 41.38 | x | 0.63 | x | 0.7 | = | 152.64 | (75) |
| Northeast 0.9x | 0.77 | x | 12.07 | x | 67.96 | x | 0.63 | x | 0.7 | = | 250.67 | (75) |
| Northeast 0.9x | 0.77 | x | 12.07 | x | 91.35 | x | 0.63 | x | 0.7 | = | 336.95 | (75) |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Northeast | 0.9x | 0.77 | x | 12.07 | x | 97.38 | x | 0.63 | x | 0.7 | = | 359.23 | (75) |
| Northeast | 0.9x | 0.77 | x | 12.07 | x | 91.1 | x | 0.63 | x | 0.7 | = | 336.05 | (75) |
| Northeast | 0.9x | 0.77 | x | 12.07 | x | 72.63 | x | 0.63 | x | 0.7 | = | 267.9 | (75) |
| Northeast | 0.9x | 0.77 | x | 12.07 | x | 50.42 | x | 0.63 | x | 0.7 | = | 185.99 | (75) |
| Northeast | 0.9x | 0.77 | x | 12.07 | x | 28.07 | x | 0.63 | x | 0.7 | = | 103.53 | (75) |
| Northeast | 0.9x | 0.77 | x | 12.07 | x | 14.2 | x | 0.63 | x | 0.7 | = | 52.37 | (75) |
| Northeast | 0.9x | 0.77 | x | 12.07 | x | 9.21 | x | 0.63 | x | 0.7 | = | 33.99 | (75) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (83)m= | 41.62 | 84.72 | 152.64 | 250.67 | 336.95 | 359.23 | 336.05 | 267.9 | 185.99 | 103.53 | 52.37 | 33.99 | (83) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (84)m= | 408.75 | 449.99 | 506.64 | 586.58 | 654.65 | 659.23 | 624.46 | 561.62 | 488.92 | 424.75 | 394.6 | 391.81 | (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= | 0.99 | 0.98 | 0.96 | 0.89 | 0.73 | 0.53 | 0.39 | 0.45 | 0.72 | 0.93 | 0.98 | 0.99 | (86) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (87)m= | 19.86 | 20.01 | 20.29 | 20.66 | 20.9 | 20.98 | 21 | 20.99 | 20.93 | 20.61 | 20.18 | 19.84 | (87) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (88)m= | 20.13 | 20.13 | 20.14 | 20.15 | 20.15 | 20.17 | 20.17 | 20.17 | 20.16 | 20.15 | 20.15 | 20.14 | (88) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (89)m= | 0.99 | 0.98 | 0.95 | 0.86 | 0.68 | 0.46 | 0.32 | 0.37 | 0.65 | 0.91 | 0.98 | 0.99 | (89) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (90)m= | 18.61 | 18.83 | 19.23 | 19.75 | 20.05 | 20.15 | 20.17 | 20.17 | 20.1 | 19.7 | 19.09 | 18.59 | (90) |

fLA = Living area ÷ (4) = 0.41 (91)

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (92)m= | 19.13 | 19.32 | 19.67 | 20.12 | 20.4 | 20.49 | 20.51 | 20.51 | 20.44 | 20.07 | 19.54 | 19.1 | (92) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (93)m= | 19.13 | 19.32 | 19.67 | 20.12 | 20.4 | 20.49 | 20.51 | 20.51 | 20.44 | 20.07 | 19.54 | 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= | 0.98 | 0.97 | 0.95 | 0.86 | 0.69 | 0.49 | 0.35 | 0.4 | 0.68 | 0.91 | 0.97 | 0.99 | (94) |
| Useful gains, hmGm , W = (94)m x (84)m | | | | | | | | | | | | | |
| (95)m= | 402.16 | 438.36 | 479.15 | 504.57 | 454.72 | 323.15 | 217.17 | 226.61 | 331.3 | 385.86 | 383.5 | 386.49 | (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= | 866.53 | 839.72 | 764.37 | 640.06 | 494.25 | 328.96 | 218.04 | 228.34 | 356.44 | 538.18 | 711.9 | 859.04 | (97) |
| Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m | | | | | | | | | | | | | |
| (98)m= | 345.5 | 269.72 | 212.21 | 97.55 | 29.41 | 0 | 0 | 0 | 0 | 113.33 | 236.45 | 351.58 | |

# DER WorkSheet: New dwelling design stage

| | | | |
|---|---|---|---|
| | Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = | 1655.74 | (98) |
| Space heating requirement in kWh/m²/year | | 26.71 | (99) |

## 9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

| | | | |
|---|---|---|---|
| Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none | | 0 | (301) |
| Fraction of space heat from community system 1 – (301) = | | 1 | (302) |

*The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.*

| | | | |
|---|---|---|---|
| Fraction of heat from Community boilers | | 1 | (303a) |
| Fraction of total space heat from Community boilers | (302) x (303a) = | 1 | (304a) |
| Factor for control and charging method (Table 4c(3)) for community heating system | | 1 | (305) |
| Distribution loss factor (Table 12c) for community heating system | | 1.05 | (306) |
| **Space heating** | | **kWh/year** | |
| Annual space heating requirement | | 1655.74 | |
| Space heat from Community boilers | (98) x (304a) x (305) x (306) = | 1738.52 | (307a) |
| Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) | | 0 | (308 |
| Space heating requirement from secondary/supplementary system | (98) x (301) x 100 ÷ (308) = | 0 | (309) |
| **Water heating** | | | |
| Annual water heating requirement | | 1950.14 | |
| If DHW from community scheme:<br>Water heat from Community boilers | (64) x (303a) x (305) x (306) = | 2047.64 | (310a) |
| Electricity used for heat distribution | 0.01 × [(307a)…(307e) + (310a)…(310e)] = | 37.86 | (313) |
| Cooling System Energy Efficiency Ratio | | 0 | (314) |
| Space cooling (if there is a fixed cooling system, if not enter 0) | = (107) ÷ (314) = | 0 | (315) |
| Electricity for pumps and fans within dwelling (Table 4f):<br>mechanical ventilation - balanced, extract or positive input from outside | | 131.85 | (330a) |
| warm air heating system fans | | 0 | (330b) |
| pump for solar water heating | | 0 | (330g) |
| Total electricity for the above, kWh/year | =(330a) + (330b) + (330g) = | 131.85 | (331) |
| Energy for lighting (calculated in Appendix L) | | 282.93 | (332) |
| Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) = | | 4200.94 | (338) |

## 12b. CO2 Emissions – Community heating scheme

| | Energy kWh/year | Emission factor kg CO2/kWh | | Emissions kg CO2/year | |
|---|---|---|---|---|---|
| CO2 from other sources of space and water heating (not CHP)<br>Efficiency of heat source 1 (%) | If there is CHP using two fuels repeat (363) to (366) for the second fuel | | | 96 | (367a) |
| CO2 associated with heat source 1 | [(307b)+(310b)] x 100 ÷ (367b) x | 0.22 | = | 851.89 | (367) |
| Electrical energy for heat distribution | [(313) x | 0.52 | = | 19.65 | (372) |

# DER WorkSheet: New dwelling design stage

| | | | | | |
|---|---|---|---|---|---|
| Total CO2 associated with community systems | (363)…(366) + (368)...(372) | | = | 871.54 | (373) |
| CO2 associated with space heating (secondary) | (309) x | 0 | = | 0 | (374) |
| CO2 associated with water from immersion heater or instantaneous heater | (312) x | 0.22 | = | 0 | (375) |
| Total CO2 associated with space and water heating | (373) + (374) + (375) = | | | 871.54 | (376) |
| CO2 associated with electricity for pumps and fans within dwelling | (331)) x | 0.52 | = | 68.43 | (378) |
| CO2 associated with electricity for lighting | (332))) x | 0.52 | = | 146.84 | (379) |
| **Total CO2, kg/year** | sum of (376)…(382) = | | | 1086.81 | (383) |
| **Dwelling CO2 Emission Rate** | (383) ÷ (4) = | | | 17.53 | (384) |
| **EI rating (section 14)** | | | | 86.39 | (385) |

# Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.50
*Printed on 06 December 2021 at 10:58:02*

## Project Information:

**Assessed By:** Neil Ingham (STRO010943) **Building Type:** Flat

## Dwelling Details:

**NEW DWELLING DESIGN STAGE** Total Floor Area: 69.44m²

**Site Reference :** Highgate Road - GREEN **Plot Reference:** 01 - E

**Address :**

## Client Details:

**Name:**

**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 (c)
Fuel factor: 1.00 (mains gas (c))

| | | |
|---|---|---|
| Target Carbon Dioxide Emission Rate (TER) | 16.69 kg/m² | |
| Dwelling Carbon Dioxide Emission Rate (DER) | 14.29 kg/m² | OK |

## 1b TFEE and DFEE

| | | |
|---|---|---|
| Target Fabric Energy Efficiency (TFEE) | 41.5 kWh/m² | |
| Dwelling Fabric Energy Efficiency (DFEE) | 33.7 kWh/m² | |
| | | OK |

## 2 Fabric U-values

| Element | Average | Highest | |
|---|---|---|---|
| External wall | 0.18 (max. 0.30) | 0.18 (max. 0.70) | OK |
| Party wall | 0.00 (max. 0.20) | - | OK |
| Floor | (no floor) | | |
| Roof | (no roof) | | |
| Openings | 1.40 (max. 2.00) | 1.40 (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 | 3.00 (design value) | |
| Maximum | 10.0 | OK |

## 4 Heating efficiency

| | |
|---|---|
| Main Heating system: | Community heating schemes - mains gas |
| Secondary heating system: | None |

## 5 Cylinder insulation

| | |
|---|---|
| Hot water Storage: | No cylinder |

## 6 Controls

| | | |
|---|---|---|
| Space heating controls | Charging system linked to use of community heating, programmer and at least two room thermostats | OK |
| Hot water controls: | No cylinder thermostat<br>No cylinder | |

# Regulations Compliance Report

| | | |
|---|---|---|
| **7 Low energy lights** | | |
| Percentage of fixed lights with low-energy fittings | 100.0% | |
| Minimum | 75.0% | **OK** |
| **8 Mechanical ventilation** | | |
| Continuous supply and extract system | | |
| Specific fan power: | 0.54 | |
| Maximum | 1.5 | **OK** |
| MVHR efficiency: | 88% | |
| Minimum | 70% | **OK** |
| **9 Summertime temperature** | | |
| Overheating risk (Thames valley): | Slight | **OK** |
| Based on: | | |
| Overshading: | Average or unknown | |
| Windows facing: North East | 8.97m² | |
| Windows facing: South West | 2.92m² | |
| Ventilation rate: | 6.00 | |
| **10 Key features** | | |
| Air permeablility | 3.0 m³/m²h | |
| Party Walls U-value | 0 W/m²K | |
| Community heating, heat from boilers – mains gas | | |

# DER WorkSheet: New dwelling design stage

User Details:

| | | | |
|---|---|---|---|
| **Assessor Name:** | Neil Ingham | **Stroma Number:** | STRO010943 |
| **Software Name:** | Stroma FSAP 2012 | **Software Version:** | Version: 1.0.5.50 |

Property Address: 01 - E

**Address :**

## 1. Overall dwelling dimensions:

| | Area(m²) | | | Av. Height(m) | | | Volume(m³) | |
|---|---|---|---|---|---|---|---|---|
| Ground floor | 69.44 | (1a) | x | 2.65 | (2a) | = | 184.02 | (3a) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n) | 69.44 | (4) | | | | | | |
| Dwelling volume | | | | (3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) = | | | 184.02 | (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 | | | | | | | 0 | x 10 = | 0 | (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) = | 0 | ÷ (5) = | 0 | (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 | | 3 | (17) |
| If based on air permeability value, then | (18) = [(17) ÷ 20]+(8), otherwise (18) = (16) | 0.15 | (18) |

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

| | | | |
|---|---|---|---|
| Number of sides sheltered | | 0 | (19) |
| Shelter factor | (20) = 1 - [0.075 x (19)] = | 1 | (20) |
| Infiltration rate incorporating shelter factor | (21) = (18) x (20) = | 0.15 | (21) |

Infiltration rate modified for monthly wind speed

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

# DER WorkSheet: New dwelling design stage

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

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.19 | 0.19 | 0.18 | 0.16 | 0.16 | 0.14 | 0.14 | 0.14 | 0.15 | 0.16 | 0.17 | 0.18 |

*Calculate effective air change rate for the applicable case*

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 74.8 (23c)

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24a)m= | 0.32 | 0.31 | 0.31 | 0.29 | 0.29 | 0.27 | 0.27 | 0.26 | 0.28 | 0.29 | 0.29 | 0.3 | (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 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24d) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (25)m= | 0.32 | 0.31 | 0.31 | 0.29 | 0.29 | 0.27 | 0.27 | 0.26 | 0.28 | 0.29 | 0.29 | 0.3 | (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 | |
|---|---|---|---|---|---|---|---|---|
| Windows Type 1 | | | 8.97 | x1/[1/( 1.4 )+ 0.04] = | 11.89 | | | (27) |
| Windows Type 2 | | | 2.92 | x1/[1/( 1.4 )+ 0.04] = | 3.87 | | | (27) |
| Walls Type1 | 41.51 | 11.89 | 29.62 | x 0.18 = | 5.33 | 60 | 1777.2 | (29) |
| Walls Type2 | 16.73 | 0 | 16.73 | x 0.17 = | 2.81 | 60 | 1003.8 | (29) |
| Total area of elements, m² | | | 58.24 | | | | | (31) |
| Party wall | | | 40.43 | x 0 = | 0 | 45 | 1819.35 | (32) |
| Party floor | | | 69.44 | | | 40 | 2777.6 | (32a) |
| Party ceiling | | | 69.44 | | | 30 | 2083.2 | (32b) |
| Internal wall ** | | | 136.21 | | | 9 | 1225.89 | (32c) |

** 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) = 23.9 (33)

Heat capacity Cm = S(A x k ) ((28)…(30) + (32) + (32a)…(32e) = 10687.04 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 153.9 (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 6.99 (36)

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

Total fabric heat loss (33) + (36) = 30.9 (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= | 19.27 | 19.04 | 18.81 | 17.67 | 17.44 | 16.3 | 16.3 | 16.08 | 16.76 | 17.44 | 17.9 | 18.35 | (38) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (39)m= | 50.16 | 49.93 | 49.71 | 48.57 | 48.34 | 47.2 | 47.2 | 46.97 | 47.66 | 48.34 | 48.79 | 49.25 | |

Average = Sum(39)$_{1\ldots12}$ /12= 48.51 (39)

# DER WorkSheet: New dwelling design stage

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

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (40)m= | 0.72 | 0.72 | 0.72 | 0.7 | 0.7 | 0.68 | 0.68 | 0.68 | 0.69 | 0.7 | 0.7 | 0.71 |

Average = Sum(40)$_{1…12}$ /12= 0.7 (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 2.23 (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 87.22 (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= | 95.94 | 92.45 | 88.97 | 85.48 | 81.99 | 78.5 | 78.5 | 81.99 | 85.48 | 88.97 | 92.45 | 95.94 |

Total = Sum(44)$_{1…12}$ = 1046.65 (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= | 142.28 | 124.44 | 128.41 | 111.95 | 107.42 | 92.7 | 85.9 | 98.57 | 99.74 | 116.24 | 126.89 | 137.79 |

Total = Sum(45)$_{1…12}$ = 1372.32 (45)

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (46)m= | 21.34 | 18.67 | 19.26 | 16.79 | 16.11 | 13.9 | 12.88 | 14.78 | 14.96 | 17.44 | 19.03 | 20.67 | (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) = 110 (50)

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

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (56)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (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= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (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= | 23.26 | 21.01 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | (59) |

# DER WorkSheet: New dwelling design stage

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 | (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= | 197.56 | 174.37 | 183.69 | 165.44 | 162.7 | 146.19 | 141.17 | 153.84 | 153.24 | 171.52 | 180.38 | 193.07 | (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= | 197.56 | 174.37 | 183.69 | 165.44 | 162.7 | 146.19 | 141.17 | 153.84 | 153.24 | 171.52 | 180.38 | 193.07 | |

Output from water heater (annual)$_{1...12}$ 2023.16 (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= | 91.53 | 81.32 | 86.92 | 80.02 | 79.94 | 73.62 | 72.78 | 76.99 | 75.96 | 82.87 | 84.98 | 90.04 | (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= | 111.62 | 111.62 | 111.62 | 111.62 | 111.62 | 111.62 | 111.62 | 111.62 | 111.62 | 111.62 | 111.62 | 111.62 | (66) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (67)m= | 18 | 15.98 | 13 | 9.84 | 7.36 | 6.21 | 6.71 | 8.72 | 11.71 | 14.87 | 17.35 | 18.5 | (67) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (68)m= | 195.99 | 198.02 | 192.9 | 181.98 | 168.21 | 155.27 | 146.62 | 144.59 | 149.71 | 160.62 | 174.4 | 187.34 | (68) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (69)m= | 34.16 | 34.16 | 34.16 | 34.16 | 34.16 | 34.16 | 34.16 | 34.16 | 34.16 | 34.16 | 34.16 | 34.16 | (69) |

Pumps and fans gains (Table 5a)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (70)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (70) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (71)m= | -89.3 | -89.3 | -89.3 | -89.3 | -89.3 | -89.3 | -89.3 | -89.3 | -89.3 | -89.3 | -89.3 | -89.3 | (71) |

Water heating gains (Table 5)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (72)m= | 123.02 | 121.01 | 116.83 | 111.14 | 107.44 | 102.24 | 97.82 | 103.49 | 105.5 | 111.39 | 118.03 | 121.02 | (72) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (73)m= | 393.49 | 391.5 | 379.21 | 359.45 | 339.5 | 320.21 | 307.64 | 313.29 | 323.41 | 343.36 | 366.27 | 383.34 | (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 | 8.97 | x | 11.28 | x | 0.63 | x | 0.7 | = | 30.93 | (75) |
| Northeast 0.9x | 0.77 | x | 8.97 | x | 22.97 | x | 0.63 | x | 0.7 | = | 62.96 | (75) |
| Northeast 0.9x | 0.77 | x | 8.97 | x | 41.38 | x | 0.63 | x | 0.7 | = | 113.43 | (75) |
| Northeast 0.9x | 0.77 | x | 8.97 | x | 67.96 | x | 0.63 | x | 0.7 | = | 186.29 | (75) |
| Northeast 0.9x | 0.77 | x | 8.97 | x | 91.35 | x | 0.63 | x | 0.7 | = | 250.41 | (75) |

# DER WorkSheet: New dwelling design stage

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Northeast 0.9x | 0.77 | x | 8.97 | x | 97.38 | x | 0.63 | x | 0.7 | = | 266.96 | (75) |
| Northeast 0.9x | 0.77 | x | 8.97 | x | 91.1 | x | 0.63 | x | 0.7 | = | 249.74 | (75) |
| Northeast 0.9x | 0.77 | x | 8.97 | x | 72.63 | x | 0.63 | x | 0.7 | = | 199.1 | (75) |
| Northeast 0.9x | 0.77 | x | 8.97 | x | 50.42 | x | 0.63 | x | 0.7 | = | 138.22 | (75) |
| Northeast 0.9x | 0.77 | x | 8.97 | x | 28.07 | x | 0.63 | x | 0.7 | = | 76.94 | (75) |
| Northeast 0.9x | 0.77 | x | 8.97 | x | 14.2 | x | 0.63 | x | 0.7 | = | 38.92 | (75) |
| Northeast 0.9x | 0.77 | x | 8.97 | x | 9.21 | x | 0.63 | x | 0.7 | = | 25.26 | (75) |
| Southwest 0.9x | 0.77 | x | 2.92 | x | 36.79 | | 0.63 | x | 0.7 | = | 32.83 | (79) |
| Southwest 0.9x | 0.77 | x | 2.92 | x | 62.67 | | 0.63 | x | 0.7 | = | 55.93 | (79) |
| Southwest 0.9x | 0.77 | x | 2.92 | x | 85.75 | | 0.63 | x | 0.7 | = | 76.52 | (79) |
| Southwest 0.9x | 0.77 | x | 2.92 | x | 106.25 | | 0.63 | x | 0.7 | = | 94.82 | (79) |
| Southwest 0.9x | 0.77 | x | 2.92 | x | 119.01 | | 0.63 | x | 0.7 | = | 106.2 | (79) |
| Southwest 0.9x | 0.77 | x | 2.92 | x | 118.15 | | 0.63 | x | 0.7 | = | 105.44 | (79) |
| Southwest 0.9x | 0.77 | x | 2.92 | x | 113.91 | | 0.63 | x | 0.7 | = | 101.65 | (79) |
| Southwest 0.9x | 0.77 | x | 2.92 | x | 104.39 | | 0.63 | x | 0.7 | = | 93.16 | (79) |
| Southwest 0.9x | 0.77 | x | 2.92 | x | 92.85 | | 0.63 | x | 0.7 | = | 82.86 | (79) |
| Southwest 0.9x | 0.77 | x | 2.92 | x | 69.27 | | 0.63 | x | 0.7 | = | 61.81 | (79) |
| Southwest 0.9x | 0.77 | x | 2.92 | x | 44.07 | | 0.63 | x | 0.7 | = | 39.33 | (79) |
| Southwest 0.9x | 0.77 | x | 2.92 | x | 31.49 | | 0.63 | x | 0.7 | = | 28.1 | (79) |

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

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (83)m= | 63.76 | 118.89 | 189.96 | 281.11 | 356.62 | 372.4 | 351.39 | 292.25 | 221.08 | 138.76 | 78.25 | 53.36 | (83) |

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

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (84)m= | 457.26 | 510.39 | 569.17 | 640.56 | 696.12 | 692.61 | 659.04 | 605.54 | 544.49 | 482.12 | 444.51 | 436.7 | (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= | 0.98 | 0.96 | 0.91 | 0.8 | 0.62 | 0.43 | 0.31 | 0.36 | 0.59 | 0.85 | 0.96 | 0.98 | (86) |

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

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (87)m= | 20.14 | 20.31 | 20.56 | 20.83 | 20.96 | 20.99 | 21 | 21 | 20.98 | 20.8 | 20.44 | 20.12 | (87) |

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

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (88)m= | 20.32 | 20.32 | 20.33 | 20.34 | 20.34 | 20.36 | 20.36 | 20.36 | 20.35 | 20.34 | 20.34 | 20.33 | (88) |

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

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (89)m= | 0.97 | 0.95 | 0.9 | 0.77 | 0.58 | 0.39 | 0.27 | 0.31 | 0.54 | 0.83 | 0.95 | 0.98 | (89) |

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

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (90)m= | 19.17 | 19.41 | 19.77 | 20.14 | 20.3 | 20.35 | 20.36 | 20.36 | 20.33 | 20.11 | 19.61 | 19.15 | (90) |

fLA = Living area ÷ (4) = 0.34 (91)

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

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (92)m= | 19.51 | 19.72 | 20.04 | 20.38 | 20.53 | 20.57 | 20.58 | 20.58 | 20.55 | 20.35 | 19.9 | 19.48 | (92) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (93)m= | 19.51 | 19.72 | 20.04 | 20.38 | 20.53 | 20.57 | 20.58 | 20.58 | 20.55 | 20.35 | 19.9 | 19.48 | (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= | 0.97 | 0.94 | 0.89 | 0.77 | 0.59 | 0.4 | 0.28 | 0.32 | 0.55 | 0.83 | 0.94 | 0.97 | (94) |
| Useful gains, hmGm , W = (94)m x (84)m | | | | | | | | | | | | | |
| (95)m= | 441.94 | 482.27 | 508.95 | 494.78 | 412.34 | 280.41 | 187.58 | 195.95 | 300.31 | 398.27 | 418.19 | 424.3 | (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= | 762.69 | 740.05 | 672.95 | 557.45 | 426.72 | 281.99 | 187.77 | 196.33 | 307.58 | 471.09 | 624.48 | 752.71 | (97) |
| Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m | | | | | | | | | | | | | |
| (98)m= | 238.64 | 173.23 | 122.02 | 45.12 | 10.7 | 0 | 0 | 0 | 0 | 54.18 | 148.53 | 244.34 | |

| | | | |
|---|---|---|---|
| | Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = | 1036.76 | (98) |
| Space heating requirement in kWh/m²/year | | 14.93 | (99) |

## 9b. Energy requirements – Community heating scheme

| | | | |
|---|---|---|---|
| This part is used for space heating, space cooling or water heating provided by a community scheme.<br>Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none | | 0 | (301) |
| Fraction of space heat from community system 1 – (301) = | | 1 | (302) |

*The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.*

| | | | |
|---|---|---|---|
| Fraction of heat from Community boilers | | 1 | (303a) |
| Fraction of total space heat from Community boilers | (302) x (303a) = | 1 | (304a) |
| Factor for control and charging method (Table 4c(3)) for community heating system | | 1 | (305) |
| Distribution loss factor (Table 12c) for community heating system | | 1.05 | (306) |
| **Space heating** | | **kWh/year** | |
| Annual space heating requirement | | 1036.76 | |
| Space heat from Community boilers | (98) x (304a) x (305) x (306) = | 1088.59 | (307a) |
| Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) | | 0 | (308 |
| Space heating requirement from secondary/supplementary system | (98) x (301) x 100 ÷ (308) = | 0 | (309) |
| **Water heating**<br>Annual water heating requirement | | 2023.16 | |
| If DHW from community scheme:<br>Water heat from Community boilers | (64) x (303a) x (305) x (306) = | 2124.32 | (310a) |
| Electricity used for heat distribution | 0.01 × [(307a)…(307e) + (310a)…(310e)] = | 32.13 | (313) |
| Cooling System Energy Efficiency Ratio | | 0 | (314) |
| Space cooling (if there is a fixed cooling system, if not enter 0) | = (107) ÷ (314) = | 0 | (315) |
| Electricity for pumps and fans within dwelling (Table 4f):<br>mechanical ventilation - balanced, extract or positive input from outside | | 169.72 | (330a) |

# DER WorkSheet: New dwelling design stage

| | | | |
|---|---|---|---|
| warm air heating system fans | | 0 | (330b) |
| pump for solar water heating | | 0 | (330g) |
| Total electricity for the above, kWh/year | =(330a) + (330b) + (330g) = | 169.72 | (331) |
| Energy for lighting (calculated in Appendix L) | | 317.84 | (332) |
| Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) = | | 3700.47 | (338) |

## 12b. CO2 Emissions – Community heating scheme

| | | Energy kWh/year | Emission factor kg CO2/kWh | | Emissions kg CO2/year | |
|---|---|---|---|---|---|---|
| CO2 from other sources of space and water heating (not CHP) | | | | | | |
| Efficiency of heat source 1 (%) | If there is CHP using two fuels repeat (363) to (366) for the second fuel | | | | 96 | (367a) |
| CO2 associated with heat source 1 | [(307b)+(310b)] x 100 ÷ (367b) x | | 0.22 | = | 722.91 | (367) |
| Electrical energy for heat distribution | [(313) x | | 0.52 | = | 16.68 | (372) |
| Total CO2 associated with community systems | (363)…(366) + (368)...(372) | | | = | 739.58 | (373) |
| CO2 associated with space heating (secondary) | (309) x | | 0 | = | 0 | (374) |
| CO2 associated with water from immersion heater or instantaneous heater | (312) x | | 0.22 | = | 0 | (375) |
| Total CO2 associated with space and water heating | (373) + (374) + (375) = | | | | 739.58 | (376) |
| CO2 associated with electricity for pumps and fans within dwelling | (331)) x | | 0.52 | = | 88.09 | (378) |
| CO2 associated with electricity for lighting | (332))) x | | 0.52 | = | 164.96 | (379) |
| **Total CO2, kg/year** | sum of (376)…(382) = | | | | 992.62 | (383) |
| **Dwelling CO2 Emission Rate** | (383) ÷ (4) = | | | | 14.29 | (384) |
| **EI rating (section 14)** | | | | | 88.38 | (385) |

# Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.50
*Printed on 06 December 2021 at 10:57:44*

## Project Information:

**Assessed By:** Neil Ingham (STRO010943) **Building Type:** Flat

## Dwelling Details:

**NEW DWELLING DESIGN STAGE** Total Floor Area: 69.61m²

**Site Reference :** Highgate Road - GREEN **Plot Reference:** 01 - F

**Address :**

## Client Details:

**Name:**

**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 (c)
Fuel factor: 1.00 (mains gas (c))

| | | |
|---|---|---|
| Target Carbon Dioxide Emission Rate (TER) | 16.77 kg/m² | |
| Dwelling Carbon Dioxide Emission Rate (DER) | 14.35 kg/m² | OK |

## 1b TFEE and DFEE

| | | |
|---|---|---|
| Target Fabric Energy Efficiency (TFEE) | 41.9 kWh/m² | |
| Dwelling Fabric Energy Efficiency (DFEE) | 34.0 kWh/m² | |
| | | OK |

## 2 Fabric U-values

| Element | Average | Highest | |
|---|---|---|---|
| External wall | 0.18 (max. 0.30) | 0.18 (max. 0.70) | OK |
| Party wall | 0.00 (max. 0.20) | - | OK |
| Floor | (no floor) | | |
| Roof | (no roof) | | |
| Openings | 1.40 (max. 2.00) | 1.40 (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 | 3.00 (design value) | |
| Maximum | 10.0 | OK |

## 4 Heating efficiency

Main Heating system: Community heating schemes - mains gas

Secondary heating system: None

## 5 Cylinder insulation

Hot water Storage: No cylinder

## 6 Controls

| | | |
|---|---|---|
| Space heating controls | Charging system linked to use of community heating, programmer and at least two room thermostats | OK |
| Hot water controls: | No cylinder thermostat<br>No cylinder | |

# Regulations Compliance Report

| 7 Low energy lights | | |
|---|---|---|
| Percentage of fixed lights with low-energy fittings | 100.0% | |
| Minimum | 75.0% | **OK** |

| 8 Mechanical ventilation | | |
|---|---|---|
| Continuous supply and extract system | | |
| Specific fan power: | 0.54 | |
| Maximum | 1.5 | **OK** |
| MVHR efficiency: | 88% | |
| Minimum | 70% | **OK** |

| 9 Summertime temperature | | |
|---|---|---|
| Overheating risk (Thames valley): | Slight | **OK** |
| Based on: | | |
| Overshading: | Average or unknown | |
| Windows facing: North East | 8.97m² | |
| Windows facing: South West | 2.92m² | |
| Ventilation rate: | 6.00 | |

| 10 Key features | |
|---|---|
| Air permeablility | 3.0 m³/m²h |
| Party  Walls U-value | 0 W/m²K |
| Community heating, heat from boilers – mains gas | |

# DER WorkSheet: New dwelling design stage

User Details:

| | | | |
|---|---|---|---|
| **Assessor Name:** | Neil Ingham | **Stroma Number:** | STRO010943 |
| **Software Name:** | Stroma FSAP 2012 | **Software Version:** | Version: 1.0.5.50 |

Property Address: 01 - F

**Address :**

## 1. Overall dwelling dimensions:

| | Area(m²) | | Av. Height(m) | | Volume(m³) | |
|---|---|---|---|---|---|---|
| Ground floor | 69.61 | (1a) x | 2.65 | (2a) = | 184.47 | (3a) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n) | 69.61 | (4) | | | | |
| Dwelling volume | | | | (3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) = | 184.47 | (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 | | | | | | | 0 | x 10 = | 0 | (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) = | 0 | ÷ (5) = | 0 | (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 *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* | | 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 | | 3 | (17) |
| If based on air permeability value, then | (18) = [(17) ÷ 20]+(8), otherwise (18) = (16) | 0.15 | (18) |

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

| | | | |
|---|---|---|---|
| Number of sides sheltered | | 0 | (19) |
| Shelter factor | (20) = 1 - [0.075 x (19)] = | 1 | (20) |
| Infiltration rate incorporating shelter factor | (21) = (18) x (20) = | 0.15 | (21) |

Infiltration rate modified for monthly wind speed

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

# DER WorkSheet: New dwelling design stage

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

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.19 | 0.19 | 0.18 | 0.16 | 0.16 | 0.14 | 0.14 | 0.14 | 0.15 | 0.16 | 0.17 | 0.18 |

*Calculate effective air change rate for the applicable case*

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 74.8 (23c)

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24a)m= | 0.32 | 0.31 | 0.31 | 0.29 | 0.29 | 0.27 | 0.27 | 0.26 | 0.28 | 0.29 | 0.29 | 0.3 | (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 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24d) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (25)m= | 0.32 | 0.31 | 0.31 | 0.29 | 0.29 | 0.27 | 0.27 | 0.26 | 0.28 | 0.29 | 0.29 | 0.3 | (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 | |
|---|---|---|---|---|---|---|---|---|
| Windows Type 1 | | | 8.97 | x1/[1/( 1.4 )+ 0.04] = | 11.89 | | | (27) |
| Windows Type 2 | | | 2.92 | x1/[1/( 1.4 )+ 0.04] = | 3.87 | | | (27) |
| Walls Type1 | 41.59 | 11.89 | 29.7 | x 0.18 = | 5.35 | 60 | 1782 | (29) |
| Walls Type2 | 18.41 | 0 | 18.41 | x 0.17 = | 3.09 | 60 | 1104.6 | (29) |
| Total area of elements, m² | | | 60 | | | | | (31) |
| Party wall | | | 38.68 | x 0 = | 0 | 45 | 1740.6 | (32) |
| Party floor | | | 69.61 | | | 40 | 2784.4 | (32a) |
| Party ceiling | | | 69.61 | | | 30 | 2088.3 | (32b) |
| Internal wall ** | | | 136.21 | | | 9 | 1225.89 | (32c) |

** 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) = 24.2 (33)

Heat capacity Cm = S(A x k ) ((28)…(30) + (32) + (32a)…(32e) = 10725.79 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 154.08 (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 6.99 (36)

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

Total fabric heat loss (33) + (36) = 31.19 (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= | 19.31 | 19.08 | 18.86 | 17.71 | 17.49 | 16.34 | 16.34 | 16.12 | 16.8 | 17.49 | 17.94 | 18.4 | (38) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (39)m= | 50.5 | 50.28 | 50.05 | 48.91 | 48.68 | 47.54 | 47.54 | 47.31 | 47.99 | 48.68 | 49.13 | 49.59 | |

Average = Sum(39)$_{1…12}$ /12= 48.85 (39)

# DER WorkSheet: New dwelling design stage

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

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (40)m= | 0.73 | 0.72 | 0.72 | 0.7 | 0.7 | 0.68 | 0.68 | 0.68 | 0.69 | 0.7 | 0.71 | 0.71 |

Average = Sum(40)$_{1…12}$ /12= 0.7 (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 2.24 (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 87.32 (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= | 96.05 | 92.56 | 89.07 | 85.57 | 82.08 | 78.59 | 78.59 | 82.08 | 85.57 | 89.07 | 92.56 | 96.05 |

Total = Sum(44)$_{1…12}$ = 1047.84 (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= | 142.44 | 124.58 | 128.56 | 112.08 | 107.54 | 92.8 | 85.99 | 98.68 | 99.86 | 116.37 | 127.03 | 137.95 |

Total = Sum(45)$_{1…12}$ = 1373.88 (45)

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (46)m= | 21.37 | 18.69 | 19.28 | 16.81 | 16.13 | 13.92 | 12.9 | 14.8 | 14.98 | 17.46 | 19.05 | 20.69 | (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) = 110 (50)

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

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (56)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (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= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (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= | 23.26 | 21.01 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | (59) |

# DER WorkSheet: New dwelling design stage

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 | (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= | 197.72 | 174.51 | 183.83 | 165.57 | 162.82 | 146.29 | 141.27 | 153.96 | 153.35 | 171.65 | 180.52 | 193.22 | (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= | 197.72 | 174.51 | 183.83 | 165.57 | 162.82 | 146.29 | 141.27 | 153.96 | 153.35 | 171.65 | 180.52 | 193.22 | |

Output from water heater (annual)$_{1...12}$ 2024.72 (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= | 91.58 | 81.36 | 86.97 | 80.06 | 79.98 | 73.65 | 72.81 | 77.03 | 76 | 82.92 | 85.03 | 90.09 | (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= | 111.83 | 111.83 | 111.83 | 111.83 | 111.83 | 111.83 | 111.83 | 111.83 | 111.83 | 111.83 | 111.83 | 111.83 | (66) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (67)m= | 18.04 | 16.02 | 13.03 | 9.87 | 7.37 | 6.23 | 6.73 | 8.74 | 11.74 | 14.9 | 17.39 | 18.54 | (67) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (68)m= | 196.39 | 198.42 | 193.29 | 182.36 | 168.55 | 155.58 | 146.92 | 144.88 | 150.02 | 160.95 | 174.75 | 187.72 | (68) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (69)m= | 34.18 | 34.18 | 34.18 | 34.18 | 34.18 | 34.18 | 34.18 | 34.18 | 34.18 | 34.18 | 34.18 | 34.18 | (69) |

Pumps and fans gains (Table 5a)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (70)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (70) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (71)m= | -89.46 | -89.46 | -89.46 | -89.46 | -89.46 | -89.46 | -89.46 | -89.46 | -89.46 | -89.46 | -89.46 | -89.46 | (71) |

Water heating gains (Table 5)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (72)m= | 123.1 | 121.08 | 116.89 | 111.2 | 107.5 | 102.29 | 97.87 | 103.54 | 105.55 | 111.45 | 118.1 | 121.09 | (72) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (73)m= | 394.07 | 392.08 | 379.76 | 359.97 | 339.98 | 320.65 | 308.06 | 313.71 | 323.86 | 343.85 | 366.79 | 383.9 | (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 | 8.97 | x | 11.28 | x | 0.63 | x | 0.7 | = | 30.93 | (75) |
| Northeast 0.9x | 0.77 | x | 8.97 | x | 22.97 | x | 0.63 | x | 0.7 | = | 62.96 | (75) |
| Northeast 0.9x | 0.77 | x | 8.97 | x | 41.38 | x | 0.63 | x | 0.7 | = | 113.43 | (75) |
| Northeast 0.9x | 0.77 | x | 8.97 | x | 67.96 | x | 0.63 | x | 0.7 | = | 186.29 | (75) |
| Northeast 0.9x | 0.77 | x | 8.97 | x | 91.35 | x | 0.63 | x | 0.7 | = | 250.41 | (75) |

# DER WorkSheet: New dwelling design stage

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Northeast 0.9x | 0.77 | x | 8.97 | x | 97.38 | x | 0.63 | x | 0.7 | = | 266.96 | (75) |
| Northeast 0.9x | 0.77 | x | 8.97 | x | 91.1 | x | 0.63 | x | 0.7 | = | 249.74 | (75) |
| Northeast 0.9x | 0.77 | x | 8.97 | x | 72.63 | x | 0.63 | x | 0.7 | = | 199.1 | (75) |
| Northeast 0.9x | 0.77 | x | 8.97 | x | 50.42 | x | 0.63 | x | 0.7 | = | 138.22 | (75) |
| Northeast 0.9x | 0.77 | x | 8.97 | x | 28.07 | x | 0.63 | x | 0.7 | = | 76.94 | (75) |
| Northeast 0.9x | 0.77 | x | 8.97 | x | 14.2 | x | 0.63 | x | 0.7 | = | 38.92 | (75) |
| Northeast 0.9x | 0.77 | x | 8.97 | x | 9.21 | x | 0.63 | x | 0.7 | = | 25.26 | (75) |
| Southwest 0.9x | 0.77 | x | 2.92 | x | 36.79 | | 0.63 | x | 0.7 | = | 32.83 | (79) |
| Southwest 0.9x | 0.77 | x | 2.92 | x | 62.67 | | 0.63 | x | 0.7 | = | 55.93 | (79) |
| Southwest 0.9x | 0.77 | x | 2.92 | x | 85.75 | | 0.63 | x | 0.7 | = | 76.52 | (79) |
| Southwest 0.9x | 0.77 | x | 2.92 | x | 106.25 | | 0.63 | x | 0.7 | = | 94.82 | (79) |
| Southwest 0.9x | 0.77 | x | 2.92 | x | 119.01 | | 0.63 | x | 0.7 | = | 106.2 | (79) |
| Southwest 0.9x | 0.77 | x | 2.92 | x | 118.15 | | 0.63 | x | 0.7 | = | 105.44 | (79) |
| Southwest 0.9x | 0.77 | x | 2.92 | x | 113.91 | | 0.63 | x | 0.7 | = | 101.65 | (79) |
| Southwest 0.9x | 0.77 | x | 2.92 | x | 104.39 | | 0.63 | x | 0.7 | = | 93.16 | (79) |
| Southwest 0.9x | 0.77 | x | 2.92 | x | 92.85 | | 0.63 | x | 0.7 | = | 82.86 | (79) |
| Southwest 0.9x | 0.77 | x | 2.92 | x | 69.27 | | 0.63 | x | 0.7 | = | 61.81 | (79) |
| Southwest 0.9x | 0.77 | x | 2.92 | x | 44.07 | | 0.63 | x | 0.7 | = | 39.33 | (79) |
| Southwest 0.9x | 0.77 | x | 2.92 | x | 31.49 | | 0.63 | x | 0.7 | = | 28.1 | (79) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (83)m= | 63.76 | 118.89 | 189.96 | 281.11 | 356.62 | 372.4 | 351.39 | 292.25 | 221.08 | 138.76 | 78.25 | 53.36 | (83) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (84)m= | 457.84 | 510.96 | 569.72 | 641.07 | 696.59 | 693.05 | 659.46 | 605.97 | 544.94 | 482.6 | 445.04 | 437.26 | (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= | 0.98 | 0.96 | 0.92 | 0.8 | 0.62 | 0.44 | 0.32 | 0.36 | 0.59 | 0.85 | 0.96 | 0.98 | (86) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (87)m= | 20.14 | 20.3 | 20.55 | 20.83 | 20.96 | 20.99 | 21 | 21 | 20.98 | 20.79 | 20.44 | 20.12 | (87) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (88)m= | 20.32 | 20.32 | 20.32 | 20.34 | 20.34 | 20.36 | 20.36 | 20.36 | 20.35 | 20.34 | 20.34 | 20.33 | (88) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (89)m= | 0.97 | 0.95 | 0.9 | 0.77 | 0.58 | 0.39 | 0.27 | 0.31 | 0.54 | 0.83 | 0.95 | 0.98 | (89) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (90)m= | 19.16 | 19.4 | 19.76 | 20.13 | 20.3 | 20.35 | 20.36 | 20.36 | 20.33 | 20.1 | 19.6 | 19.14 | (90) |

fLA = Living area ÷ (4) = | 0.38 | (91)

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (92)m= | 19.53 | 19.74 | 20.06 | 20.4 | 20.55 | 20.6 | 20.6 | 20.6 | 20.58 | 20.37 | 19.92 | 19.51 | (92) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (93)m= | 19.53 | 19.74 | 20.06 | 20.4 | 20.55 | 20.6 | 20.6 | 20.6 | 20.58 | 20.37 | 19.92 | 19.51 | (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= | 0.97 | 0.95 | 0.9 | 0.78 | 0.6 | 0.41 | 0.29 | 0.33 | 0.56 | 0.83 | 0.94 | 0.97 | (94) |
| Useful gains, hmGm , W = (94)m x (84)m | | | | | | | | | | | | | |
| (95)m= | 442.81 | 483.37 | 510.56 | 497.42 | 415.67 | 283.37 | 189.97 | 198.39 | 303.11 | 400.16 | 419.22 | 425.1 | (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= | 769.26 | 746.33 | 678.64 | 562.34 | 430.79 | 285.07 | 190.19 | 198.8 | 310.81 | 475.38 | 629.94 | 759.24 | (97) |
| Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m | | | | | | | | | | | | | |
| (98)m= | 242.87 | 176.71 | 125.05 | 46.74 | 11.25 | 0 | 0 | 0 | 0 | 55.96 | 151.71 | 248.6 | |

| | | | |
|---|---|---|---|
| Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = | | 1058.9 | (98) |
| Space heating requirement in kWh/m²/year | | 15.21 | (99) |

## 9b. Energy requirements – Community heating scheme

| | | | |
|---|---|---|---|
| This part is used for space heating, space cooling or water heating provided by a community scheme.<br>Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none | | 0 | (301) |
| Fraction of space heat from community system 1 – (301) = | | 1 | (302) |

*The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.*

| | | | |
|---|---|---|---|
| Fraction of heat from Community boilers | | 1 | (303a) |
| Fraction of total space heat from Community boilers | (302) x (303a) = | 1 | (304a) |
| Factor for control and charging method (Table 4c(3)) for community heating system | | 1 | (305) |
| Distribution loss factor (Table 12c) for community heating system | | 1.05 | (306) |
| **Space heating** | | **kWh/year** | |
| Annual space heating requirement | | 1058.9 | |
| Space heat from Community boilers | (98) x (304a) x (305) x (306) = | 1111.84 | (307a) |
| Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) | | 0 | (308 |
| Space heating requirement from secondary/supplementary system | (98) x (301) x 100 ÷ (308) = | 0 | (309) |
| **Water heating** | | | |
| Annual water heating requirement | | 2024.72 | |
| If DHW from community scheme:<br>Water heat from Community boilers | (64) x (303a) x (305) x (306) = | 2125.95 | (310a) |
| Electricity used for heat distribution | 0.01 × [(307a)…(307e) + (310a)…(310e)] = | 32.38 | (313) |
| Cooling System Energy Efficiency Ratio | | 0 | (314) |
| Space cooling (if there is a fixed cooling system, if not enter 0) | = (107) ÷ (314) = | 0 | (315) |
| Electricity for pumps and fans within dwelling (Table 4f):<br>mechanical ventilation - balanced, extract or positive input from outside | | 170.14 | (330a) |

| | | | |
|---|---|---|---|
| warm air heating system fans | | 0 | (330b) |
| pump for solar water heating | | 0 | (330g) |
| Total electricity for the above, kWh/year | =(330a) + (330b) + (330g) = | 170.14 | (331) |
| Energy for lighting (calculated in Appendix L) | | 318.62 | (332) |
| Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) = | | 3726.56 | (338) |

## 12b. CO2 Emissions – Community heating scheme

| | | Energy kWh/year | Emission factor kg CO2/kWh | | Emissions kg CO2/year | |
|---|---|---|---|---|---|---|
| CO2 from other sources of space and water heating (not CHP) | | | | | | |
| Efficiency of heat source 1 (%) | If there is CHP using two fuels repeat (363) to (366) for the second fuel | | | | 96 | (367a) |
| CO2 associated with heat source 1 | [(307b)+(310b)] x 100 ÷ (367b) x | | 0.22 | = | 728.5 | (367) |
| Electrical energy for heat distribution | [(313) x | | 0.52 | = | 16.8 | (372) |
| Total CO2 associated with community systems | (363)…(366) + (368)...(372) | | | = | 745.31 | (373) |
| CO2 associated with space heating (secondary) | (309) x | | 0 | = | 0 | (374) |
| CO2 associated with water from immersion heater or instantaneous heater | (312) x | | 0.22 | = | 0 | (375) |
| Total CO2 associated with space and water heating | (373) + (374) + (375) = | | | | 745.31 | (376) |
| CO2 associated with electricity for pumps and fans within dwelling | (331)) x | | 0.52 | = | 88.3 | (378) |
| CO2 associated with electricity for lighting | (332))) x | | 0.52 | = | 165.36 | (379) |
| **Total CO2, kg/year** | sum of (376)…(382) = | | | | 998.97 | (383) |
| **Dwelling CO2 Emission Rate** | (383) ÷ (4) = | | | | 14.35 | (384) |
| **EI rating (section 14)** | | | | | 88.32 | (385) |

# Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.50
*Printed on 06 December 2021 at 10:57:25*

## Project Information:

**Assessed By:** Neil Ingham (STRO010943) **Building Type:** Flat

## Dwelling Details:

**NEW DWELLING DESIGN STAGE** Total Floor Area: 50.62m²

**Site Reference :** Highgate Road - GREEN **Plot Reference:** 01 - G

**Address :**

## Client Details:

**Name:**

**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 (c) | | |
| Fuel factor: 1.00 (mains gas (c)) | | |
| Target Carbon Dioxide Emission Rate (TER) | 19.64 kg/m² | |
| Dwelling Carbon Dioxide Emission Rate (DER) | 16.45 kg/m² | **OK** |

## 1b TFEE and DFEE

| | | |
|---|---|---|
| Target Fabric Energy Efficiency (TFEE) | 48.0 kWh/m² | |
| Dwelling Fabric Energy Efficiency (DFEE) | 38.7 kWh/m² | |
| | | **OK** |

## 2 Fabric U-values

| Element | Average | Highest | |
|---|---|---|---|
| External wall | 0.17 (max. 0.30) | 0.18 (max. 0.70) | **OK** |
| Party wall | 0.00 (max. 0.20) | - | **OK** |
| Floor | (no floor) | | |
| Roof | (no roof) | | |
| Openings | 1.40 (max. 2.00) | 1.40 (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 | 3.00 (design value) | |
| Maximum | 10.0 | **OK** |

## 4 Heating efficiency

| | |
|---|---|
| Main Heating system: | Community heating schemes - mains gas |
| Secondary heating system: | None |

## 5 Cylinder insulation

| | |
|---|---|
| Hot water Storage: | No cylinder |

## 6 Controls

| | | |
|---|---|---|
| Space heating controls | Charging system linked to use of community heating, programmer and at least two room thermostats | **OK** |
| Hot water controls: | No cylinder thermostat<br>No cylinder | |

# Regulations Compliance Report

## 7 Low energy lights

| | | |
|---|---|---|
| Percentage of fixed lights with low-energy fittings | 100.0% | |
| Minimum | 75.0% | **OK** |

## 8 Mechanical ventilation

| | | |
|---|---|---|
| Continuous supply and extract system | | |
| Specific fan power: | 0.47 | |
| Maximum | 1.5 | **OK** |
| MVHR efficiency: | 89% | |
| Minimum | 70% | **OK** |

## 9 Summertime temperature

| | | |
|---|---|---|
| Overheating risk (Thames valley): | Medium | **OK** |
| Based on: | | |
| Overshading: | Average or unknown | |
| Windows facing: North East | $8.97m^2$ | |
| Ventilation rate: | 4.00 | |

## 10 Key features

| | |
|---|---|
| Air permeablility | $3.0\ m^3/m^2h$ |
| Party  Walls U-value | $0\ W/m^2K$ |
| Community heating, heat from boilers – mains gas | |

# DER WorkSheet: New dwelling design stage

User Details:

| | | | |
|---|---|---|---|
| **Assessor Name:** | Neil Ingham | **Stroma Number:** | STRO010943 |
| **Software Name:** | Stroma FSAP 2012 | **Software Version:** | Version: 1.0.5.50 |

Property Address: 01 - G

**Address :**

## 1. Overall dwelling dimensions:

| | Area(m²) | | | Av. Height(m) | | | Volume(m³) | |
|---|---|---|---|---|---|---|---|---|
| Ground floor | 50.62 | (1a) | x | 2.65 | (2a) | = | 134.14 | (3a) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n) | 50.62 | (4) | | | | | | |
| Dwelling volume | | | | (3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) | | = | 134.14 | (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 | | | | | | | 0 | x 10 = | 0 | (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) = | 0 | ÷ (5) = | 0 | (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 | | 3 | (17) |
| If based on air permeability value, then | (18) = [(17) ÷ 20]+(8), otherwise (18) = (16) | 0.15 | (18) |

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

| | | | |
|---|---|---|---|
| Number of sides sheltered | | 0 | (19) |
| Shelter factor | (20) = 1 - [0.075 x (19)] = | 1 | (20) |
| Infiltration rate incorporating shelter factor | (21) = (18) x (20) = | 0.15 | (21) |

Infiltration rate modified for monthly wind speed

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

# DER WorkSheet: New dwelling design stage

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

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.19 | 0.19 | 0.18 | 0.16 | 0.16 | 0.14 | 0.14 | 0.14 | 0.15 | 0.16 | 0.17 | 0.18 |

*Calculate effective air change rate for the applicable case*

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 75.65 (23c)

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24a)m= | 0.31 | 0.31 | 0.31 | 0.29 | 0.28 | 0.26 | 0.26 | 0.26 | 0.27 | 0.28 | 0.29 | 0.3 | (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 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24d) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (25)m= | 0.31 | 0.31 | 0.31 | 0.29 | 0.28 | 0.26 | 0.26 | 0.26 | 0.27 | 0.28 | 0.29 | 0.3 | (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 | |
|---|---|---|---|---|---|---|---|---|---|---|
| Windows | | | 8.97 | x1/[1/( 1.4 )+ 0.04] | | = | 11.89 | | | (27) |
| Walls Type1 | 31.4 | 8.97 | 22.43 | x | 0.18 | = | 4.04 | 60 | 1345.8 | (29) |
| Walls Type2 | 22.92 | 0 | 22.92 | x | 0.17 | = | 3.85 | 60 | 1375.2 | (29) |
| Total area of elements, m² | | | 54.32 | | | | | | | (31) |
| Party wall | | | 30.08 | x | 0 | = | 0 | 45 | 1353.6 | (32) |
| Party floor | | | 50.62 | | | | | 40 | 2024.8 | (32a) |
| Party ceiling | | | 50.62 | | | | | 30 | 1518.6 | (32b) |
| Internal wall ** | | | 83.2 | | | | | 9 | 748.8 | (32c) |

** 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) = 19.78 (33)

Heat capacity Cm = S(A x k ) ((28)…(30) + (32) + (32a)…(32e) = 8366.8 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 165.29 (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 5.92 (36)

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

Total fabric heat loss (33) + (36) = 25.7 (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= | 13.86 | 13.69 | 13.52 | 12.69 | 12.53 | 11.7 | 11.7 | 11.53 | 12.03 | 12.53 | 12.86 | 13.19 | (38) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (39)m= | 39.55 | 39.39 | 39.22 | 38.39 | 38.22 | 37.39 | 37.39 | 37.23 | 37.73 | 38.22 | 38.56 | 38.89 | |

Average = Sum(39)$_{1…12}$ /12= 38.35 (39)

# DER WorkSheet: New dwelling design stage

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (40)m= | 0.78 | 0.78 | 0.77 | 0.76 | 0.76 | 0.74 | 0.74 | 0.74 | 0.75 | 0.76 | 0.76 | 0.77 | |

Average = Sum(40)$_{1...12}$ /12= 0.76 (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 1.71 (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 74.77 (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= | 82.25 | 79.26 | 76.27 | 73.28 | 70.29 | 67.3 | 67.3 | 70.29 | 73.28 | 76.27 | 79.26 | 82.25 | |

Total = Sum(44)$_{1...12}$ = 897.28 (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= | 121.98 | 106.68 | 110.09 | 95.97 | 92.09 | 79.47 | 73.64 | 84.5 | 85.51 | 99.65 | 108.78 | 118.13 | |

Total = Sum(45)$_{1...12}$ = 1176.48 (45)

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (46)m= | 18.3 | 16 | 16.51 | 14.4 | 13.81 | 11.92 | 11.05 | 12.68 | 12.83 | 14.95 | 16.32 | 17.72 | (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) = 110 (50)

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

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (56)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (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= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (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= | 23.26 | 21.01 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | (59) |

# DER WorkSheet: New dwelling design stage

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 | (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= | 177.25 | 156.61 | 165.36 | 149.47 | 147.37 | 132.96 | 128.91 | 139.78 | 139 | 154.93 | 162.27 | 173.4 | (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= | 177.25 | 156.61 | 165.36 | 149.47 | 147.37 | 132.96 | 128.91 | 139.78 | 139 | 154.93 | 162.27 | 173.4 | |

Output from water heater (annual)$_{1…12}$ 1827.32 (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= | 84.78 | 75.41 | 80.82 | 74.71 | 74.84 | 69.22 | 68.71 | 72.32 | 71.23 | 77.36 | 78.96 | 83.5 | (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= | 85.42 | 85.42 | 85.42 | 85.42 | 85.42 | 85.42 | 85.42 | 85.42 | 85.42 | 85.42 | 85.42 | 85.42 | (66) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (67)m= | 13.59 | 12.07 | 9.81 | 7.43 | 5.55 | 4.69 | 5.07 | 6.59 | 8.84 | 11.22 | 13.1 | 13.97 | (67) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (68)m= | 148.84 | 150.39 | 146.5 | 138.21 | 127.75 | 117.92 | 111.35 | 109.81 | 113.7 | 121.99 | 132.45 | 142.28 | (68) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (69)m= | 31.54 | 31.54 | 31.54 | 31.54 | 31.54 | 31.54 | 31.54 | 31.54 | 31.54 | 31.54 | 31.54 | 31.54 | (69) |

Pumps and fans gains (Table 5a)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (70)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (70) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (71)m= | -68.33 | -68.33 | -68.33 | -68.33 | -68.33 | -68.33 | -68.33 | -68.33 | -68.33 | -68.33 | -68.33 | -68.33 | (71) |

Water heating gains (Table 5)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (72)m= | 113.95 | 112.22 | 108.64 | 103.76 | 100.59 | 96.14 | 92.35 | 97.2 | 98.93 | 103.97 | 109.67 | 112.23 | (72) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (73)m= | 325.01 | 323.3 | 313.57 | 298.03 | 282.52 | 267.37 | 257.39 | 262.22 | 270.09 | 285.81 | 303.84 | 317.1 | (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 | 8.97 | x | 11.28 | x | 0.63 | x | 0.7 | = | 30.93 | (75) |
| Northeast 0.9x | 0.77 | x | 8.97 | x | 22.97 | x | 0.63 | x | 0.7 | = | 62.96 | (75) |
| Northeast 0.9x | 0.77 | x | 8.97 | x | 41.38 | x | 0.63 | x | 0.7 | = | 113.43 | (75) |
| Northeast 0.9x | 0.77 | x | 8.97 | x | 67.96 | x | 0.63 | x | 0.7 | = | 186.29 | (75) |
| Northeast 0.9x | 0.77 | x | 8.97 | x | 91.35 | x | 0.63 | x | 0.7 | = | 250.41 | (75) |

# DER WorkSheet: New dwelling design stage

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Northeast 0.9x | 0.77 | x | 8.97 | x | 97.38 | x | 0.63 | x | 0.7 | = | 266.96 | (75) |
| Northeast 0.9x | 0.77 | x | 8.97 | x | 91.1 | x | 0.63 | x | 0.7 | = | 249.74 | (75) |
| Northeast 0.9x | 0.77 | x | 8.97 | x | 72.63 | x | 0.63 | x | 0.7 | = | 199.1 | (75) |
| Northeast 0.9x | 0.77 | x | 8.97 | x | 50.42 | x | 0.63 | x | 0.7 | = | 138.22 | (75) |
| Northeast 0.9x | 0.77 | x | 8.97 | x | 28.07 | x | 0.63 | x | 0.7 | = | 76.94 | (75) |
| Northeast 0.9x | 0.77 | x | 8.97 | x | 14.2 | x | 0.63 | x | 0.7 | = | 38.92 | (75) |
| Northeast 0.9x | 0.77 | x | 8.97 | x | 9.21 | x | 0.63 | x | 0.7 | = | 25.26 | (75) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (83)m= | 30.93 | 62.96 | 113.43 | 186.29 | 250.41 | 266.96 | 249.74 | 199.1 | 138.22 | 76.94 | 38.92 | 25.26 | (83) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (84)m= | 355.94 | 386.26 | 427.01 | 484.32 | 532.94 | 534.34 | 507.13 | 461.32 | 408.31 | 362.75 | 342.76 | 342.36 | (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= | 0.98 | 0.96 | 0.93 | 0.82 | 0.64 | 0.44 | 0.32 | 0.37 | 0.61 | 0.87 | 0.96 | 0.98 | (86) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (87)m= | 20.13 | 20.27 | 20.52 | 20.81 | 20.95 | 20.99 | 21 | 21 | 20.97 | 20.77 | 20.42 | 20.11 | (87) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (88)m= | 20.27 | 20.27 | 20.28 | 20.29 | 20.29 | 20.31 | 20.31 | 20.31 | 20.3 | 20.29 | 20.29 | 20.28 | (88) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (89)m= | 0.97 | 0.96 | 0.91 | 0.79 | 0.59 | 0.4 | 0.27 | 0.31 | 0.56 | 0.84 | 0.95 | 0.98 | (89) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (90)m= | 19.1 | 19.31 | 19.66 | 20.06 | 20.24 | 20.3 | 20.31 | 20.31 | 20.28 | 20.03 | 19.54 | 19.09 | (90) |

fLA = Living area ÷ (4) = 0.49 (91)

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (92)m= | 19.61 | 19.78 | 20.08 | 20.43 | 20.59 | 20.64 | 20.65 | 20.65 | 20.62 | 20.39 | 19.97 | 19.59 | (92) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (93)m= | 19.61 | 19.78 | 20.08 | 20.43 | 20.59 | 20.64 | 20.65 | 20.65 | 20.62 | 20.39 | 19.97 | 19.59 | (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= | 0.97 | 0.95 | 0.91 | 0.79 | 0.61 | 0.42 | 0.3 | 0.34 | 0.58 | 0.85 | 0.95 | 0.97 | (94) |
| Useful gains, hmGm , W = (94)m x (84)m | | | | | | | | | | | | | |
| (95)m= | 344.68 | 367.88 | 388.24 | 384.81 | 326.31 | 224.34 | 151.08 | 157.68 | 238.18 | 307.45 | 324.2 | 332.97 | (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= | 605.37 | 586.05 | 532.59 | 442.53 | 339.89 | 225.9 | 151.29 | 158.09 | 245.86 | 374.26 | 496.17 | 598.46 | (97) |
| Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m | | | | | | | | | | | | | |
| (98)m= | 193.95 | 146.61 | 107.39 | 41.56 | 10.1 | 0 | 0 | 0 | 0 | 49.71 | 123.82 | 197.53 | |

# DER WorkSheet: New dwelling design stage

| | | | |
|---|---|---|---|
| | Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = | 870.67 | (98) |
| Space heating requirement in kWh/m²/year | | 17.2 | (99) |

## 9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

| | | | |
|---|---|---|---|
| Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none | | 0 | (301) |
| Fraction of space heat from community system 1 – (301) = | | 1 | (302) |

*The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.*

| | | | |
|---|---|---|---|
| Fraction of heat from Community boilers | | 1 | (303a) |
| Fraction of total space heat from Community boilers | (302) x (303a) = | 1 | (304a) |
| Factor for control and charging method (Table 4c(3)) for community heating system | | 1 | (305) |
| Distribution loss factor (Table 12c) for community heating system | | 1.05 | (306) |
| **Space heating** | | **kWh/year** | |
| Annual space heating requirement | | 870.67 | |
| Space heat from Community boilers | (98) x (304a) x (305) x (306) = | 914.2 | (307a) |
| Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) | | 0 | (308 |
| Space heating requirement from secondary/supplementary system | (98) x (301) x 100 ÷ (308) = | 0 | (309) |
| **Water heating** | | | |
| Annual water heating requirement | | 1827.32 | |
| If DHW from community scheme: Water heat from Community boilers | (64) x (303a) x (305) x (306) = | 1918.69 | (310a) |
| Electricity used for heat distribution | 0.01 × [(307a)…(307e) + (310a)…(310e)] = | 28.33 | (313) |
| Cooling System Energy Efficiency Ratio | | 0 | (314) |
| Space cooling (if there is a fixed cooling system, if not enter 0) | = (107) ÷ (314) = | 0 | (315) |
| Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside | | 107.68 | (330a) |
| warm air heating system fans | | 0 | (330b) |
| pump for solar water heating | | 0 | (330g) |
| Total electricity for the above, kWh/year | =(330a) + (330b) + (330g) = | 107.68 | (331) |
| Energy for lighting (calculated in Appendix L) | | 239.96 | (332) |
| Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) = | | 3180.53 | (338) |

## 12b. CO2 Emissions – Community heating scheme

| | | Energy kWh/year | Emission factor kg CO2/kWh | | Emissions kg CO2/year | |
|---|---|---|---|---|---|---|
| CO2 from other sources of space and water heating (not CHP) Efficiency of heat source 1 (%) | If there is CHP using two fuels repeat (363) to (366) for the second fuel | | | | 96 | (367a) |
| CO2 associated with heat source 1 | [(307b)+(310b)] x 100 ÷ (367b) x | | 0.22 | = | 637.4 | (367) |
| Electrical energy for heat distribution | [(313) x | | 0.52 | = | 14.7 | (372) |

# DER WorkSheet: New dwelling design stage

| | | | | | |
|---|---|---|---|---|---|
| Total CO2 associated with community systems | (363)…(366) + (368)...(372) | | = | 652.1 | (373) |
| CO2 associated with space heating (secondary) | (309) x | 0 | = | 0 | (374) |
| CO2 associated with water from immersion heater or instantaneous heater | (312) x | 0.22 | = | 0 | (375) |
| Total CO2 associated with space and water heating | (373) + (374) + (375) = | | | 652.1 | (376) |
| CO2 associated with electricity for pumps and fans within dwelling | (331)) x | 0.52 | = | 55.89 | (378) |
| CO2 associated with electricity for lighting | (332))) x | 0.52 | = | 124.54 | (379) |
| **Total CO2, kg/year** | sum of (376)…(382) = | | | 832.53 | (383) |
| **Dwelling CO2 Emission Rate** | (383) ÷ (4) = | | | 16.45 | (384) |
| **EI rating (section 14)** | | | | 88.33 | (385) |

# Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.50
*Printed on 06 December 2021 at 10:57:09*

## Project Information:

| | | | |
|---|---|---|---|
| **Assessed By:** | Neil Ingham (STRO010943) | **Building Type:** | Flat |

## Dwelling Details:

| | | | |
|---|---|---|---|
| **NEW DWELLING DESIGN STAGE** | | Total Floor Area: 63.92m² | |
| **Site Reference :** | Highgate Road - GREEN | **Plot Reference:** | 01 - H |
| **Address :** | | | |

## Client Details:

**Name:**
**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 (c) | | |
| Fuel factor: 1.00 (mains gas (c)) | | |
| Target Carbon Dioxide Emission Rate (TER) | 17.67 kg/m² | |
| Dwelling Carbon Dioxide Emission Rate (DER) | 15.46 kg/m² | OK |

## 1b TFEE and DFEE

| | | |
|---|---|---|
| Target Fabric Energy Efficiency (TFEE) | 45.6 kWh/m² | |
| Dwelling Fabric Energy Efficiency (DFEE) | 38.8 kWh/m² | |
| | | OK |

## 2 Fabric U-values

| Element | Average | Highest | |
|---|---|---|---|
| External wall | 0.18 (max. 0.30) | 0.18 (max. 0.70) | OK |
| Party wall | 0.00 (max. 0.20) | - | OK |
| Floor | (no floor) | | |
| Roof | (no roof) | | |
| Openings | 1.40 (max. 2.00) | 1.40 (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 | 3.00 (design value) | |
| Maximum | 10.0 | OK |

## 4 Heating efficiency

| | |
|---|---|
| Main Heating system: | Community heating schemes - mains gas |
| Secondary heating system: | None |

## 5 Cylinder insulation

| | |
|---|---|
| Hot water Storage: | No cylinder |

## 6 Controls

| | | |
|---|---|---|
| Space heating controls | Charging system linked to use of community heating, programmer and at least two room thermostats | OK |
| Hot water controls: | No cylinder thermostat<br>No cylinder | |

# Regulations Compliance Report

| | | |
|---|---|---|
| **7 Low energy lights** | | |
| Percentage of fixed lights with low-energy fittings | 100.0% | |
| Minimum | 75.0% | **OK** |
| **8 Mechanical ventilation** | | |
| Continuous supply and extract system | | |
| Specific fan power: | 0.47 | |
| Maximum | 1.5 | **OK** |
| MVHR efficiency: | 89% | |
| Minimum | 70% | **OK** |
| **9 Summertime temperature** | | |
| Overheating risk (Thames valley): | Slight | **OK** |
| Based on: | | |
| Overshading: | Average or unknown | |
| Windows facing: North East | 9.56m² | |
| Windows facing: South East | 8.76m² | |
| Ventilation rate: | 6.00 | |
| **10 Key features** | | |
| Air permeablility | 3.0 m³/m²h | |
| Party Walls U-value | 0 W/m²K | |
| Community heating, heat from boilers – mains gas | | |

# DER WorkSheet: New dwelling design stage

## User Details:

| | | | |
|---|---|---|---|
| **Assessor Name:** | Neil Ingham | **Stroma Number:** | STRO010943 |
| **Software Name:** | Stroma FSAP 2012 | **Software Version:** | Version: 1.0.5.50 |

Property Address: 01 - H

**Address :**

## 1. Overall dwelling dimensions:

| | Area(m²) | | Av. Height(m) | | Volume(m³) | |
|---|---|---|---|---|---|---|
| Ground floor | 63.92 | (1a) x | 2.65 | (2a) = | 169.39 | (3a) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n) | 63.92 | (4) | | | | |
| Dwelling volume | | | | (3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) = | 169.39 | (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 | | | | | | | 0 | x 10 = | 0 | (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) = | 0 | ÷ (5) = | 0 | (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 | | 3 | (17) |
| If based on air permeability value, then | (18) = [(17) ÷ 20]+(8), otherwise (18) = (16) | 0.15 | (18) |

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

| | | | |
|---|---|---|---|
| Number of sides sheltered | | 0 | (19) |
| Shelter factor | (20) = 1 - [0.075 x (19)] = | 1 | (20) |
| Infiltration rate incorporating shelter factor | (21) = (18) x (20) = | 0.15 | (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 |

Wind Factor (22a)m = (22)m ÷ 4

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (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 |

# DER WorkSheet: New dwelling design stage

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

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.19 | 0.19 | 0.18 | 0.16 | 0.16 | 0.14 | 0.14 | 0.14 | 0.15 | 0.16 | 0.17 | 0.18 |

*Calculate effective air change rate for the applicable case*

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 75.65 (23c)

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24a)m= | 0.31 | 0.31 | 0.31 | 0.29 | 0.28 | 0.26 | 0.26 | 0.26 | 0.27 | 0.28 | 0.29 | 0.3 | (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 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24d) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (25)m= | 0.31 | 0.31 | 0.31 | 0.29 | 0.28 | 0.26 | 0.26 | 0.26 | 0.27 | 0.28 | 0.29 | 0.3 | (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 | |
|---|---|---|---|---|---|---|---|---|---|---|
| Windows Type 1 | | | 9.56 | x1/[1/( 1.4 )+ 0.04] | | = | 12.67 | | | (27) |
| Windows Type 2 | | | 8.76 | x1/[1/( 1.4 )+ 0.04] | | = | 11.61 | | | (27) |
| Walls Type1 | 61.09 | 18.32 | 42.77 | x | 0.18 | = | 7.7 | 60 | 2566.2 | (29) |
| Walls Type2 | 3.86 | 0 | 3.86 | x | 0.17 | = | 0.65 | 60 | 231.6 | (29) |
| Total area of elements, m² | | | 64.95 | | | | | | | (31) |
| Party wall | | | 37.5 | x | 0 | = | 0 | 45 | 1687.5 | (32) |
| Party floor | | | 63.92 | | | | | 40 | 2556.8 | (32a) |
| Party ceiling | | | 63.92 | | | | | 30 | 1917.6 | (32b) |
| Internal wall ** | | | 113.47 | | | | | 9 | 1021.23 | (32c) |

** 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) = 32.63 (33)

Heat capacity Cm = S(A x k ) ((28)…(30) + (32) + (32a)…(32e) = 9980.93 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 156.15 (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 7.91 (36)

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

Total fabric heat loss (33) + (36) = 40.54 (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= | 17.5 | 17.29 | 17.08 | 16.03 | 15.82 | 14.77 | 14.77 | 14.56 | 15.19 | 15.82 | 16.24 | 16.66 | (38) |

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

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (39)m= | 58.04 | 57.83 | 57.62 | 56.57 | 56.36 | 55.32 | 55.32 | 55.11 | 55.73 | 56.36 | 56.78 | 57.2 |

Average = Sum(39)$_{1…12}$ /12= 56.52 (39)

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

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (40)m= | 0.91 | 0.9 | 0.9 | 0.89 | 0.88 | 0.87 | 0.87 | 0.86 | 0.87 | 0.88 | 0.89 | 0.89 |

Average = Sum(40)$_{1…12}$ /12= 0.88 (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 2.09 (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 83.84 (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= | 92.22 | 88.87 | 85.51 | 82.16 | 78.81 | 75.45 | 75.45 | 78.81 | 82.16 | 85.51 | 88.87 | 92.22 |

Total = Sum(44)$_{1…12}$ = 1006.06 (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= | 136.76 | 119.61 | 123.43 | 107.61 | 103.25 | 89.1 | 82.56 | 94.74 | 95.88 | 111.73 | 121.97 | 132.45 |

Total = Sum(45)$_{1…12}$ = 1319.1 (45)

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (46)m= | 20.51 | 17.94 | 18.51 | 16.14 | 15.49 | 13.37 | 12.38 | 14.21 | 14.38 | 16.76 | 18.29 | 19.87 | (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) = 110 (50)

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

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (56)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (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= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (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= | 23.26 | 21.01 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | (59) |

# DER WorkSheet: New dwelling design stage

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 | (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= | 192.04 | 169.54 | 178.71 | 161.1 | 158.53 | 142.59 | 137.84 | 150.02 | 149.37 | 167.01 | 175.46 | 187.72 | (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= | 192.04 | 169.54 | 178.71 | 161.1 | 158.53 | 142.59 | 137.84 | 150.02 | 149.37 | 167.01 | 175.46 | 187.72 | |

Output from water heater (annual)$_{1...12}$ 1969.94 (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= | 89.69 | 79.71 | 85.26 | 78.58 | 78.55 | 72.42 | 71.67 | 75.72 | 74.67 | 81.37 | 83.35 | 88.26 | (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= | 104.5 | 104.5 | 104.5 | 104.5 | 104.5 | 104.5 | 104.5 | 104.5 | 104.5 | 104.5 | 104.5 | 104.5 | (66) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (67)m= | 16.29 | 14.47 | 11.77 | 8.91 | 6.66 | 5.62 | 6.07 | 7.9 | 10.6 | 13.46 | 15.7 | 16.74 | (67) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (68)m= | 182.71 | 184.61 | 179.83 | 169.66 | 156.82 | 144.75 | 136.69 | 134.8 | 139.57 | 149.75 | 162.58 | 174.65 | (68) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (69)m= | 33.45 | 33.45 | 33.45 | 33.45 | 33.45 | 33.45 | 33.45 | 33.45 | 33.45 | 33.45 | 33.45 | 33.45 | (69) |

Pumps and fans gains (Table 5a)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (70)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (70) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (71)m= | -83.6 | -83.6 | -83.6 | -83.6 | -83.6 | -83.6 | -83.6 | -83.6 | -83.6 | -83.6 | -83.6 | -83.6 | (71) |

Water heating gains (Table 5)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (72)m= | 120.56 | 118.62 | 114.6 | 109.13 | 105.58 | 100.58 | 96.34 | 101.78 | 103.71 | 109.37 | 115.76 | 118.63 | (72) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (73)m= | 373.91 | 372.05 | 360.55 | 342.05 | 323.41 | 305.31 | 293.45 | 298.82 | 308.23 | 326.92 | 348.4 | 364.37 | (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 | 9.56 | x | 11.28 | x | 0.63 | x | 0.7 | = | 32.96 | (75) |
| Northeast | 0.9x | 0.77 | x | 9.56 | x | 22.97 | x | 0.63 | x | 0.7 | = | 67.1 | (75) |
| Northeast | 0.9x | 0.77 | x | 9.56 | x | 41.38 | x | 0.63 | x | 0.7 | = | 120.89 | (75) |
| Northeast | 0.9x | 0.77 | x | 9.56 | x | 67.96 | x | 0.63 | x | 0.7 | = | 198.54 | (75) |
| Northeast | 0.9x | 0.77 | x | 9.56 | x | 91.35 | x | 0.63 | x | 0.7 | = | 266.88 | (75) |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Northeast 0.9x | 0.77 | x | 9.56 | x | 97.38 | x | 0.63 | x | 0.7 | = | 284.52 | (75) |
| Northeast 0.9x | 0.77 | x | 9.56 | x | 91.1 | x | 0.63 | x | 0.7 | = | 266.17 | (75) |
| Northeast 0.9x | 0.77 | x | 9.56 | x | 72.63 | x | 0.63 | x | 0.7 | = | 212.19 | (75) |
| Northeast 0.9x | 0.77 | x | 9.56 | x | 50.42 | x | 0.63 | x | 0.7 | = | 147.31 | (75) |
| Northeast 0.9x | 0.77 | x | 9.56 | x | 28.07 | x | 0.63 | x | 0.7 | = | 82 | (75) |
| Northeast 0.9x | 0.77 | x | 9.56 | x | 14.2 | x | 0.63 | x | 0.7 | = | 41.48 | (75) |
| Northeast 0.9x | 0.77 | x | 9.56 | x | 9.21 | x | 0.63 | x | 0.7 | = | 26.92 | (75) |
| Southeast 0.9x | 0.77 | x | 8.76 | x | 36.79 | x | 0.63 | x | 0.7 | = | 98.5 | (77) |
| Southeast 0.9x | 0.77 | x | 8.76 | x | 62.67 | x | 0.63 | x | 0.7 | = | 167.79 | (77) |
| Southeast 0.9x | 0.77 | x | 8.76 | x | 85.75 | x | 0.63 | x | 0.7 | = | 229.57 | (77) |
| Southeast 0.9x | 0.77 | x | 8.76 | x | 106.25 | x | 0.63 | x | 0.7 | = | 284.45 | (77) |
| Southeast 0.9x | 0.77 | x | 8.76 | x | 119.01 | x | 0.63 | x | 0.7 | = | 318.61 | (77) |
| Southeast 0.9x | 0.77 | x | 8.76 | x | 118.15 | x | 0.63 | x | 0.7 | = | 316.31 | (77) |
| Southeast 0.9x | 0.77 | x | 8.76 | x | 113.91 | x | 0.63 | x | 0.7 | = | 304.95 | (77) |
| Southeast 0.9x | 0.77 | x | 8.76 | x | 104.39 | x | 0.63 | x | 0.7 | = | 279.47 | (77) |
| Southeast 0.9x | 0.77 | x | 8.76 | x | 92.85 | x | 0.63 | x | 0.7 | = | 248.58 | (77) |
| Southeast 0.9x | 0.77 | x | 8.76 | x | 69.27 | x | 0.63 | x | 0.7 | = | 185.44 | (77) |
| Southeast 0.9x | 0.77 | x | 8.76 | x | 44.07 | x | 0.63 | x | 0.7 | = | 117.98 | (77) |
| Southeast 0.9x | 0.77 | x | 8.76 | x | 31.49 | x | 0.63 | x | 0.7 | = | 84.3 | (77) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (83)m= | 131.47 | 234.89 | 350.47 | 483 | 585.49 | 600.83 | 571.12 | 491.66 | 395.89 | 267.44 | 159.46 | 111.22 | (83) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (84)m= | 505.38 | 606.94 | 711.02 | 825.05 | 908.91 | 906.14 | 864.57 | 790.48 | 704.13 | 594.37 | 507.86 | 475.59 | (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= | 0.97 | 0.94 | 0.87 | 0.73 | 0.55 | 0.39 | 0.28 | 0.32 | 0.53 | 0.8 | 0.94 | 0.97 | (86) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (87)m= | 19.93 | 20.19 | 20.51 | 20.81 | 20.95 | 20.99 | 21 | 21 | 20.97 | 20.76 | 20.3 | 19.89 | (87) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (88)m= | 20.16 | 20.16 | 20.17 | 20.18 | 20.18 | 20.2 | 20.2 | 20.2 | 20.19 | 20.18 | 20.18 | 20.17 | (88) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (89)m= | 0.96 | 0.92 | 0.85 | 0.69 | 0.51 | 0.34 | 0.23 | 0.26 | 0.47 | 0.77 | 0.93 | 0.97 | (89) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (90)m= | 18.74 | 19.11 | 19.56 | 19.97 | 20.13 | 20.19 | 20.2 | 20.2 | 20.17 | 19.91 | 19.29 | 18.69 | (90) |

fLA = Living area ÷ (4) = 0.38 (91)

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (92)m= | 19.19 | 19.52 | 19.92 | 20.29 | 20.44 | 20.5 | 20.5 | 20.5 | 20.47 | 20.23 | 19.67 | 19.14 | (92) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (93)m= | 19.19 | 19.52 | 19.92 | 20.29 | 20.44 | 20.5 | 20.5 | 20.5 | 20.47 | 20.23 | 19.67 | 19.14 | (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= | 0.95 | 0.91 | 0.84 | 0.7 | 0.52 | 0.36 | 0.25 | 0.29 | 0.49 | 0.77 | 0.92 | 0.96 | (94) |
| Useful gains, hmGm , W = (94)m x (84)m | | | | | | | | | | | | | |
| (95)m= | 481.7 | 555.07 | 597.49 | 576.76 | 475.72 | 323.61 | 215.39 | 225.34 | 345.69 | 458.98 | 466.53 | 457.07 | (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= | 864.4 | 845.57 | 773.35 | 644.22 | 492.83 | 326.09 | 215.79 | 226.04 | 355.11 | 542.96 | 713.83 | 854.77 | (97) |
| Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m | | | | | | | | | | | | | |
| (98)m= | 284.73 | 195.21 | 130.84 | 48.57 | 12.73 | 0 | 0 | 0 | 0 | 62.48 | 178.05 | 295.89 | |

| | | |
|---|---|---|
| Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = | 1208.5 | (98) |
| Space heating requirement in kWh/m²/year | 18.91 | (99) |

## 9b. Energy requirements – Community heating scheme

| | | | |
|---|---|---|---|
| This part is used for space heating, space cooling or water heating provided by a community scheme. Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none | | 0 | (301) |
| Fraction of space heat from community system 1 – (301) = | | 1 | (302) |

*The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.*

| | | | |
|---|---|---|---|
| Fraction of heat from Community boilers | | 1 | (303a) |
| Fraction of total space heat from Community boilers | (302) x (303a) = | 1 | (304a) |
| Factor for control and charging method (Table 4c(3)) for community heating system | | 1 | (305) |
| Distribution loss factor (Table 12c) for community heating system | | 1.05 | (306) |
| **Space heating** | | **kWh/year** | |
| Annual space heating requirement | | 1208.5 | |
| Space heat from Community boilers | (98) x (304a) x (305) x (306) = | 1268.93 | (307a) |
| Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) | | 0 | (308 |
| Space heating requirement from secondary/supplementary system | (98) x (301) x 100 ÷ (308) = | 0 | (309) |
| **Water heating** | | | |
| Annual water heating requirement | | 1969.94 | |
| If DHW from community scheme: Water heat from Community boilers | (64) x (303a) x (305) x (306) = | 2068.44 | (310a) |
| Electricity used for heat distribution | 0.01 × [(307a)…(307e) + (310a)…(310e)] = | 33.37 | (313) |
| Cooling System Energy Efficiency Ratio | | 0 | (314) |
| Space cooling (if there is a fixed cooling system, if not enter 0) | = (107) ÷ (314) = | 0 | (315) |
| Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside | | 135.98 | (330a) |

| | | | | | |
|---|---|---|---|---|---|
| warm air heating system fans | | | | 0 | (330b) |
| pump for solar water heating | | | | 0 | (330g) |
| Total electricity for the above, kWh/year | =(330a) + (330b) + (330g) = | | | 135.98 | (331) |
| Energy for lighting (calculated in Appendix L) | | | | 287.67 | (332) |
| Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) = | | | | 3761.01 | (338) |

## 12b. CO2 Emissions – Community heating scheme

| | | Energy kWh/year | Emission factor kg CO2/kWh | | Emissions kg CO2/year | |
|---|---|---|---|---|---|---|
| CO2 from other sources of space and water heating (not CHP) | | | | | | |
| Efficiency of heat source 1 (%) | If there is CHP using two fuels repeat (363) to (366) for the second fuel | | | | 96 | (367a) |
| CO2 associated with heat source 1 | [(307b)+(310b)] x 100 ÷ (367b) x | | 0.22 | = | 750.91 | (367) |
| Electrical energy for heat distribution | [(313) x | | 0.52 | = | 17.32 | (372) |
| Total CO2 associated with community systems | (363)…(366) + (368)...(372) | | | = | 768.23 | (373) |
| CO2 associated with space heating (secondary) | (309) x | | 0 | = | 0 | (374) |
| CO2 associated with water from immersion heater or instantaneous heater | (312) x | | 0.22 | = | 0 | (375) |
| Total CO2 associated with space and water heating | (373) + (374) + (375) = | | | | 768.23 | (376) |
| CO2 associated with electricity for pumps and fans within dwelling | (331)) x | | 0.52 | = | 70.57 | (378) |
| CO2 associated with electricity for lighting | (332))) x | | 0.52 | = | 149.3 | (379) |
| **Total CO2, kg/year** | sum of (376)…(382) = | | | | 988.1 | (383) |
| **Dwelling CO2 Emission Rate** | (383) ÷ (4) = | | | | 15.46 | (384) |
| **EI rating (section 14)** | | | | | 87.84 | (385) |

# Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.50
*Printed on 06 December 2021 at 10:56:51*

## Project Information:

**Assessed By:** Neil Ingham (STRO010943) **Building Type:** Flat

## Dwelling Details:

**NEW DWELLING DESIGN STAGE** Total Floor Area: 60.34m²

**Site Reference :** Highgate Road - GREEN **Plot Reference:** 01 - I

**Address :**

## Client Details:

**Name:**

**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 (c)
Fuel factor: 1.00 (mains gas (c))

| | | |
|---|---|---|
| Target Carbon Dioxide Emission Rate (TER) | 18.05 kg/m² | |
| Dwelling Carbon Dioxide Emission Rate (DER) | 15.55 kg/m² | OK |

## 1b TFEE and DFEE

| | | |
|---|---|---|
| Target Fabric Energy Efficiency (TFEE) | 45.6 kWh/m² | |
| Dwelling Fabric Energy Efficiency (DFEE) | 37.8 kWh/m² | |
| | | OK |

## 2 Fabric U-values

| Element | Average | Highest | |
|---|---|---|---|
| External wall | 0.18 (max. 0.30) | 0.18 (max. 0.70) | OK |
| Party wall | 0.00 (max. 0.20) | - | OK |
| Floor | (no floor) | | |
| Roof | (no roof) | | |
| Openings | 1.40 (max. 2.00) | 1.40 (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 | 3.00 (design value) | |
| Maximum | 10.0 | OK |

## 4 Heating efficiency

| | |
|---|---|
| Main Heating system: | Community heating schemes - mains gas |
| Secondary heating system: | None |

## 5 Cylinder insulation

| | |
|---|---|
| Hot water Storage: | No cylinder |

## 6 Controls

| | | |
|---|---|---|
| Space heating controls | Charging system linked to use of community heating, programmer and at least two room thermostats | OK |
| Hot water controls: | No cylinder thermostat<br>No cylinder | |

# Regulations Compliance Report

## 7 Low energy lights

| | | |
|---|---|---|
| Percentage of fixed lights with low-energy fittings | 100.0% | |
| Minimum | 75.0% | **OK** |

## 8 Mechanical ventilation

| | | |
|---|---|---|
| Continuous supply and extract system | | |
| Specific fan power: | 0.47 | |
| Maximum | 1.5 | **OK** |
| MVHR efficiency: | 89% | |
| Minimum | 70% | **OK** |

## 9 Summertime temperature

| | | |
|---|---|---|
| Overheating risk (Thames valley): | Slight | **OK** |

Based on:

| | |
|---|---|
| Overshading: | Average or unknown |
| Windows facing: South West | 4.7m² |
| Windows facing: South East | 6.09m² |
| Windows facing: North West | 2.92m² |
| Ventilation rate: | 6.00 |

## 10 Key features

| | |
|---|---|
| Air permeablility | 3.0 m³/m²h |
| Party  Walls U-value | 0 W/m²K |
| Community heating, heat from boilers – mains gas | |

# DER WorkSheet: New dwelling design stage

User Details:

| | | | |
|---|---|---|---|
| **Assessor Name:** | Neil Ingham | **Stroma Number:** | STRO010943 |
| **Software Name:** | Stroma FSAP 2012 | **Software Version:** | Version: 1.0.5.50 |

Property Address: 01 - I

**Address :**

## 1. Overall dwelling dimensions:

| | Area(m²) | | Av. Height(m) | | Volume(m³) | |
|---|---|---|---|---|---|---|
| Ground floor | 60.34 | (1a) x | 2.65 | (2a) = | 159.9 | (3a) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n) | 60.34 | (4) | | | | |
| Dwelling volume | | | | (3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) = | 159.9 | (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 | | | | | | | 0 | x 10 = | 0 | (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) = | 0 | ÷ (5) = | 0 | (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 | | 3 | (17) |
| If based on air permeability value, then | (18) = [(17) ÷ 20]+(8), otherwise (18) = (16) | 0.15 | (18) |

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

| | | | |
|---|---|---|---|
| Number of sides sheltered | | 0 | (19) |
| Shelter factor | (20) = 1 - [0.075 x (19)] = | 1 | (20) |
| Infiltration rate incorporating shelter factor | (21) = (18) x (20) = | 0.15 | (21) |

Infiltration rate modified for monthly wind speed

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

# DER WorkSheet: New dwelling design stage

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

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.19 | 0.19 | 0.18 | 0.16 | 0.16 | 0.14 | 0.14 | 0.14 | 0.15 | 0.16 | 0.17 | 0.18 |

*Calculate effective air change rate for the applicable case*

| | | |
|---|---|---|
| If mechanical ventilation: | 0.5 | (23a) |
| If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) | 0.5 | (23b) |
| If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = | 75.65 | (23c) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24a)m= | 0.31 | 0.31 | 0.31 | 0.29 | 0.28 | 0.26 | 0.26 | 0.26 | 0.27 | 0.28 | 0.29 | 0.3 | (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 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24d) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (25)m= | 0.31 | 0.31 | 0.31 | 0.29 | 0.28 | 0.26 | 0.26 | 0.26 | 0.27 | 0.28 | 0.29 | 0.3 | (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 | |
|---|---|---|---|---|---|---|---|---|---|---|
| Windows Type 1 | | | 4.7 | x1/[1/( 1.4 )+ 0.04] | | = | 6.23 | | | (27) |
| Windows Type 2 | | | 6.09 | x1/[1/( 1.4 )+ 0.04] | | = | 8.07 | | | (27) |
| Windows Type 3 | | | 2.92 | x1/[1/( 1.4 )+ 0.04] | | = | 3.87 | | | (27) |
| Walls Type1 | 52.8 | 13.71 | 39.09 | x | 0.18 | = | 7.04 | 60 | 2345.4 | (29) |
| Walls Type2 | 27.31 | 0 | 27.31 | x | 0.17 | = | 4.59 | 60 | 1638.6 | (29) |
| Total area of elements, m² | | | 80.11 | | | | | | | (31) |
| Party wall | | | 16.88 | x | 0 | = | 0 | 45 | 759.6 | (32) |
| Party floor | | | 60.34 | | | | | 40 | 2413.6 | (32a) |
| Party ceiling | | | 60.34 | | | | | 30 | 1810.2 | (32b) |
| Internal wall ** | | | 107.91 | | | | | 9 | 971.1901 | (32c) |

* *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) = | 29.8 | (33) |
| Heat capacity Cm = S(A x k ) | ((28)…(30) + (32) + (32a)…(32e) = | 9938.59 | (34) |
| Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K | = (34) ÷ (4) = | 164.71 | (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 | | 7.62 | (36) |

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

| | | | |
|---|---|---|---|
| Total fabric heat loss | (33) + (36) = | 37.42 | (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 |
|---|---|---|---|---|---|---|---|---|---|---|---|

# DER WorkSheet: New dwelling design stage

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (38)m= | 16.52 | 16.32 | 16.12 | 15.13 | 14.93 | 13.94 | 13.94 | 13.75 | 14.34 | 14.93 | 15.33 | 15.72 | (38) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (39)m= | 53.93 | 53.74 | 53.54 | 52.55 | 52.35 | 51.36 | 51.36 | 51.16 | 51.76 | 52.35 | 52.75 | 53.14 | |

Average = Sum(39)$_{1…12}$ /12= 52.5 (39)

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

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (40)m= | 0.89 | 0.89 | 0.89 | 0.87 | 0.87 | 0.85 | 0.85 | 0.85 | 0.86 | 0.87 | 0.87 | 0.88 |

Average = Sum(40)$_{1…12}$ /12= 0.87 (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 1.99 (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 81.49 (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= | 89.64 | 86.38 | 83.12 | 79.86 | 76.6 | 73.34 | 73.34 | 76.6 | 79.86 | 83.12 | 86.38 | 89.64 |

Total = Sum(44)$_{1…12}$ = 977.9 (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= | 132.93 | 116.27 | 119.98 | 104.6 | 100.36 | 86.61 | 80.25 | 92.09 | 93.19 | 108.61 | 118.55 | 128.74 |

Total = Sum(45)$_{1…12}$ = 1282.18 (45)

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (46)m= | 19.94 | 17.44 | 18 | 15.69 | 15.05 | 12.99 | 12.04 | 13.81 | 13.98 | 16.29 | 17.78 | 19.31 | (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) = 110 (50)

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

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (56)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (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= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (57) |

# DER WorkSheet: New dwelling design stage

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= | 23.26 | 21.01 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | (59) |

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 | (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= | 188.21 | 166.19 | 175.25 | 158.09 | 155.64 | 140.1 | 135.53 | 147.37 | 146.69 | 163.88 | 172.05 | 184.02 | (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= | 188.21 | 166.19 | 175.25 | 158.09 | 155.64 | 140.1 | 135.53 | 147.37 | 146.69 | 163.88 | 172.05 | 184.02 | |

Output from water heater (annual)$_{1...12}$ | 1933.02 | (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= | 88.42 | 78.6 | 84.11 | 77.57 | 77.59 | 71.59 | 70.91 | 74.84 | 73.78 | 80.33 | 82.21 | 87.03 | (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= | 99.56 | 99.56 | 99.56 | 99.56 | 99.56 | 99.56 | 99.56 | 99.56 | 99.56 | 99.56 | 99.56 | 99.56 | (66) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (67)m= | 15.49 | 13.76 | 11.19 | 8.47 | 6.33 | 5.35 | 5.78 | 7.51 | 10.08 | 12.8 | 14.94 | 15.93 | (67) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (68)m= | 173.8 | 175.61 | 171.06 | 161.39 | 149.17 | 137.69 | 130.03 | 128.22 | 132.77 | 142.44 | 154.66 | 166.13 | (68) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (69)m= | 32.96 | 32.96 | 32.96 | 32.96 | 32.96 | 32.96 | 32.96 | 32.96 | 32.96 | 32.96 | 32.96 | 32.96 | (69) |

Pumps and fans gains (Table 5a)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (70)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (70) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (71)m= | -79.65 | -79.65 | -79.65 | -79.65 | -79.65 | -79.65 | -79.65 | -79.65 | -79.65 | -79.65 | -79.65 | -79.65 | (71) |

Water heating gains (Table 5)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (72)m= | 118.85 | 116.96 | 113.06 | 107.74 | 104.29 | 99.43 | 95.3 | 100.59 | 102.47 | 107.97 | 114.19 | 116.97 | (72) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (73)m= | 361.01 | 359.2 | 348.18 | 330.47 | 312.67 | 295.34 | 283.98 | 289.2 | 298.19 | 316.08 | 336.65 | 351.9 | (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) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Southeast 0.9x | 0.77 | x | 6.09 | x | 36.79 | x | 0.63 | x | 0.7 | = | 68.48 | (77) |
| Southeast 0.9x | 0.77 | x | 6.09 | x | 62.67 | x | 0.63 | x | 0.7 | = | 116.65 | (77) |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Southeast 0.9x | 0.77 | x | 6.09 | x | 85.75 | x | 0.63 | x | 0.7 | = | 159.6 | (77) |
| Southeast 0.9x | 0.77 | x | 6.09 | x | 106.25 | x | 0.63 | x | 0.7 | = | 197.75 | (77) |
| Southeast 0.9x | 0.77 | x | 6.09 | x | 119.01 | x | 0.63 | x | 0.7 | = | 221.5 | (77) |
| Southeast 0.9x | 0.77 | x | 6.09 | x | 118.15 | x | 0.63 | x | 0.7 | = | 219.9 | (77) |
| Southeast 0.9x | 0.77 | x | 6.09 | x | 113.91 | x | 0.63 | x | 0.7 | = | 212.01 | (77) |
| Southeast 0.9x | 0.77 | x | 6.09 | x | 104.39 | x | 0.63 | x | 0.7 | = | 194.29 | (77) |
| Southeast 0.9x | 0.77 | x | 6.09 | x | 92.85 | x | 0.63 | x | 0.7 | = | 172.81 | (77) |
| Southeast 0.9x | 0.77 | x | 6.09 | x | 69.27 | x | 0.63 | x | 0.7 | = | 128.92 | (77) |
| Southeast 0.9x | 0.77 | x | 6.09 | x | 44.07 | x | 0.63 | x | 0.7 | = | 82.02 | (77) |
| Southeast 0.9x | 0.77 | x | 6.09 | x | 31.49 | x | 0.63 | x | 0.7 | = | 58.6 | (77) |
| Southwest 0.9x | 0.77 | x | 4.7 | x | 36.79 | | 0.63 | x | 0.7 | = | 52.85 | (79) |
| Southwest 0.9x | 0.77 | x | 4.7 | x | 62.67 | | 0.63 | x | 0.7 | = | 90.02 | (79) |
| Southwest 0.9x | 0.77 | x | 4.7 | x | 85.75 | | 0.63 | x | 0.7 | = | 123.17 | (79) |
| Southwest 0.9x | 0.77 | x | 4.7 | x | 106.25 | | 0.63 | x | 0.7 | = | 152.62 | (79) |
| Southwest 0.9x | 0.77 | x | 4.7 | x | 119.01 | | 0.63 | x | 0.7 | = | 170.94 | (79) |
| Southwest 0.9x | 0.77 | x | 4.7 | x | 118.15 | | 0.63 | x | 0.7 | = | 169.71 | (79) |
| Southwest 0.9x | 0.77 | x | 4.7 | x | 113.91 | | 0.63 | x | 0.7 | = | 163.62 | (79) |
| Southwest 0.9x | 0.77 | x | 4.7 | x | 104.39 | | 0.63 | x | 0.7 | = | 149.94 | (79) |
| Southwest 0.9x | 0.77 | x | 4.7 | x | 92.85 | | 0.63 | x | 0.7 | = | 133.37 | (79) |
| Southwest 0.9x | 0.77 | x | 4.7 | x | 69.27 | | 0.63 | x | 0.7 | = | 99.49 | (79) |
| Southwest 0.9x | 0.77 | x | 4.7 | x | 44.07 | | 0.63 | x | 0.7 | = | 63.3 | (79) |
| Southwest 0.9x | 0.77 | x | 4.7 | x | 31.49 | | 0.63 | x | 0.7 | = | 45.23 | (79) |
| Northwest 0.9x | 0.77 | x | 2.92 | x | 11.28 | x | 0.63 | x | 0.7 | = | 10.07 | (81) |
| Northwest 0.9x | 0.77 | x | 2.92 | x | 22.97 | x | 0.63 | x | 0.7 | = | 20.5 | (81) |
| Northwest 0.9x | 0.77 | x | 2.92 | x | 41.38 | x | 0.63 | x | 0.7 | = | 36.93 | (81) |
| Northwest 0.9x | 0.77 | x | 2.92 | x | 67.96 | x | 0.63 | x | 0.7 | = | 60.64 | (81) |
| Northwest 0.9x | 0.77 | x | 2.92 | x | 91.35 | x | 0.63 | x | 0.7 | = | 81.52 | (81) |
| Northwest 0.9x | 0.77 | x | 2.92 | x | 97.38 | x | 0.63 | x | 0.7 | = | 86.9 | (81) |
| Northwest 0.9x | 0.77 | x | 2.92 | x | 91.1 | x | 0.63 | x | 0.7 | = | 81.3 | (81) |
| Northwest 0.9x | 0.77 | x | 2.92 | x | 72.63 | x | 0.63 | x | 0.7 | = | 64.81 | (81) |
| Northwest 0.9x | 0.77 | x | 2.92 | x | 50.42 | x | 0.63 | x | 0.7 | = | 44.99 | (81) |
| Northwest 0.9x | 0.77 | x | 2.92 | x | 28.07 | x | 0.63 | x | 0.7 | = | 25.05 | (81) |
| Northwest 0.9x | 0.77 | x | 2.92 | x | 14.2 | x | 0.63 | x | 0.7 | = | 12.67 | (81) |
| Northwest 0.9x | 0.77 | x | 2.92 | x | 9.21 | x | 0.63 | x | 0.7 | = | 8.22 | (81) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (83)m= | 131.4 | 227.17 | 319.7 | 411.01 | 473.96 | 476.51 | 456.92 | 409.05 | 351.18 | 253.46 | 157.99 | 112.06 | (83) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (84)m= | 492.41 | 586.37 | 667.88 | 741.48 | 786.63 | 771.86 | 740.9 | 698.24 | 649.37 | 569.55 | 494.64 | 463.96 | (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 |
|---|---|---|---|---|---|---|---|---|---|---|---|

# DER WorkSheet: New dwelling design stage

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (86)m= | 0.97 | 0.93 | 0.87 | 0.75 | 0.59 | 0.42 | 0.3 | 0.34 | 0.53 | 0.8 | 0.94 | 0.97 | (86) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (87)m= | 20.03 | 20.28 | 20.56 | 20.82 | 20.95 | 20.99 | 21 | 21 | 20.97 | 20.8 | 20.38 | 19.99 | (87) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (88)m= | 20.17 | 20.18 | 20.18 | 20.19 | 20.2 | 20.21 | 20.21 | 20.21 | 20.2 | 20.2 | 20.19 | 20.18 | (88) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (89)m= | 0.96 | 0.92 | 0.85 | 0.72 | 0.55 | 0.37 | 0.25 | 0.28 | 0.48 | 0.76 | 0.92 | 0.97 | (89) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (90)m= | 18.9 | 19.24 | 19.63 | 19.99 | 20.14 | 20.2 | 20.21 | 20.21 | 20.18 | 19.97 | 19.41 | 18.84 | (90) |

fLA = Living area ÷ (4) = 0.44 (91)

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (92)m= | 19.4 | 19.7 | 20.04 | 20.35 | 20.5 | 20.55 | 20.56 | 20.56 | 20.53 | 20.34 | 19.84 | 19.35 | (92) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (93)m= | 19.4 | 19.7 | 20.04 | 20.35 | 20.5 | 20.55 | 20.56 | 20.56 | 20.53 | 20.34 | 19.84 | 19.35 | (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= | 0.95 | 0.92 | 0.85 | 0.72 | 0.56 | 0.39 | 0.27 | 0.3 | 0.5 | 0.77 | 0.92 | 0.96 | (94) |
| Useful gains, hmGm , W = (94)m x (84)m | | | | | | | | | | | | | |
| (95)m= | 469.79 | 536.92 | 566.33 | 537.01 | 442.7 | 303.05 | 202.92 | 212.18 | 325.06 | 438.84 | 454.12 | 446.31 | (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= | 814.42 | 795.35 | 725.02 | 601.93 | 460.68 | 305.71 | 203.32 | 212.81 | 333 | 509.67 | 672 | 805.28 | (97) |
| Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m | | | | | | | | | | | | | |
| (98)m= | 256.41 | 173.67 | 118.07 | 46.74 | 13.38 | 0 | 0 | 0 | 0 | 52.7 | 156.87 | 267.08 | |

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1084.92 (98)

Space heating requirement in kWh/m²/year 17.98 (99)

## 9b. Energy requirements – Community heating scheme

| | | |
|---|---|---|
| This part is used for space heating, space cooling or water heating provided by a community scheme. Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none | 0 | (301) |
| Fraction of space heat from community system 1 – (301) = | 1 | (302) |

*The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.*

| | | | |
|---|---|---|---|
| Fraction of heat from Community boilers | | 1 | (303a) |
| Fraction of total space heat from Community boilers | (302) x (303a) = | 1 | (304a) |
| Factor for control and charging method (Table 4c(3)) for community heating system | | 1 | (305) |
| Distribution loss factor (Table 12c) for community heating system | | 1.05 | (306) |
| **Space heating** | | **kWh/year** | |
| Annual space heating requirement | | 1084.92 | |

# DER WorkSheet: New dwelling design stage

| | | | |
|---|---|---|---|
| Space heat from Community boilers | (98) x (304a) x (305) x (306) = | 1139.16 | (307a) |
| Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) | | 0 | (308 |
| Space heating requirement from secondary/supplementary system | (98) x (301) x 100 ÷ (308) = | 0 | (309) |

**Water heating**

| | | | |
|---|---|---|---|
| Annual water heating requirement | | 1933.02 | |
| If DHW from community scheme:<br>Water heat from Community boilers | (64) x (303a) x (305) x (306) = | 2029.67 | (310a) |
| Electricity used for heat distribution | 0.01 × [(307a)…(307e) + (310a)…(310e)] = | 31.69 | (313) |
| Cooling System Energy Efficiency Ratio | | 0 | (314) |
| Space cooling (if there is a fixed cooling system, if not enter 0) | = (107) ÷ (314) = | 0 | (315) |
| Electricity for pumps and fans within dwelling (Table 4f):<br>mechanical ventilation - balanced, extract or positive input from outside | | 128.36 | (330a) |
| warm air heating system fans | | 0 | (330b) |
| pump for solar water heating | | 0 | (330g) |
| Total electricity for the above, kWh/year | =(330a) + (330b) + (330g) = | 128.36 | (331) |
| Energy for lighting (calculated in Appendix L) | | 273.64 | (332) |
| Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) = | | 3570.84 | (338) |

## 12b. CO2 Emissions – Community heating scheme

| | Energy kWh/year | Emission factor kg CO2/kWh | | Emissions kg CO2/year | |
|---|---|---|---|---|---|
| CO2 from other sources of space and water heating (not CHP)<br>Efficiency of heat source 1 (%) | If there is CHP using two fuels repeat (363) to (366) for the second fuel | | | 96 | (367a) |
| CO2 associated with heat source 1 | [(307b)+(310b)] x 100 ÷ (367b) x | 0.22 | = | 712.99 | (367) |
| Electrical energy for heat distribution | [(313) x | 0.52 | = | 16.45 | (372) |
| Total CO2 associated with community systems | (363)…(366) + (368)...(372) | | = | 729.43 | (373) |
| CO2 associated with space heating (secondary) | (309) x | 0 | = | 0 | (374) |
| CO2 associated with water from immersion heater or instantaneous heater | (312) x | 0.22 | = | 0 | (375) |
| Total CO2 associated with space and water heating | (373) + (374) + (375) = | | | 729.43 | (376) |
| CO2 associated with electricity for pumps and fans within dwelling | (331)) x | 0.52 | = | 66.62 | (378) |
| CO2 associated with electricity for lighting | (332))) x | 0.52 | = | 142.02 | (379) |
| **Total CO2, kg/year** | sum of (376)…(382) = | | | 938.07 | (383) |
| **Dwelling CO2 Emission Rate** | (383) ÷ (4) = | | | 15.55 | (384) |
| **EI rating (section 14)** | | | | 88.07 | (385) |

# Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.50
*Printed on 06 December 2021 at 10:56:35*

## Project Information:

**Assessed By:** Neil Ingham (STRO010943) **Building Type:** Flat

## Dwelling Details:

**NEW DWELLING DESIGN STAGE** Total Floor Area: 48.96m²

**Site Reference :** Highgate Road - GREEN **Plot Reference:** 02 - A

**Address :**

## Client Details:

**Name:**

**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 (c)
Fuel factor: 1.00 (mains gas (c))

| | | |
|---|---|---|
| Target Carbon Dioxide Emission Rate (TER) | 19.27 kg/m² | |
| Dwelling Carbon Dioxide Emission Rate (DER) | 16.43 kg/m² | OK |

## 1b TFEE and DFEE

| | | |
|---|---|---|
| Target Fabric Energy Efficiency (TFEE) | 45.7 kWh/m² | |
| Dwelling Fabric Energy Efficiency (DFEE) | 37.5 kWh/m² | |
| | | OK |

## 2 Fabric U-values

| Element | Average | Highest | |
|---|---|---|---|
| External wall | 0.17 (max. 0.30) | 0.18 (max. 0.70) | OK |
| Party wall | 0.00 (max. 0.20) | - | OK |
| Floor | (no floor) | | |
| Roof | (no roof) | | |
| Openings | 1.40 (max. 2.00) | 1.40 (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 | 3.00 (design value) | |
| Maximum | 10.0 | OK |

## 4 Heating efficiency

| | |
|---|---|
| Main Heating system: | Community heating schemes - mains gas |
| Secondary heating system: | None |

## 5 Cylinder insulation

| | |
|---|---|
| Hot water Storage: | No cylinder |

## 6 Controls

| | | |
|---|---|---|
| Space heating controls | Charging system linked to use of community heating, programmer and at least two room thermostats | OK |
| Hot water controls: | No cylinder thermostat<br>No cylinder | |

# Regulations Compliance Report

| | | |
|---|---|---|
| **7 Low energy lights** | | |
| Percentage of fixed lights with low-energy fittings | 100.0% | |
| Minimum | 75.0% | **OK** |
| **8 Mechanical ventilation** | | |
| Continuous supply and extract system | | |
| Specific fan power: | 0.47 | |
| Maximum | 1.5 | **OK** |
| MVHR efficiency: | 89% | |
| Minimum | 70% | **OK** |
| **9 Summertime temperature** | | |
| Overheating risk (Thames valley): | Slight | **OK** |
| Based on: | | |
| Overshading: | Average or unknown | |
| Windows facing: South West | 5.45m² | |
| Windows facing: South East | 6.09m² | |
| Ventilation rate: | 6.00 | |
| **10 Key features** | | |
| Air permeablility | 3.0 m³/m²h | |
| Party Walls U-value | 0 W/m²K | |
| Community heating, heat from boilers – mains gas | | |

# DER WorkSheet: New dwelling design stage

User Details:

| | | | |
|---|---|---|---|
| **Assessor Name:** | Neil Ingham | **Stroma Number:** | STRO010943 |
| **Software Name:** | Stroma FSAP 2012 | **Software Version:** | Version: 1.0.5.50 |

Property Address: 02 - A

**Address :**

## 1. Overall dwelling dimensions:

| | Area(m²) | | | Av. Height(m) | | | Volume(m³) | |
|---|---|---|---|---|---|---|---|---|
| Ground floor | 48.96 | (1a) | x | 2.65 | (2a) | = | 129.74 | (3a) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n) | 48.96 | (4) | | | | | | |
| Dwelling volume | | | | (3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) = | | | 129.74 | (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 | | | | | | | 0 | x 10 = | 0 | (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) = | 0 | ÷ (5) = | 0 | (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 | | 3 | (17) |
| If based on air permeability value, then | (18) = [(17) ÷ 20]+(8), otherwise (18) = (16) | 0.15 | (18) |

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

| | | | |
|---|---|---|---|
| Number of sides sheltered | | 0 | (19) |
| Shelter factor | (20) = 1 - [0.075 x (19)] = | 1 | (20) |
| Infiltration rate incorporating shelter factor | (21) = (18) x (20) = | 0.15 | (21) |

Infiltration rate modified for monthly wind speed

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|

Monthly average wind speed from Table 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 |

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 |

# DER WorkSheet: New dwelling design stage

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

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.19 | 0.19 | 0.18 | 0.16 | 0.16 | 0.14 | 0.14 | 0.14 | 0.15 | 0.16 | 0.17 | 0.18 |

*Calculate effective air change rate for the applicable case*

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 75.65 (23c)

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24a)m= | 0.31 | 0.31 | 0.31 | 0.29 | 0.28 | 0.26 | 0.26 | 0.26 | 0.27 | 0.28 | 0.29 | 0.3 | (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 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24d) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (25)m= | 0.31 | 0.31 | 0.31 | 0.29 | 0.28 | 0.26 | 0.26 | 0.26 | 0.27 | 0.28 | 0.29 | 0.3 | (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 | |
|---|---|---|---|---|---|---|---|---|
| Windows Type 1 | | | 5.45 | x1/[1/( 1.4 )+ 0.04] = | 7.23 | | | (27) |
| Windows Type 2 | | | 6.09 | x1/[1/( 1.4 )+ 0.04] = | 8.07 | | | (27) |
| Walls Type1 | 35.3 | 11.54 | 23.76 | x 0.18 = | 4.28 | 60 | 1425.6 | (29) |
| Walls Type2 | 35.99 | 0 | 35.99 | x 0.17 = | 6.04 | 60 | 2159.4 | (29) |
| Total area of elements, m² | | | 71.29 | | | | | (31) |
| Party wall | | | 14.89 | x 0 = | 0 | 45 | 670.05 | (32) |
| Party floor | | | 48.96 | | | 40 | 1958.4 | (32a) |
| Party ceiling | | | 48.96 | | | 30 | 1468.8 | (32b) |
| Internal wall ** | | | 96.46 | | | 9 | 868.14 | (32c) |

** 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) = 25.62 (33)

Heat capacity Cm = S(A x k ) ((28)…(30) + (32) + (32a)…(32e) = 8550.39 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 174.64 (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 6.09 (36)

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

Total fabric heat loss (33) + (36) = 31.71 (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= | 13.4 | 13.24 | 13.08 | 12.28 | 12.12 | 11.31 | 11.31 | 11.15 | 11.64 | 12.12 | 12.44 | 12.76 | (38) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (39)m= | 45.11 | 44.95 | 44.79 | 43.99 | 43.83 | 43.03 | 43.03 | 42.87 | 43.35 | 43.83 | 44.15 | 44.47 | |

Average = Sum(39)$_{1…12}$ /12= 43.95 (39)

# DER WorkSheet: New dwelling design stage

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

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (40)m= | 0.92 | 0.92 | 0.91 | 0.9 | 0.9 | 0.88 | 0.88 | 0.88 | 0.89 | 0.9 | 0.9 | 0.91 |

Average = Sum(40)$_{1…12}$ /12= 0.9 (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 1.66 (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 73.61 (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= | 80.98 | 78.03 | 75.09 | 72.14 | 69.2 | 66.25 | 66.25 | 69.2 | 72.14 | 75.09 | 78.03 | 80.98 |

Total = Sum(44)$_{1…12}$ = 883.37 (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= | 120.08 | 105.03 | 108.38 | 94.49 | 90.66 | 78.23 | 72.5 | 83.19 | 84.18 | 98.11 | 107.09 | 116.29 |

Total = Sum(45)$_{1…12}$ = 1158.23 (45)

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (46)m= | 18.01 | 15.75 | 16.26 | 14.17 | 13.6 | 11.74 | 10.87 | 12.48 | 12.63 | 14.72 | 16.06 | 17.44 | (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) = 110 (50)

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

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (56)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (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= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (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= | 23.26 | 21.01 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | (59) |

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 | (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= | 175.36 | 154.95 | 163.65 | 147.98 | 145.94 | 131.73 | 127.77 | 138.47 | 137.68 | 153.38 | 160.59 | 171.57 | (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= | 175.36 | 154.95 | 163.65 | 147.98 | 145.94 | 131.73 | 127.77 | 138.47 | 137.68 | 153.38 | 160.59 | 171.57 | |

Output from water heater (annual)$_{1...12}$ 1809.07 (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= | 84.15 | 74.86 | 80.26 | 74.21 | 74.37 | 68.81 | 68.33 | 71.88 | 70.79 | 76.84 | 78.4 | 82.89 | (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= | 82.98 | 82.98 | 82.98 | 82.98 | 82.98 | 82.98 | 82.98 | 82.98 | 82.98 | 82.98 | 82.98 | 82.98 | (66) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (67)m= | 12.89 | 11.44 | 9.31 | 7.05 | 5.27 | 4.45 | 4.8 | 6.25 | 8.38 | 10.64 | 12.42 | 13.24 | (67) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (68)m= | 144.53 | 146.03 | 142.25 | 134.21 | 124.05 | 114.51 | 108.13 | 106.63 | 110.41 | 118.45 | 128.61 | 138.16 | (68) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (69)m= | 31.3 | 31.3 | 31.3 | 31.3 | 31.3 | 31.3 | 31.3 | 31.3 | 31.3 | 31.3 | 31.3 | 31.3 | (69) |

Pumps and fans gains (Table 5a)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (70)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (70) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (71)m= | -66.38 | -66.38 | -66.38 | -66.38 | -66.38 | -66.38 | -66.38 | -66.38 | -66.38 | -66.38 | -66.38 | -66.38 | (71) |

Water heating gains (Table 5)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (72)m= | 113.1 | 111.4 | 107.87 | 103.07 | 99.95 | 95.57 | 91.84 | 96.62 | 98.31 | 103.28 | 108.89 | 111.41 | (72) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (73)m= | 318.42 | 316.77 | 307.33 | 292.22 | 277.17 | 262.41 | 252.66 | 257.38 | 265 | 280.27 | 297.82 | 310.7 | (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) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Southeast | 0.9x | 0.77 | x | 6.09 | x | 36.79 | x | 0.63 | x | 0.7 | = | 68.48 | (77) |
| Southeast | 0.9x | 0.77 | x | 6.09 | x | 62.67 | x | 0.63 | x | 0.7 | = | 116.65 | (77) |
| Southeast | 0.9x | 0.77 | x | 6.09 | x | 85.75 | x | 0.63 | x | 0.7 | = | 159.6 | (77) |
| Southeast | 0.9x | 0.77 | x | 6.09 | x | 106.25 | x | 0.63 | x | 0.7 | = | 197.75 | (77) |
| Southeast | 0.9x | 0.77 | x | 6.09 | x | 119.01 | x | 0.63 | x | 0.7 | = | 221.5 | (77) |

# DER WorkSheet: New dwelling design stage

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Southeast | 0.9x | 0.77 | x | 6.09 | x | 118.15 | x | 0.63 | x | 0.7 | = | 219.9 | (77) |
| Southeast | 0.9x | 0.77 | x | 6.09 | x | 113.91 | x | 0.63 | x | 0.7 | = | 212.01 | (77) |
| Southeast | 0.9x | 0.77 | x | 6.09 | x | 104.39 | x | 0.63 | x | 0.7 | = | 194.29 | (77) |
| Southeast | 0.9x | 0.77 | x | 6.09 | x | 92.85 | x | 0.63 | x | 0.7 | = | 172.81 | (77) |
| Southeast | 0.9x | 0.77 | x | 6.09 | x | 69.27 | x | 0.63 | x | 0.7 | = | 128.92 | (77) |
| Southeast | 0.9x | 0.77 | x | 6.09 | x | 44.07 | x | 0.63 | x | 0.7 | = | 82.02 | (77) |
| Southeast | 0.9x | 0.77 | x | 6.09 | x | 31.49 | x | 0.63 | x | 0.7 | = | 58.6 | (77) |
| Southwest | 0.9x | 0.77 | x | 5.45 | x | 36.79 | | 0.63 | x | 0.7 | = | 61.28 | (79) |
| Southwest | 0.9x | 0.77 | x | 5.45 | x | 62.67 | | 0.63 | x | 0.7 | = | 104.39 | (79) |
| Southwest | 0.9x | 0.77 | x | 5.45 | x | 85.75 | | 0.63 | x | 0.7 | = | 142.83 | (79) |
| Southwest | 0.9x | 0.77 | x | 5.45 | x | 106.25 | | 0.63 | x | 0.7 | = | 176.97 | (79) |
| Southwest | 0.9x | 0.77 | x | 5.45 | x | 119.01 | | 0.63 | x | 0.7 | = | 198.22 | (79) |
| Southwest | 0.9x | 0.77 | x | 5.45 | x | 118.15 | | 0.63 | x | 0.7 | = | 196.79 | (79) |
| Southwest | 0.9x | 0.77 | x | 5.45 | x | 113.91 | | 0.63 | x | 0.7 | = | 189.73 | (79) |
| Southwest | 0.9x | 0.77 | x | 5.45 | x | 104.39 | | 0.63 | x | 0.7 | = | 173.87 | (79) |
| Southwest | 0.9x | 0.77 | x | 5.45 | x | 92.85 | | 0.63 | x | 0.7 | = | 154.65 | (79) |
| Southwest | 0.9x | 0.77 | x | 5.45 | x | 69.27 | | 0.63 | x | 0.7 | = | 115.37 | (79) |
| Southwest | 0.9x | 0.77 | x | 5.45 | x | 44.07 | | 0.63 | x | 0.7 | = | 73.4 | (79) |
| Southwest | 0.9x | 0.77 | x | 5.45 | x | 31.49 | | 0.63 | x | 0.7 | = | 52.45 | (79) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (83)m= | 129.76 | 221.04 | 302.43 | 374.73 | 419.72 | 416.69 | 401.73 | 368.16 | 327.47 | 244.29 | 155.43 | 111.05 | (83) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (84)m= | 448.18 | 537.81 | 609.76 | 666.94 | 696.89 | 679.1 | 654.39 | 625.54 | 592.46 | 524.56 | 453.25 | 421.75 | (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= | 0.96 | 0.92 | 0.84 | 0.72 | 0.56 | 0.4 | 0.29 | 0.31 | 0.49 | 0.76 | 0.92 | 0.97 | (86) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (87)m= | 20.14 | 20.38 | 20.64 | 20.86 | 20.96 | 20.99 | 21 | 21 | 20.98 | 20.85 | 20.47 | 20.09 | (87) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (88)m= | 20.15 | 20.15 | 20.15 | 20.17 | 20.17 | 20.19 | 20.19 | 20.19 | 20.18 | 20.17 | 20.17 | 20.16 | (88) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (89)m= | 0.95 | 0.9 | 0.82 | 0.68 | 0.52 | 0.35 | 0.24 | 0.26 | 0.44 | 0.72 | 0.9 | 0.96 | (89) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (90)m= | 19.02 | 19.37 | 19.72 | 20.01 | 20.13 | 20.18 | 20.19 | 20.19 | 20.17 | 20.01 | 19.51 | 18.97 | (90) |

fLA = Living area ÷ (4) = 0.5 (91)

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (92)m= | 19.58 | 19.87 | 20.18 | 20.43 | 20.54 | 20.58 | 20.59 | 20.59 | 20.57 | 20.42 | 19.99 | 19.53 | (92) |

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

# DER WorkSheet: New dwelling design stage

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (93)m= | 19.58 | 19.87 | 20.18 | 20.43 | 20.54 | 20.58 | 20.59 | 20.59 | 20.57 | 20.42 | 19.99 | 19.53 | (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= | 0.94 | 0.9 | 0.82 | 0.69 | 0.54 | 0.38 | 0.26 | 0.29 | 0.47 | 0.73 | 0.9 | 0.95 | (94) |
| Useful gains, hmGm , W = (94)m x (84)m | | | | | | | | | | | | | |
| (95)m= | 423.35 | 482.65 | 500.76 | 463.26 | 375.66 | 255.76 | 171.39 | 179.24 | 275.91 | 384.24 | 408.09 | 402.4 | (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= | 689.14 | 673.12 | 612.61 | 507.26 | 387.6 | 257.47 | 171.63 | 179.6 | 280.53 | 430.55 | 569.04 | 681.54 | (97) |
| Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m | | | | | | | | | | | | | |
| (98)m= | 197.75 | 127.99 | 83.22 | 31.68 | 8.88 | 0 | 0 | 0 | 0 | 34.46 | 115.88 | 207.69 | |

| | | |
|---|---|---|
| Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = | 807.54 | (98) |
| Space heating requirement in kWh/m²/year | 16.49 | (99) |

## 9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

| | | | |
|---|---|---|---|
| Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none | | 0 | (301) |
| Fraction of space heat from community system 1 – (301) = | | 1 | (302) |

*The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.*

| | | | |
|---|---|---|---|
| Fraction of heat from Community boilers | | 1 | (303a) |
| Fraction of total space heat from Community boilers | (302) x (303a) = | 1 | (304a) |
| Factor for control and charging method (Table 4c(3)) for community heating system | | 1 | (305) |
| Distribution loss factor (Table 12c) for community heating system | | 1.05 | (306) |
| **Space heating** | | **kWh/year** | |
| Annual space heating requirement | | 807.54 | |
| Space heat from Community boilers | (98) x (304a) x (305) x (306) = | 847.92 | (307a) |
| Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) | | 0 | (308 |
| Space heating requirement from secondary/supplementary system | (98) x (301) x 100 ÷ (308) = | 0 | (309) |
| **Water heating** | | | |
| Annual water heating requirement | | 1809.07 | |
| If DHW from community scheme:<br>Water heat from Community boilers | (64) x (303a) x (305) x (306) = | 1899.52 | (310a) |
| Electricity used for heat distribution | 0.01 × [(307a)…(307e) + (310a)…(310e)] = | 27.47 | (313) |
| Cooling System Energy Efficiency Ratio | | 0 | (314) |
| Space cooling (if there is a fixed cooling system, if not enter 0) | = (107) ÷ (314) = | 0 | (315) |
| Electricity for pumps and fans within dwelling (Table 4f):<br>mechanical ventilation - balanced, extract or positive input from outside | | 104.15 | (330a) |

| | | | | |
|---|---|---|---|---|
| warm air heating system fans | | | 0 | (330b) |
| pump for solar water heating | | | 0 | (330g) |
| Total electricity for the above, kWh/year | =(330a) + (330b) + (330g) = | | 104.15 | (331) |
| Energy for lighting (calculated in Appendix L) | | | 227.56 | (332) |
| Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) = | | | 3079.16 | (338) |

## 12b. CO2 Emissions – Community heating scheme

| | | Energy kWh/year | Emission factor kg CO2/kWh | | Emissions kg CO2/year | |
|---|---|---|---|---|---|---|
| CO2 from other sources of space and water heating (not CHP) | | | | | | |
| Efficiency of heat source 1 (%) | If there is CHP using two fuels repeat (363) to (366) for the second fuel | | | | 96 | (367a) |
| CO2 associated with heat source 1 | [(307b)+(310b)] x 100 ÷ (367b) x | | 0.22 | = | 618.18 | (367) |
| Electrical energy for heat distribution | [(313) x | | 0.52 | = | 14.26 | (372) |
| Total CO2 associated with community systems | (363)…(366) + (368)...(372) | | | = | 632.43 | (373) |
| CO2 associated with space heating (secondary) | (309) x | | 0 | = | 0 | (374) |
| CO2 associated with water from immersion heater or instantaneous heater | (312) x | | 0.22 | = | 0 | (375) |
| Total CO2 associated with space and water heating | (373) + (374) + (375) = | | | | 632.43 | (376) |
| CO2 associated with electricity for pumps and fans within dwelling | (331)) x | | 0.52 | = | 54.06 | (378) |
| CO2 associated with electricity for lighting | (332))) x | | 0.52 | = | 118.1 | (379) |
| **Total CO2, kg/year** | sum of (376)…(382) = | | | | 804.59 | (383) |
| **Dwelling CO2 Emission Rate** | (383) ÷ (4) = | | | | 16.43 | (384) |
| **EI rating (section 14)** | | | | | 88.53 | (385) |

# Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.50
*Printed on 06 December 2021 at 10:56:21*

## Project Information:

**Assessed By:** Neil Ingham (STRO010943) **Building Type:** Flat

## Dwelling Details:

**NEW DWELLING DESIGN STAGE** Total Floor Area: 53.46m²
**Site Reference :** Highgate Road - GREEN **Plot Reference:** 02 - B
**Address :**

## Client Details:

**Name:**
**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 (c)
Fuel factor: 1.00 (mains gas (c))

| | | |
|---|---|---|
| Target Carbon Dioxide Emission Rate (TER) | 18.07 kg/m² | |
| Dwelling Carbon Dioxide Emission Rate (DER) | 15.38 kg/m² | **OK** |

## 1b TFEE and DFEE

| | | |
|---|---|---|
| Target Fabric Energy Efficiency (TFEE) | 42.5 kWh/m² | |
| Dwelling Fabric Energy Efficiency (DFEE) | 35.0 kWh/m² | |
| | | **OK** |

## 2 Fabric U-values

| Element | Average | Highest | |
|---|---|---|---|
| External wall | 0.18 (max. 0.30) | 0.18 (max. 0.70) | **OK** |
| Party wall | 0.00 (max. 0.20) | - | **OK** |
| Floor | (no floor) | | |
| Roof | (no roof) | | |
| Openings | 1.40 (max. 2.00) | 1.40 (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 | 3.00 (design value) | |
| Maximum | 10.0 | **OK** |

## 4 Heating efficiency

Main Heating system: Community heating schemes - mains gas

Secondary heating system: None

## 5 Cylinder insulation

Hot water Storage: No cylinder

## 6 Controls

| | | |
|---|---|---|
| Space heating controls | Charging system linked to use of community heating, programmer and at least two room thermostats | **OK** |
| Hot water controls: | No cylinder thermostat<br>No cylinder | |

# Regulations Compliance Report

## 7 Low energy lights

| | | |
|---|---|---|
| Percentage of fixed lights with low-energy fittings | 100.0% | |
| Minimum | 75.0% | **OK** |

## 8 Mechanical ventilation

| | | |
|---|---|---|
| Continuous supply and extract system | | |
| Specific fan power: | 0.47 | |
| Maximum | 1.5 | **OK** |
| MVHR efficiency: | 89% | |
| Minimum | 70% | **OK** |

## 9 Summertime temperature

| | | |
|---|---|---|
| Overheating risk (Thames valley): | Slight | **OK** |
| Based on: | | |
| Overshading: | Average or unknown | |
| Windows facing: South West | 9.56m² | |
| Windows facing: North West | 3.98m² | |
| Ventilation rate: | 6.00 | |

## 10 Key features

| | |
|---|---|
| Air permeablility | 3.0 m³/m²h |
| Party  Walls U-value | 0 W/m²K |
| Community heating, heat from boilers – mains gas | |

# DER WorkSheet: New dwelling design stage

User Details:

| | | | |
|---|---|---|---|
| **Assessor Name:** | Neil Ingham | **Stroma Number:** | STRO010943 |
| **Software Name:** | Stroma FSAP 2012 | **Software Version:** | Version: 1.0.5.50 |

Property Address: 02 - B

**Address :**

## 1. Overall dwelling dimensions:

| | Area(m²) | | | Av. Height(m) | | | Volume(m³) | |
|---|---|---|---|---|---|---|---|---|
| Ground floor | 53.46 | (1a) | x | 2.65 | (2a) | = | 141.67 | (3a) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n) | 53.46 | (4) | | | | | | |
| Dwelling volume | | | | | (3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) = | | 141.67 | (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 | | | | | | | 0 | x 10 = | 0 | (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) = | 0 | ÷ (5) = | 0 | (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 | | 3 | (17) |
| If based on air permeability value, then | (18) = [(17) ÷ 20]+(8), otherwise (18) = (16) | 0.15 | (18) |

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

| | | | |
|---|---|---|---|
| Number of sides sheltered | | 0 | (19) |
| Shelter factor | (20) = 1 - [0.075 x (19)] = | 1 | (20) |
| Infiltration rate incorporating shelter factor | (21) = (18) x (20) = | 0.15 | (21) |

Infiltration rate modified for monthly wind speed

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

# DER WorkSheet: New dwelling design stage

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

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.19 | 0.19 | 0.18 | 0.16 | 0.16 | 0.14 | 0.14 | 0.14 | 0.15 | 0.16 | 0.17 | 0.18 |

*Calculate effective air change rate for the applicable case*

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 75.65 (23c)

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24a)m= | 0.31 | 0.31 | 0.31 | 0.29 | 0.28 | 0.26 | 0.26 | 0.26 | 0.27 | 0.28 | 0.29 | 0.3 | (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 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24d) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (25)m= | 0.31 | 0.31 | 0.31 | 0.29 | 0.28 | 0.26 | 0.26 | 0.26 | 0.27 | 0.28 | 0.29 | 0.3 | (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 | |
|---|---|---|---|---|---|---|---|---|---|---|
| Windows Type 1 | | | 9.56 | x1/[1/( 1.4 )+ 0.04] | | = | 12.67 | | | (27) |
| Windows Type 2 | | | 3.98 | x1/[1/( 1.4 )+ 0.04] | | = | 5.28 | | | (27) |
| Walls Type1 | 40.04 | 13.54 | 26.5 | x | 0.18 | = | 4.77 | 60 | 1590 | (29) |
| Walls Type2 | 12.16 | 0 | 12.16 | x | 0.17 | = | 2.04 | 60 | 729.6 | (29) |
| Total area of elements, m² | | | 52.2 | | | | | | | (31) |
| Party wall | | | 27.88 | x | 0 | = | 0 | 45 | 1254.6 | (32) |
| Party floor | | | 53.46 | | | | | 70 | 3742.2 | (32a) |
| Party ceiling | | | 53.46 | | | | | 30 | 1603.8 | (32b) |
| Internal wall ** | | | 102.03 | | | | | 9 | 918.27 | (32c) |

** 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) = 24.76 (33)

Heat capacity Cm = S(A x k ) ((28)…(30) + (32) + (32a)…(32e) = 9838.47 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 184.03 (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 6.09 (36)

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

Total fabric heat loss (33) + (36) = 30.85 (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= | 14.63 | 14.46 | 14.28 | 13.41 | 13.23 | 12.35 | 12.35 | 12.18 | 12.7 | 13.23 | 13.58 | 13.93 | (38) |

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

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (39)m= | 45.49 | 45.31 | 45.14 | 44.26 | 44.08 | 43.21 | 43.21 | 43.03 | 43.56 | 44.08 | 44.43 | 44.78 |

Average = Sum(39)$_{1…12}$ /12= 44.21 (39)

# DER WorkSheet: New dwelling design stage

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

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (40)m= | 0.85 | 0.85 | 0.84 | 0.83 | 0.82 | 0.81 | 0.81 | 0.8 | 0.81 | 0.82 | 0.83 | 0.84 |

Average = Sum(40)$_{1…12}$ /12= 0.83 (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 — 1.79 (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 — 76.76 (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)*

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

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (44)m= | 84.44 | 81.37 | 78.3 | 75.23 | 72.16 | 69.09 | 69.09 | 72.16 | 75.23 | 78.3 | 81.37 | 84.44 | |

Total = Sum(44)$_{1…12}$ = 921.15 (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= | 125.22 | 109.52 | 113.01 | 98.53 | 94.54 | 81.58 | 75.6 | 86.75 | 87.78 | 102.3 | 111.67 | 121.27 |

Total = Sum(45)$_{1…12}$ = 1207.78 (45)

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (46)m= | 18.78 | 16.43 | 16.95 | 14.78 | 14.18 | 12.24 | 11.34 | 13.01 | 13.17 | 15.35 | 16.75 | 18.19 | (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) = 110 (50)

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

Hot water storage loss factor from Table 2 (kWh/litre/day) — 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a — 1.03 (52)

Temperature factor from Table 2b — 0.6 (53)

Energy lost from water storage, kWh/year — (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) — 1.03 (55)

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (56)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (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= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (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= | 23.26 | 21.01 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | (59) |

# DER WorkSheet: New dwelling design stage

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 | (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= | 180.5 | 159.45 | 168.29 | 152.02 | 149.82 | 135.07 | 130.87 | 142.02 | 141.28 | 157.58 | 165.17 | 176.55 | (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= | 180.5 | 159.45 | 168.29 | 152.02 | 149.82 | 135.07 | 130.87 | 142.02 | 141.28 | 157.58 | 165.17 | 176.55 | |

Output from water heater (annual)$_{1...12}$ 1858.62 (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= | 85.86 | 76.36 | 81.8 | 75.56 | 75.66 | 69.92 | 69.36 | 73.07 | 71.98 | 78.24 | 79.93 | 84.54 | (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= | 89.61 | 89.61 | 89.61 | 89.61 | 89.61 | 89.61 | 89.61 | 89.61 | 89.61 | 89.61 | 89.61 | 89.61 | (66) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (67)m= | 13.93 | 12.37 | 10.06 | 7.62 | 5.69 | 4.81 | 5.19 | 6.75 | 9.06 | 11.5 | 13.43 | 14.31 | (67) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (68)m= | 156.21 | 157.83 | 153.74 | 145.05 | 134.07 | 123.75 | 116.86 | 115.24 | 119.33 | 128.02 | 139 | 149.32 | (68) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (69)m= | 31.96 | 31.96 | 31.96 | 31.96 | 31.96 | 31.96 | 31.96 | 31.96 | 31.96 | 31.96 | 31.96 | 31.96 | (69) |

Pumps and fans gains (Table 5a)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (70)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (70) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (71)m= | -71.68 | -71.68 | -71.68 | -71.68 | -71.68 | -71.68 | -71.68 | -71.68 | -71.68 | -71.68 | -71.68 | -71.68 | (71) |

Water heating gains (Table 5)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (72)m= | 115.4 | 113.63 | 109.94 | 104.94 | 101.69 | 97.11 | 93.22 | 98.21 | 99.98 | 105.16 | 111.01 | 113.63 | (72) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (73)m= | 335.42 | 333.71 | 323.63 | 307.48 | 291.33 | 275.55 | 265.16 | 270.08 | 278.24 | 294.57 | 313.32 | 327.14 | (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) | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Southwest 0.9x | 0.77 | x | 9.56 | x | 36.79 | 0.63 | x | 0.7 | = | 107.5 | (79) |
| Southwest 0.9x | 0.77 | x | 9.56 | x | 62.67 | 0.63 | x | 0.7 | = | 183.11 | (79) |
| Southwest 0.9x | 0.77 | x | 9.56 | x | 85.75 | 0.63 | x | 0.7 | = | 250.54 | (79) |
| Southwest 0.9x | 0.77 | x | 9.56 | x | 106.25 | 0.63 | x | 0.7 | = | 310.43 | (79) |
| Southwest 0.9x | 0.77 | x | 9.56 | x | 119.01 | 0.63 | x | 0.7 | = | 347.71 | (79) |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Southwest | 0.9x | 0.77 | x | 9.56 | x | 118.15 | | 0.63 | x | 0.7 | = | 345.19 | (79) |
| Southwest | 0.9x | 0.77 | x | 9.56 | x | 113.91 | | 0.63 | x | 0.7 | = | 332.8 | (79) |
| Southwest | 0.9x | 0.77 | x | 9.56 | x | 104.39 | | 0.63 | x | 0.7 | = | 304.99 | (79) |
| Southwest | 0.9x | 0.77 | x | 9.56 | x | 92.85 | | 0.63 | x | 0.7 | = | 271.28 | (79) |
| Southwest | 0.9x | 0.77 | x | 9.56 | x | 69.27 | | 0.63 | x | 0.7 | = | 202.38 | (79) |
| Southwest | 0.9x | 0.77 | x | 9.56 | x | 44.07 | | 0.63 | x | 0.7 | = | 128.76 | (79) |
| Southwest | 0.9x | 0.77 | x | 9.56 | x | 31.49 | | 0.63 | x | 0.7 | = | 92 | (79) |
| Northwest | 0.9x | 0.77 | x | 3.98 | x | 11.28 | x | 0.63 | x | 0.7 | = | 13.72 | (81) |
| Northwest | 0.9x | 0.77 | x | 3.98 | x | 22.97 | x | 0.63 | x | 0.7 | = | 27.94 | (81) |
| Northwest | 0.9x | 0.77 | x | 3.98 | x | 41.38 | x | 0.63 | x | 0.7 | = | 50.33 | (81) |
| Northwest | 0.9x | 0.77 | x | 3.98 | x | 67.96 | x | 0.63 | x | 0.7 | = | 82.66 | (81) |
| Northwest | 0.9x | 0.77 | x | 3.98 | x | 91.35 | x | 0.63 | x | 0.7 | = | 111.11 | (81) |
| Northwest | 0.9x | 0.77 | x | 3.98 | x | 97.38 | x | 0.63 | x | 0.7 | = | 118.45 | (81) |
| Northwest | 0.9x | 0.77 | x | 3.98 | x | 91.1 | x | 0.63 | x | 0.7 | = | 110.81 | (81) |
| Northwest | 0.9x | 0.77 | x | 3.98 | x | 72.63 | x | 0.63 | x | 0.7 | = | 88.34 | (81) |
| Northwest | 0.9x | 0.77 | x | 3.98 | x | 50.42 | x | 0.63 | x | 0.7 | = | 61.33 | (81) |
| Northwest | 0.9x | 0.77 | x | 3.98 | x | 28.07 | x | 0.63 | x | 0.7 | = | 34.14 | (81) |
| Northwest | 0.9x | 0.77 | x | 3.98 | x | 14.2 | x | 0.63 | x | 0.7 | = | 17.27 | (81) |
| Northwest | 0.9x | 0.77 | x | 3.98 | x | 9.21 | x | 0.63 | x | 0.7 | = | 11.21 | (81) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (83)m= | 121.22 | 211.05 | 300.87 | 393.09 | 458.82 | 463.65 | 443.61 | 393.33 | 332.61 | 236.52 | 146.03 | 103.2 | (83) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (84)m= | 456.64 | 544.75 | 624.5 | 700.57 | 750.15 | 739.2 | 708.77 | 663.41 | 610.85 | 531.08 | 459.34 | 430.35 | (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= | 0.97 | 0.93 | 0.85 | 0.71 | 0.54 | 0.37 | 0.27 | 0.3 | 0.49 | 0.77 | 0.93 | 0.97 | (86) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (87)m= | 20.24 | 20.47 | 20.71 | 20.91 | 20.98 | 21 | 21 | 21 | 20.99 | 20.88 | 20.55 | 20.2 | (87) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (88)m= | 20.21 | 20.21 | 20.22 | 20.23 | 20.23 | 20.25 | 20.25 | 20.25 | 20.24 | 20.23 | 20.23 | 20.22 | (88) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (89)m= | 0.96 | 0.92 | 0.83 | 0.67 | 0.49 | 0.33 | 0.22 | 0.25 | 0.43 | 0.73 | 0.92 | 0.97 | (89) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (90)m= | 19.21 | 19.53 | 19.86 | 20.13 | 20.21 | 20.24 | 20.25 | 20.25 | 20.23 | 20.1 | 19.66 | 19.17 | (90) |

fLA = Living area ÷ (4) = 0.45 (91)

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (92)m= | 19.68 | 19.95 | 20.25 | 20.48 | 20.56 | 20.58 | 20.59 | 20.59 | 20.57 | 20.46 | 20.06 | 19.63 | (92) |

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

# DER WorkSheet: New dwelling design stage

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (93)m= | 19.68 | 19.95 | 20.25 | 20.48 | 20.56 | 20.58 | 20.59 | 20.59 | 20.57 | 20.46 | 20.06 | 19.63 | (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= | 0.96 | 0.91 | 0.83 | 0.68 | 0.51 | 0.35 | 0.24 | 0.27 | 0.46 | 0.74 | 0.91 | 0.96 | (94) |
| Useful gains, hmGm , W = (94)m x (84)m | | | | | | | | | | | | | |
| (95)m= | 436.32 | 496.94 | 519.33 | 479.81 | 383.83 | 257.86 | 172.14 | 180.05 | 279.24 | 394.63 | 420.13 | 414.76 | (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= | 699.49 | 682.13 | 620.42 | 512.39 | 390.52 | 258.56 | 172.22 | 180.19 | 282.03 | 434.44 | 575.85 | 691.24 | (97) |
| Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m | | | | | | | | | | | | | |
| (98)m= | 195.8 | 124.45 | 75.21 | 23.46 | 4.97 | 0 | 0 | 0 | 0 | 29.62 | 112.12 | 205.7 | |

| | | | |
|---|---|---|---|
| | Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = | 771.33 | (98) |
| Space heating requirement in kWh/m²/year | | 14.43 | (99) |

## 9b. Energy requirements – Community heating scheme

| | | | |
|---|---|---|---|
| This part is used for space heating, space cooling or water heating provided by a community scheme.<br>Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none | | 0 | (301) |
| Fraction of space heat from community system 1 – (301) = | | 1 | (302) |

*The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.*

| | | | |
|---|---|---|---|
| Fraction of heat from Community boilers | | 1 | (303a) |
| Fraction of total space heat from Community boilers | (302) x (303a) = | 1 | (304a) |
| Factor for control and charging method (Table 4c(3)) for community heating system | | 1 | (305) |
| Distribution loss factor (Table 12c) for community heating system | | 1.05 | (306) |
| **Space heating** | | **kWh/year** | |
| Annual space heating requirement | | 771.33 | |
| Space heat from Community boilers | (98) x (304a) x (305) x (306) = | 809.9 | (307a) |
| Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) | | 0 | (308 |
| Space heating requirement from secondary/supplementary system | (98) x (301) x 100 ÷ (308) = | 0 | (309) |
| **Water heating** | | | |
| Annual water heating requirement | | 1858.62 | |
| If DHW from community scheme:<br>Water heat from Community boilers | (64) x (303a) x (305) x (306) = | 1951.55 | (310a) |
| Electricity used for heat distribution | 0.01 × [(307a)…(307e) + (310a)…(310e)] = | 27.61 | (313) |
| Cooling System Energy Efficiency Ratio | | 0 | (314) |
| Space cooling (if there is a fixed cooling system, if not enter 0) | = (107) ÷ (314) = | 0 | (315) |
| Electricity for pumps and fans within dwelling (Table 4f):<br>mechanical ventilation - balanced, extract or positive input from outside | | 113.73 | (330a) |

# DER WorkSheet: New dwelling design stage

| | | | | |
|---|---|---|---|---|
| warm air heating system fans | | | 0 | (330b) |
| pump for solar water heating | | | 0 | (330g) |
| Total electricity for the above, kWh/year | =(330a) + (330b) + (330g) = | | 113.73 | (331) |
| Energy for lighting (calculated in Appendix L) | | | 245.94 | (332) |
| Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) = | | | 3121.11 | (338) |

## 12b. CO2 Emissions – Community heating scheme

| | | Energy kWh/year | Emission factor kg CO2/kWh | | Emissions kg CO2/year | |
|---|---|---|---|---|---|---|
| CO2 from other sources of space and water heating (not CHP) | | | | | | |
| Efficiency of heat source 1 (%) | If there is CHP using two fuels repeat (363) to (366) for the second fuel | | | | 96 | (367a) |
| CO2 associated with heat source 1 | [(307b)+(310b)] x 100 ÷ (367b) x | | 0.22 | = | 621.32 | (367) |
| Electrical energy for heat distribution | [(313) x | | 0.52 | = | 14.33 | (372) |
| Total CO2 associated with community systems | (363)…(366) + (368)...(372) | | | = | 635.66 | (373) |
| CO2 associated with space heating (secondary) | (309) x | | 0 | = | 0 | (374) |
| CO2 associated with water from immersion heater or instantaneous heater | (312) x | | 0.22 | = | 0 | (375) |
| Total CO2 associated with space and water heating | (373) + (374) + (375) = | | | | 635.66 | (376) |
| CO2 associated with electricity for pumps and fans within dwelling | (331)) x | | 0.52 | = | 59.02 | (378) |
| CO2 associated with electricity for lighting | (332))) x | | 0.52 | = | 127.64 | (379) |
| **Total CO2, kg/year** | sum of (376)…(382) = | | | | 822.32 | (383) |
| **Dwelling CO2 Emission Rate** | (383) ÷ (4) = | | | | 15.38 | (384) |
| **EI rating (section 14)** | | | | | 88.81 | (385) |

# Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.50
*Printed on 06 December 2021 at 10:56:09*

## Project Information:

**Assessed By:** Neil Ingham (STRO010943) **Building Type:** Flat

## Dwelling Details:

**NEW DWELLING DESIGN STAGE** Total Floor Area: 72.62m²

**Site Reference :** Highgate Road - GREEN **Plot Reference:** 02 - C

**Address :**

## Client Details:

**Name:**

**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 (c)
Fuel factor: 1.00 (mains gas (c))

| | | |
|---|---|---|
| Target Carbon Dioxide Emission Rate (TER) | 18.46 kg/m² | |
| Dwelling Carbon Dioxide Emission Rate (DER) | 15.74 kg/m² | **OK** |

## 1b TFEE and DFEE

| | | |
|---|---|---|
| Target Fabric Energy Efficiency (TFEE) | 52.6 kWh/m² | |
| Dwelling Fabric Energy Efficiency (DFEE) | 42.5 kWh/m² | |
| | | **OK** |

## 2 Fabric U-values

| Element | Average | Highest | |
|---|---|---|---|
| External wall | 0.18 (max. 0.30) | 0.18 (max. 0.70) | **OK** |
| Party wall | 0.00 (max. 0.20) | - | **OK** |
| Floor | (no floor) | | |
| Roof | (no roof) | | |
| Openings | 1.40 (max. 2.00) | 1.40 (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 | 3.00 (design value) | |
| Maximum | 10.0 | **OK** |

## 4 Heating efficiency

| | |
|---|---|
| Main Heating system: | Community heating schemes - mains gas |
| Secondary heating system: | None |

## 5 Cylinder insulation

| | |
|---|---|
| Hot water Storage: | No cylinder |

## 6 Controls

| | | |
|---|---|---|
| Space heating controls | Charging system linked to use of community heating, programmer and at least two room thermostats | **OK** |
| Hot water controls: | No cylinder thermostat<br>No cylinder | |

# Regulations Compliance Report

## 7 Low energy lights

| | | |
|---|---|---|
| Percentage of fixed lights with low-energy fittings | 100.0% | |
| Minimum | 75.0% | **OK** |

## 8 Mechanical ventilation

| | | |
|---|---|---|
| Continuous supply and extract system | | |
| Specific fan power: | 0.54 | |
| Maximum | 1.5 | **OK** |
| MVHR efficiency: | 88% | |
| Minimum | 70% | **OK** |

## 9 Summertime temperature

| | | |
|---|---|---|
| Overheating risk (Thames valley): | Slight | **OK** |
| Based on: | | |
| Overshading: | Average or unknown | |
| Windows facing: North East | $12.71m^2$ | |
| Windows facing: North West | $3.46m^2$ | |
| Ventilation rate: | 6.00 | |

## 10 Key features

| | |
|---|---|
| Air permeablility | $3.0\ m^3/m^2h$ |
| Party Walls U-value | $0\ W/m^2K$ |
| Community heating, heat from boilers – mains gas | |

# DER WorkSheet: New dwelling design stage

User Details:

| | | | |
|---|---|---|---|
| **Assessor Name:** | Neil Ingham | **Stroma Number:** | STRO010943 |
| **Software Name:** | Stroma FSAP 2012 | **Software Version:** | Version: 1.0.5.50 |

Property Address: 02 - C

**Address :**

## 1. Overall dwelling dimensions:

| | Area(m²) | | Av. Height(m) | | | Volume(m³) | |
|---|---|---|---|---|---|---|---|
| Ground floor | 72.62 | (1a) x | 2.65 | (2a) | = | 192.44 | (3a) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n) | 72.62 | (4) | | | | | |
| Dwelling volume | | | (3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) | | = | 192.44 | (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 | | | | | | | 0 | x 10 = | 0 | (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) = | 0 | ÷ (5) = | 0 | (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 | | 3 | (17) |
| If based on air permeability value, then | (18) = [(17) ÷ 20]+(8), otherwise (18) = (16) | 0.15 | (18) |

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

| | | | |
|---|---|---|---|
| Number of sides sheltered | | 0 | (19) |
| Shelter factor | (20) = 1 - [0.075 x (19)] = | 1 | (20) |
| Infiltration rate incorporating shelter factor | (21) = (18) x (20) = | 0.15 | (21) |

Infiltration rate modified for monthly wind speed

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|

Monthly average wind speed from Table 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 |

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 |

# DER WorkSheet: New dwelling design stage

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

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.19 | 0.19 | 0.18 | 0.16 | 0.16 | 0.14 | 0.14 | 0.14 | 0.15 | 0.16 | 0.17 | 0.18 |

*Calculate effective air change rate for the applicable case*

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 74.8 (23c)

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24a)m= | 0.32 | 0.31 | 0.31 | 0.29 | 0.29 | 0.27 | 0.27 | 0.26 | 0.28 | 0.29 | 0.29 | 0.3 | (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 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24d) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (25)m= | 0.32 | 0.31 | 0.31 | 0.29 | 0.29 | 0.27 | 0.27 | 0.26 | 0.28 | 0.29 | 0.29 | 0.3 | (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 | |
|---|---|---|---|---|---|---|---|---|---|---|
| Windows Type 1 | | | 12.71 | x1/[1/( 1.4 )+ 0.04] | | = | 16.85 | | | (27) |
| Windows Type 2 | | | 3.46 | x1/[1/( 1.4 )+ 0.04] | | = | 4.59 | | | (27) |
| Walls Type1 | 72.62 | 16.17 | 56.45 | x | 0.18 | = | 10.16 | 60 | 3387 | (29) |
| Walls Type2 | 17.78 | 0 | 17.78 | x | 0.17 | = | 2.99 | 60 | 1066.8 | (29) |
| Total area of elements, m² | | | 90.4 | | | | | | | (31) |
| Party wall | | | 30.32 | x | 0 | = | 0 | 45 | 1364.4 | (32) |
| Party floor | | | 72.62 | | | | | 40 | 2904.8 | (32a) |
| Party ceiling | | | 72.62 | | | | | 30 | 2178.6 | (32b) |
| Internal wall ** | | | 146.17 | | | | | 9 | 1315.53 | (32c) |

** 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) = 34.58 (33)

Heat capacity Cm = S(A x k ) ((28)…(30) + (32) + (32a)…(32e) = 12217.13 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 168.23 (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 7.11 (36)

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

Total fabric heat loss (33) + (36) = 41.69 (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= | 20.15 | 19.91 | 19.67 | 18.48 | 18.24 | 17.05 | 17.05 | 16.81 | 17.53 | 18.24 | 18.72 | 19.19 | (38) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (39)m= | 61.84 | 61.6 | 61.36 | 60.17 | 59.93 | 58.74 | 58.74 | 58.51 | 59.22 | 59.93 | 60.41 | 60.89 | |

Average = Sum(39)$_{1…12}$ /12= 60.11 (39)

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (40)m= | 0.85 | 0.85 | 0.84 | 0.83 | 0.83 | 0.81 | 0.81 | 0.81 | 0.82 | 0.83 | 0.83 | 0.84 | |

Average = Sum(40)1…12 /12= 0.83 (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 2.31 (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 89.02 (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= | 97.92 | 94.36 | 90.8 | 87.24 | 83.67 | 80.11 | 80.11 | 83.67 | 87.24 | 90.8 | 94.36 | 97.92 | |

Total = Sum(44)1…12 = 1068.18 (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= | 145.21 | 127 | 131.05 | 114.25 | 109.63 | 94.6 | 87.66 | 100.59 | 101.8 | 118.63 | 129.5 | 140.63 | |

Total = Sum(45)1…12 = 1400.56 (45)

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (46)m= | 21.78 | 19.05 | 19.66 | 17.14 | 16.44 | 14.19 | 13.15 | 15.09 | 15.27 | 17.8 | 19.42 | 21.09 | (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) = 110 (50)

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

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (56)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (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= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (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= | 23.26 | 21.01 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | (59) |

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 | (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= | 200.48 | 176.93 | 186.33 | 167.75 | 164.91 | 148.1 | 142.94 | 155.87 | 155.29 | 173.91 | 182.99 | 195.9 | (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= | 200.48 | 176.93 | 186.33 | 167.75 | 164.91 | 148.1 | 142.94 | 155.87 | 155.29 | 173.91 | 182.99 | 195.9 | |

Output from water heater (annual)$_{1...12}$ 2051.4 (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= | 92.5 | 82.17 | 87.8 | 80.78 | 80.67 | 74.25 | 73.37 | 77.67 | 76.64 | 83.67 | 85.85 | 90.98 | (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= | 115.4 | 115.4 | 115.4 | 115.4 | 115.4 | 115.4 | 115.4 | 115.4 | 115.4 | 115.4 | 115.4 | 115.4 | (66) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (67)m= | 18.13 | 16.1 | 13.09 | 9.91 | 7.41 | 6.26 | 6.76 | 8.79 | 11.79 | 14.97 | 17.48 | 18.63 | (67) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (68)m= | 203.33 | 205.44 | 200.13 | 188.81 | 174.52 | 161.09 | 152.12 | 150.01 | 155.32 | 166.64 | 180.93 | 194.36 | (68) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (69)m= | 34.54 | 34.54 | 34.54 | 34.54 | 34.54 | 34.54 | 34.54 | 34.54 | 34.54 | 34.54 | 34.54 | 34.54 | (69) |

Pumps and fans gains (Table 5a)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (70)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (70) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (71)m= | -92.32 | -92.32 | -92.32 | -92.32 | -92.32 | -92.32 | -92.32 | -92.32 | -92.32 | -92.32 | -92.32 | -92.32 | (71) |

Water heating gains (Table 5)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (72)m= | 124.33 | 122.28 | 118.01 | 112.2 | 108.43 | 103.13 | 98.61 | 104.39 | 106.45 | 112.46 | 119.24 | 122.28 | (72) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (73)m= | 403.41 | 401.44 | 388.85 | 368.54 | 347.98 | 328.09 | 315.11 | 320.81 | 331.19 | 351.69 | 375.27 | 392.9 | (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 | 12.71 | x | 11.28 | x | 0.63 | x | 0.7 | = | 43.83 | (75) |
| Northeast 0.9x | 0.77 | x | 12.71 | x | 22.97 | x | 0.63 | x | 0.7 | = | 89.21 | (75) |
| Northeast 0.9x | 0.77 | x | 12.71 | x | 41.38 | x | 0.63 | x | 0.7 | = | 160.73 | (75) |
| Northeast 0.9x | 0.77 | x | 12.71 | x | 67.96 | x | 0.63 | x | 0.7 | = | 263.96 | (75) |
| Northeast 0.9x | 0.77 | x | 12.71 | x | 91.35 | x | 0.63 | x | 0.7 | = | 354.82 | (75) |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Northeast | 0.9x | 0.77 | x | 12.71 | x | 97.38 | x | 0.63 | x | 0.7 | = | 378.27 | (75) |
| Northeast | 0.9x | 0.77 | x | 12.71 | x | 91.1 | x | 0.63 | x | 0.7 | = | 353.87 | (75) |
| Northeast | 0.9x | 0.77 | x | 12.71 | x | 72.63 | x | 0.63 | x | 0.7 | = | 282.11 | (75) |
| Northeast | 0.9x | 0.77 | x | 12.71 | x | 50.42 | x | 0.63 | x | 0.7 | = | 195.85 | (75) |
| Northeast | 0.9x | 0.77 | x | 12.71 | x | 28.07 | x | 0.63 | x | 0.7 | = | 109.02 | (75) |
| Northeast | 0.9x | 0.77 | x | 12.71 | x | 14.2 | x | 0.63 | x | 0.7 | = | 55.15 | (75) |
| Northeast | 0.9x | 0.77 | x | 12.71 | x | 9.21 | x | 0.63 | x | 0.7 | = | 35.79 | (75) |
| Northwest | 0.9x | 0.77 | x | 3.46 | x | 11.28 | x | 0.63 | x | 0.7 | = | 11.93 | (81) |
| Northwest | 0.9x | 0.77 | x | 3.46 | x | 22.97 | x | 0.63 | x | 0.7 | = | 24.29 | (81) |
| Northwest | 0.9x | 0.77 | x | 3.46 | x | 41.38 | x | 0.63 | x | 0.7 | = | 43.75 | (81) |
| Northwest | 0.9x | 0.77 | x | 3.46 | x | 67.96 | x | 0.63 | x | 0.7 | = | 71.86 | (81) |
| Northwest | 0.9x | 0.77 | x | 3.46 | x | 91.35 | x | 0.63 | x | 0.7 | = | 96.59 | (81) |
| Northwest | 0.9x | 0.77 | x | 3.46 | x | 97.38 | x | 0.63 | x | 0.7 | = | 102.98 | (81) |
| Northwest | 0.9x | 0.77 | x | 3.46 | x | 91.1 | x | 0.63 | x | 0.7 | = | 96.33 | (81) |
| Northwest | 0.9x | 0.77 | x | 3.46 | x | 72.63 | x | 0.63 | x | 0.7 | = | 76.8 | (81) |
| Northwest | 0.9x | 0.77 | x | 3.46 | x | 50.42 | x | 0.63 | x | 0.7 | = | 53.32 | (81) |
| Northwest | 0.9x | 0.77 | x | 3.46 | x | 28.07 | x | 0.63 | x | 0.7 | = | 29.68 | (81) |
| Northwest | 0.9x | 0.77 | x | 3.46 | x | 14.2 | x | 0.63 | x | 0.7 | = | 15.01 | (81) |
| Northwest | 0.9x | 0.77 | x | 3.46 | x | 9.21 | x | 0.63 | x | 0.7 | = | 9.74 | (81) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (83)m= | 55.76 | 113.5 | 204.48 | 335.82 | 451.41 | 481.25 | 450.2 | 358.9 | 249.17 | 138.7 | 70.16 | 45.53 | (83) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (84)m= | 459.17 | 514.94 | 593.33 | 704.36 | 799.39 | 809.34 | 765.31 | 679.71 | 580.35 | 490.4 | 445.43 | 438.43 | (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= | 0.99 | 0.98 | 0.94 | 0.84 | 0.65 | 0.46 | 0.34 | 0.39 | 0.66 | 0.91 | 0.98 | 0.99 | (86) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (87)m= | 19.91 | 20.08 | 20.38 | 20.74 | 20.93 | 20.99 | 21 | 21 | 20.95 | 20.66 | 20.23 | 19.89 | (87) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (88)m= | 20.21 | 20.21 | 20.21 | 20.23 | 20.23 | 20.25 | 20.25 | 20.25 | 20.24 | 20.23 | 20.23 | 20.22 | (88) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (89)m= | 0.98 | 0.97 | 0.93 | 0.81 | 0.61 | 0.41 | 0.28 | 0.33 | 0.6 | 0.89 | 0.97 | 0.99 | (89) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (90)m= | 18.74 | 18.99 | 19.42 | 19.93 | 20.17 | 20.24 | 20.24 | 20.25 | 20.2 | 19.84 | 19.23 | 18.72 | (90) |

fLA = Living area ÷ (4) = 0.38 (91)

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (92)m= | 19.19 | 19.41 | 19.79 | 20.24 | 20.46 | 20.53 | 20.53 | 20.54 | 20.49 | 20.15 | 19.61 | 19.17 | (92) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (93)m= | 19.19 | 19.41 | 19.79 | 20.24 | 20.46 | 20.53 | 20.53 | 20.54 | 20.49 | 20.15 | 19.61 | 19.17 | (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= | 0.98 | 0.97 | 0.93 | 0.81 | 0.62 | 0.43 | 0.3 | 0.35 | 0.62 | 0.88 | 0.96 | 0.98 | (94) |
| Useful gains, hmGm , W = (94)m x (84)m | | | | | | | | | | | | | |
| (95)m= | 449.99 | 497.58 | 549.78 | 572.64 | 498.55 | 344.88 | 230.65 | 240.9 | 360.02 | 433.61 | 429.81 | 431.1 | (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= | 920.89 | 893.8 | 815.46 | 682.31 | 525.12 | 348.22 | 231.14 | 241.92 | 378.27 | 572.65 | 755.98 | 911.39 | (97) |
| Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m | | | | | | | | | | | | | |
| (98)m= | 350.35 | 266.26 | 197.66 | 78.97 | 19.77 | 0 | 0 | 0 | 0 | 103.45 | 234.84 | 357.33 | |

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1608.62 (98)

Space heating requirement in kWh/m²/year 22.15 (99)

## 9b. Energy requirements – Community heating scheme

| | | | |
|---|---|---|---|
| This part is used for space heating, space cooling or water heating provided by a community scheme. Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none | | 0 | (301) |
| Fraction of space heat from community system 1 – (301) = | | 1 | (302) |

*The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.*

| | | | |
|---|---|---|---|
| Fraction of heat from Community boilers | | 1 | (303a) |
| Fraction of total space heat from Community boilers | (302) x (303a) = | 1 | (304a) |
| Factor for control and charging method (Table 4c(3)) for community heating system | | 1 | (305) |
| Distribution loss factor (Table 12c) for community heating system | | 1.05 | (306) |
| **Space heating** | | **kWh/year** | |
| Annual space heating requirement | | 1608.62 | |
| Space heat from Community boilers | (98) x (304a) x (305) x (306) = | 1689.05 | (307a) |
| Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) | | 0 | (308 |
| Space heating requirement from secondary/supplementary system | (98) x (301) x 100 ÷ (308) = | 0 | (309) |
| **Water heating** | | | |
| Annual water heating requirement | | 2051.4 | |
| If DHW from community scheme: Water heat from Community boilers | (64) x (303a) x (305) x (306) = | 2153.97 | (310a) |
| Electricity used for heat distribution | 0.01 × [(307a)…(307e) + (310a)…(310e)] = | 38.43 | (313) |
| Cooling System Energy Efficiency Ratio | | 0 | (314) |
| Space cooling (if there is a fixed cooling system, if not enter 0) | = (107) ÷ (314) = | 0 | (315) |
| Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside | | 177.49 | (330a) |

| | | | |
|---|---|---|---|
| warm air heating system fans | | 0 | (330b) |
| pump for solar water heating | | 0 | (330g) |
| Total electricity for the above, kWh/year | =(330a) + (330b) + (330g) = | 177.49 | (331) |
| Energy for lighting (calculated in Appendix L) | | 320.14 | (332) |
| Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) = | | 4340.66 | (338) |

## 12b. CO2 Emissions – Community heating scheme

| | | Energy kWh/year | Emission factor kg CO2/kWh | | Emissions kg CO2/year | |
|---|---|---|---|---|---|---|
| CO2 from other sources of space and water heating (not CHP) Efficiency of heat source 1 (%) | If there is CHP using two fuels repeat (363) to (366) for the second fuel | | | | 96 | (367a) |
| CO2 associated with heat source 1 | [(307b)+(310b)] x 100 ÷ (367b) x | | 0.22 | = | 864.68 | (367) |
| Electrical energy for heat distribution | [(313) x | | 0.52 | = | 19.95 | (372) |
| Total CO2 associated with community systems | (363)…(366) + (368)...(372) | | | = | 884.62 | (373) |
| CO2 associated with space heating (secondary) | (309) x | | 0 | = | 0 | (374) |
| CO2 associated with water from immersion heater or instantaneous heater | (312) x | | 0.22 | = | 0 | (375) |
| Total CO2 associated with space and water heating | (373) + (374) + (375) = | | | | 884.62 | (376) |
| CO2 associated with electricity for pumps and fans within dwelling | (331)) x | | 0.52 | = | 92.12 | (378) |
| CO2 associated with electricity for lighting | (332))) x | | 0.52 | = | 166.15 | (379) |
| **Total CO2, kg/year** | sum of (376)…(382) = | | | | 1142.9 | (383) |
| **Dwelling CO2 Emission Rate** | (383) ÷ (4) = | | | | 15.74 | (384) |
| **EI rating (section 14)** | | | | | 86.98 | (385) |

# Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.50
*Printed on 06 December 2021 at 10:55:54*

## Project Information:

**Assessed By:** Neil Ingham (STRO010943) **Building Type:** Flat

## Dwelling Details:

**NEW DWELLING DESIGN STAGE** Total Floor Area: 53.96m²

**Site Reference :** Highgate Road - GREEN **Plot Reference:** 02 - D

**Address :**

## Client Details:

**Name:**

**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 (c)
Fuel factor: 1.00 (mains gas (c))

| | | |
|---|---|---|
| Target Carbon Dioxide Emission Rate (TER) | 19.25 kg/m² | |
| Dwelling Carbon Dioxide Emission Rate (DER) | 16.23 kg/m² | OK |

## 1b TFEE and DFEE

| | | |
|---|---|---|
| Target Fabric Energy Efficiency (TFEE) | 48.6 kWh/m² | |
| Dwelling Fabric Energy Efficiency (DFEE) | 39.2 kWh/m² | |
| | | OK |

## 2 Fabric U-values

| Element | Average | Highest | |
|---|---|---|---|
| External wall | 0.17 (max. 0.30) | 0.18 (max. 0.70) | OK |
| Party wall | 0.00 (max. 0.20) | - | OK |
| Floor | (no floor) | | |
| Roof | (no roof) | | |
| Openings | 1.40 (max. 2.00) | 1.40 (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 | 3.00 (design value) | |
| Maximum | 10.0 | OK |

## 4 Heating efficiency

Main Heating system: Community heating schemes - mains gas

Secondary heating system: None

## 5 Cylinder insulation

Hot water Storage: No cylinder

## 6 Controls

| | | |
|---|---|---|
| Space heating controls | Charging system linked to use of community heating, programmer and at least two room thermostats | OK |
| Hot water controls: | No cylinder thermostat<br>No cylinder | |

# Regulations Compliance Report

## 7 Low energy lights

| | | |
|---|---|---|
| Percentage of fixed lights with low-energy fittings | 100.0% | |
| Minimum | 75.0% | **OK** |

## 8 Mechanical ventilation

| | | |
|---|---|---|
| Continuous supply and extract system | | |
| Specific fan power: | 0.47 | |
| Maximum | 1.5 | **OK** |
| MVHR efficiency: | 89% | |
| Minimum | 70% | **OK** |

## 9 Summertime temperature

| | | |
|---|---|---|
| Overheating risk (Thames valley): | Medium | **OK** |
| Based on: | | |
| Overshading: | Average or unknown | |
| Windows facing: North East | 12.07m² | |
| Ventilation rate: | 4.00 | |

## 10 Key features

| | |
|---|---|
| Air permeablility | 3.0 m³/m²h |
| Party Walls U-value | 0 W/m²K |
| Community heating, heat from boilers – mains gas | |

# DER WorkSheet: New dwelling design stage

User Details:

**Assessor Name:** Neil Ingham
**Stroma Number:** STRO010943
**Software Name:** Stroma FSAP 2012
**Software Version:** Version: 1.0.5.50

Property Address: 02 - D

**Address :**

## 1. Overall dwelling dimensions:

| | Area(m²) | | Av. Height(m) | | Volume(m³) | |
|---|---|---|---|---|---|---|
| Ground floor | 53.96 | (1a) x | 2.65 | (2a) = | 142.99 | (3a) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n) | 53.96 | (4) | | | | |
| Dwelling volume | | | | (3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) = | 142.99 | (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 | | | | | | | 0 | x 10 = | 0 | (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) = | 0 | ÷ (5) = | 0 | (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 | | 3 | (17) |
| If based on air permeability value, then | (18) = [(17) ÷ 20]+(8), otherwise (18) = (16) | 0.15 | (18) |
| *Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used* | | | |
| Number of sides sheltered | | 0 | (19) |
| Shelter factor | (20) = 1 - [0.075 x (19)] = | 1 | (20) |
| Infiltration rate incorporating shelter factor | (21) = (18) x (20) = | 0.15 | (21) |

Infiltration rate modified for monthly wind speed

Monthly average wind speed from Table 7

Wind Factor (22a)m = (22)m ÷ 4

| | 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 |
| (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 |

# DER WorkSheet: New dwelling design stage

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

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.19 | 0.19 | 0.18 | 0.16 | 0.16 | 0.14 | 0.14 | 0.14 | 0.15 | 0.16 | 0.17 | 0.18 |

*Calculate effective air change rate for the applicable case*

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 75.65 (23c)

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24a)m= | 0.31 | 0.31 | 0.31 | 0.29 | 0.28 | 0.26 | 0.26 | 0.26 | 0.27 | 0.28 | 0.29 | 0.3 | (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 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24d) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (25)m= | 0.31 | 0.31 | 0.31 | 0.29 | 0.28 | 0.26 | 0.26 | 0.26 | 0.27 | 0.28 | 0.29 | 0.3 | (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 | |
|---|---|---|---|---|---|---|---|---|---|---|
| Windows | | | 12.07 | x1/[1/( 1.4 )+ 0.04] | | = | 16 | | | (27) |
| Walls Type1 | 27.66 | 12.07 | 15.59 | x | 0.18 | = | 2.81 | 60 | 935.4 | (29) |
| Walls Type2 | 24.24 | 0 | 24.24 | x | 0.17 | = | 4.07 | 60 | 1454.4 | (29) |
| Total area of elements, m² | | | 51.9 | | | | | | | (31) |
| Party wall | | | 31.67 | x | 0 | = | 0 | 45 | 1425.15 | (32) |
| Party floor | | | 53.96 | | | | | 40 | 2158.4 | (32a) |
| Party ceiling | | | 53.96 | | | | | 30 | 1618.8 | (32b) |
| Internal wall ** | | | 95.03 | | | | | 9 | 855.27 | (32c) |

* *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) = 22.88 (33)

Heat capacity Cm = S(A x k ) ((28)…(30) + (32) + (32a)…(32e) = 8447.42 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 156.55 (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 6.04 (36)

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

Total fabric heat loss (33) + (36) = 28.91 (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= | 14.77 | 14.59 | 14.42 | 13.53 | 13.35 | 12.47 | 12.47 | 12.29 | 12.82 | 13.35 | 13.71 | 14.06 | (38) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (39)m= | 43.68 | 43.51 | 43.33 | 42.45 | 42.27 | 41.38 | 41.38 | 41.21 | 41.74 | 42.27 | 42.62 | 42.98 | |

Average = $Sum(39)_{1…12}$ /12= 42.4 (39)

# DER WorkSheet: New dwelling design stage

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

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (40)m= | 0.81 | 0.81 | 0.8 | 0.79 | 0.78 | 0.77 | 0.77 | 0.76 | 0.77 | 0.78 | 0.79 | 0.8 |

Average = Sum(40)$_{1…12}$ /12= 0.79 (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 — 1.81 (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 — 77.11 (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)*

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

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (44)m= | 84.82 | 81.74 | 78.65 | 75.57 | 72.49 | 69.4 | 69.4 | 72.49 | 75.57 | 78.65 | 81.74 | 84.82 |

Total = Sum(44)$_{1…12}$ = 925.35 (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)*

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (45)m= | 125.79 | 110.02 | 113.53 | 98.98 | 94.97 | 81.95 | 75.94 | 87.14 | 88.18 | 102.77 | 112.18 | 121.82 |

Total = Sum(45)$_{1…12}$ = 1213.27 (45)

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

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (46)m= | 18.87 | 16.5 | 17.03 | 14.85 | 14.25 | 12.29 | 11.39 | 13.07 | 13.23 | 15.42 | 16.83 | 18.27 | (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) = — 110 (50)

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

Hot water storage loss factor from Table 2 (kWh/litre/day) — 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a — 1.03 (52)

Temperature factor from Table 2b — 0.6 (53)

Energy lost from water storage, kWh/year — (47) x (51) x (52) x (53) = — 1.03 (54)

Enter (50) or (54) in (55) — 1.03 (55)

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

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (56)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (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

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (57)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (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)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (59)m= | 23.26 | 21.01 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | (59) |

# DER WorkSheet: New dwelling design stage

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 | (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= | 181.07 | 159.94 | 168.8 | 152.47 | 150.25 | 135.45 | 131.22 | 142.42 | 141.68 | 158.05 | 165.67 | 177.1 | (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= | 181.07 | 159.94 | 168.8 | 152.47 | 150.25 | 135.45 | 131.22 | 142.42 | 141.68 | 158.05 | 165.67 | 177.1 | |

Output from water heater (annual)$_{1...12}$ 1864.11 (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= | 86.05 | 76.52 | 81.97 | 75.7 | 75.8 | 70.04 | 69.47 | 73.2 | 72.12 | 78.39 | 80.1 | 84.73 | (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= | 90.34 | 90.34 | 90.34 | 90.34 | 90.34 | 90.34 | 90.34 | 90.34 | 90.34 | 90.34 | 90.34 | 90.34 | (66) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (67)m= | 14.04 | 12.47 | 10.14 | 7.68 | 5.74 | 4.85 | 5.24 | 6.81 | 9.13 | 11.6 | 13.54 | 14.43 | (67) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (68)m= | 157.5 | 159.14 | 155.02 | 146.25 | 135.18 | 124.78 | 117.83 | 116.2 | 120.31 | 129.08 | 140.15 | 150.55 | (68) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (69)m= | 32.03 | 32.03 | 32.03 | 32.03 | 32.03 | 32.03 | 32.03 | 32.03 | 32.03 | 32.03 | 32.03 | 32.03 | (69) |

Pumps and fans gains (Table 5a)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (70)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (70) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (71)m= | -72.27 | -72.27 | -72.27 | -72.27 | -72.27 | -72.27 | -72.27 | -72.27 | -72.27 | -72.27 | -72.27 | -72.27 | (71) |

Water heating gains (Table 5)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (72)m= | 115.65 | 113.87 | 110.17 | 105.15 | 101.88 | 97.28 | 93.38 | 98.38 | 100.16 | 105.37 | 111.24 | 113.88 | (72) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (73)m= | 337.3 | 335.58 | 325.44 | 309.18 | 292.9 | 277.01 | 266.54 | 271.49 | 279.71 | 296.15 | 315.03 | 328.97 | (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 | 12.07 | x | 11.28 | x | 0.63 | x | 0.7 | = | 41.62 | (75) |
| Northeast 0.9x | 0.77 | x | 12.07 | x | 22.97 | x | 0.63 | x | 0.7 | = | 84.72 | (75) |
| Northeast 0.9x | 0.77 | x | 12.07 | x | 41.38 | x | 0.63 | x | 0.7 | = | 152.64 | (75) |
| Northeast 0.9x | 0.77 | x | 12.07 | x | 67.96 | x | 0.63 | x | 0.7 | = | 250.67 | (75) |
| Northeast 0.9x | 0.77 | x | 12.07 | x | 91.35 | x | 0.63 | x | 0.7 | = | 336.95 | (75) |

# DER WorkSheet: New dwelling design stage

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Northeast | 0.9x | 0.77 | x | 12.07 | x | 97.38 | x | 0.63 | x | 0.7 | = | 359.23 | (75) |
| Northeast | 0.9x | 0.77 | x | 12.07 | x | 91.1 | x | 0.63 | x | 0.7 | = | 336.05 | (75) |
| Northeast | 0.9x | 0.77 | x | 12.07 | x | 72.63 | x | 0.63 | x | 0.7 | = | 267.9 | (75) |
| Northeast | 0.9x | 0.77 | x | 12.07 | x | 50.42 | x | 0.63 | x | 0.7 | = | 185.99 | (75) |
| Northeast | 0.9x | 0.77 | x | 12.07 | x | 28.07 | x | 0.63 | x | 0.7 | = | 103.53 | (75) |
| Northeast | 0.9x | 0.77 | x | 12.07 | x | 14.2 | x | 0.63 | x | 0.7 | = | 52.37 | (75) |
| Northeast | 0.9x | 0.77 | x | 12.07 | x | 9.21 | x | 0.63 | x | 0.7 | = | 33.99 | (75) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (83)m= | 41.62 | 84.72 | 152.64 | 250.67 | 336.95 | 359.23 | 336.05 | 267.9 | 185.99 | 103.53 | 52.37 | 33.99 | (83) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (84)m= | 378.92 | 420.3 | 478.07 | 559.85 | 629.86 | 636.24 | 602.59 | 539.39 | 465.7 | 399.68 | 367.4 | 362.95 | (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= | 0.98 | 0.96 | 0.91 | 0.79 | 0.6 | 0.41 | 0.3 | 0.35 | 0.59 | 0.86 | 0.96 | 0.98 | (86) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (87)m= | 20.03 | 20.19 | 20.48 | 20.8 | 20.95 | 20.99 | 21 | 21 | 20.97 | 20.74 | 20.34 | 20 | (87) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (88)m= | 20.25 | 20.25 | 20.25 | 20.26 | 20.27 | 20.28 | 20.28 | 20.28 | 20.28 | 20.27 | 20.26 | 20.26 | (88) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (89)m= | 0.97 | 0.95 | 0.9 | 0.76 | 0.56 | 0.37 | 0.25 | 0.3 | 0.54 | 0.83 | 0.95 | 0.98 | (89) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (90)m= | 18.94 | 19.19 | 19.59 | 20.03 | 20.22 | 20.28 | 20.28 | 20.28 | 20.25 | 19.97 | 19.41 | 18.92 | (90) |

fLA = Living area ÷ (4) = 0.47 (91)

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (92)m= | 19.45 | 19.66 | 20.01 | 20.4 | 20.57 | 20.62 | 20.62 | 20.62 | 20.59 | 20.33 | 19.85 | 19.43 | (92) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (93)m= | 19.45 | 19.66 | 20.01 | 20.4 | 20.57 | 20.62 | 20.62 | 20.62 | 20.59 | 20.33 | 19.85 | 19.43 | (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= | 0.97 | 0.95 | 0.89 | 0.76 | 0.57 | 0.39 | 0.28 | 0.32 | 0.56 | 0.84 | 0.94 | 0.97 | (94) |
| Useful gains, hmGm , W = (94)m x (84)m | | | | | | | | | | | | | |
| (95)m= | 365.75 | 397.48 | 427.33 | 427.25 | 360.81 | 247.22 | 166.11 | 173.41 | 261.73 | 334.22 | 345.95 | 352.08 | (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= | 661.94 | 642.24 | 585.42 | 487.92 | 374.76 | 248.93 | 166.37 | 173.92 | 270.77 | 411.33 | 543.52 | 654.55 | (97) |
| Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m | | | | | | | | | | | | | |
| (98)m= | 220.37 | 164.48 | 117.62 | 43.69 | 10.37 | 0 | 0 | 0 | 0 | 57.37 | 142.25 | 225.03 | |

# DER WorkSheet: New dwelling design stage

| | | | |
|---|---|---|---|
| | Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = | 981.18 | (98) |
| Space heating requirement in kWh/m²/year | | 18.18 | (99) |

## 9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

| | | | |
|---|---|---|---|
| Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none | | 0 | (301) |
| Fraction of space heat from community system 1 – (301) = | | 1 | (302) |

*The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.*

| | | | |
|---|---|---|---|
| Fraction of heat from Community boilers | | 1 | (303a) |
| Fraction of total space heat from Community boilers | (302) x (303a) = | 1 | (304a) |
| Factor for control and charging method (Table 4c(3)) for community heating system | | 1 | (305) |
| Distribution loss factor (Table 12c) for community heating system | | 1.05 | (306) |
| **Space heating** | | **kWh/year** | |
| Annual space heating requirement | | 981.18 | |
| Space heat from Community boilers | (98) x (304a) x (305) x (306) = | 1030.24 | (307a) |
| Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) | | 0 | (308 |
| Space heating requirement from secondary/supplementary system | (98) x (301) x 100 ÷ (308) = | 0 | (309) |
| **Water heating** | | | |
| Annual water heating requirement | | 1864.11 | |
| If DHW from community scheme:<br>Water heat from Community boilers | (64) x (303a) x (305) x (306) = | 1957.32 | (310a) |
| Electricity used for heat distribution | 0.01 × [(307a)…(307e) + (310a)…(310e)] = | 29.88 | (313) |
| Cooling System Energy Efficiency Ratio | | 0 | (314) |
| Space cooling (if there is a fixed cooling system, if not enter 0) | = (107) ÷ (314) = | 0 | (315) |
| Electricity for pumps and fans within dwelling (Table 4f):<br>mechanical ventilation - balanced, extract or positive input from outside | | 114.79 | (330a) |
| warm air heating system fans | | 0 | (330b) |
| pump for solar water heating | | 0 | (330g) |
| Total electricity for the above, kWh/year | =(330a) + (330b) + (330g) = | 114.79 | (331) |
| Energy for lighting (calculated in Appendix L) | | 247.96 | (332) |
| Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) = | | 3350.31 | (338) |

## 12b. CO2 Emissions – Community heating scheme

| | | Energy kWh/year | Emission factor kg CO2/kWh | | Emissions kg CO2/year | |
|---|---|---|---|---|---|---|
| CO2 from other sources of space and water heating (not CHP)<br>Efficiency of heat source 1 (%) | If there is CHP using two fuels repeat (363) to (366) for the second fuel | | | | 96 | (367a) |
| CO2 associated with heat source 1 | [(307b)+(310b)] x 100 ÷ (367b) x | | 0.22 | = | 672.2 | (367) |
| Electrical energy for heat distribution | [(313) x | | 0.52 | = | 15.51 | (372) |

# DER WorkSheet: New dwelling design stage

| | | | | | |
|---|---|---|---|---|---|
| Total CO2 associated with community systems | (363)…(366) + (368)...(372) | | = | 687.71 | (373) |
| CO2 associated with space heating (secondary) | (309) x | 0 | = | 0 | (374) |
| CO2 associated with water from immersion heater or instantaneous heater | (312) x | 0.22 | = | 0 | (375) |
| Total CO2 associated with space and water heating | (373) + (374) + (375) = | | | 687.71 | (376) |
| CO2 associated with electricity for pumps and fans within dwelling | (331)) x | 0.52 | = | 59.58 | (378) |
| CO2 associated with electricity for lighting | (332))) x | 0.52 | = | 128.69 | (379) |
| **Total CO2, kg/year** | sum of (376)…(382) = | | | 875.97 | (383) |
| **Dwelling CO2 Emission Rate** | (383) ÷ (4) = | | | 16.23 | (384) |
| **EI rating (section 14)** | | | | 88.14 | (385) |

# Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.50
*Printed on 06 December 2021 at 10:55:42*

## Project Information:

**Assessed By:** Neil Ingham (STRO010943) **Building Type:** Flat

## Dwelling Details:

**NEW DWELLING DESIGN STAGE** Total Floor Area: 69.44m²

**Site Reference :** Highgate Road - GREEN **Plot Reference:** 02 - E

**Address :**

## Client Details:

**Name:**

**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 (c)
Fuel factor: 1.00 (mains gas (c))

| | | |
|---|---|---|
| Target Carbon Dioxide Emission Rate (TER) | 16.69 kg/m² | |
| Dwelling Carbon Dioxide Emission Rate (DER) | 14.29 kg/m² | OK |

## 1b TFEE and DFEE

| | | |
|---|---|---|
| Target Fabric Energy Efficiency (TFEE) | 41.5 kWh/m² | |
| Dwelling Fabric Energy Efficiency (DFEE) | 33.7 kWh/m² | |
| | | OK |

## 2 Fabric U-values

| Element | Average | Highest | |
|---|---|---|---|
| External wall | 0.18 (max. 0.30) | 0.18 (max. 0.70) | OK |
| Party wall | 0.00 (max. 0.20) | - | OK |
| Floor | (no floor) | | |
| Roof | (no roof) | | |
| Openings | 1.40 (max. 2.00) | 1.40 (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 | 3.00 (design value) | |
| Maximum | 10.0 | OK |

## 4 Heating efficiency

| | |
|---|---|
| Main Heating system: | Community heating schemes - mains gas |
| Secondary heating system: | None |

## 5 Cylinder insulation

| | |
|---|---|
| Hot water Storage: | No cylinder |

## 6 Controls

| | | |
|---|---|---|
| Space heating controls | Charging system linked to use of community heating, programmer and at least two room thermostats | OK |
| Hot water controls: | No cylinder thermostat<br>No cylinder | |

# Regulations Compliance Report

| | | |
|---|---|---|
| **7 Low energy lights** | | |
| Percentage of fixed lights with low-energy fittings | 100.0% | |
| Minimum | 75.0% | **OK** |
| **8 Mechanical ventilation** | | |
| Continuous supply and extract system | | |
| Specific fan power: | 0.54 | |
| Maximum | 1.5 | **OK** |
| MVHR efficiency: | 88% | |
| Minimum | 70% | **OK** |
| **9 Summertime temperature** | | |
| Overheating risk (Thames valley): | Slight | **OK** |
| Based on: | | |
| Overshading: | Average or unknown | |
| Windows facing: North East | 8.97m² | |
| Windows facing: South West | 2.92m² | |
| Ventilation rate: | 6.00 | |
| **10 Key features** | | |
| Air permeablility | 3.0 m³/m²h | |
| Party  Walls U-value | 0 W/m²K | |
| Community heating, heat from boilers – mains gas | | |

# DER WorkSheet: New dwelling design stage

User Details:

| | | | |
|---|---|---|---|
| **Assessor Name:** | Neil Ingham | **Stroma Number:** | STRO010943 |
| **Software Name:** | Stroma FSAP 2012 | **Software Version:** | Version: 1.0.5.50 |

Property Address: 02 - E

**Address :**

## 1. Overall dwelling dimensions:

| | Area(m²) | | Av. Height(m) | | Volume(m³) | |
|---|---|---|---|---|---|---|
| Ground floor | 69.44 | (1a) x | 2.65 | (2a) = | 184.02 | (3a) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n) | 69.44 | (4) | | | | |
| Dwelling volume | | | | (3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) = | 184.02 | (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 | | | | | | | 0 | x 10 = | 0 | (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) = | 0 | ÷ (5) = | 0 | (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 | | 3 | (17) |
| If based on air permeability value, then | (18) = [(17) ÷ 20]+(8), otherwise (18) = (16) | 0.15 | (18) |

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

| | | | |
|---|---|---|---|
| Number of sides sheltered | | 0 | (19) |
| Shelter factor | (20) = 1 - [0.075 x (19)] = | 1 | (20) |
| Infiltration rate incorporating shelter factor | (21) = (18) x (20) = | 0.15 | (21) |

Infiltration rate modified for monthly wind speed

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

# DER WorkSheet: New dwelling design stage

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

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.19 | 0.19 | 0.18 | 0.16 | 0.16 | 0.14 | 0.14 | 0.14 | 0.15 | 0.16 | 0.17 | 0.18 |

*Calculate effective air change rate for the applicable case*

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 74.8 (23c)

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24a)m= | 0.32 | 0.31 | 0.31 | 0.29 | 0.29 | 0.27 | 0.27 | 0.26 | 0.28 | 0.29 | 0.29 | 0.3 | (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 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24d) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (25)m= | 0.32 | 0.31 | 0.31 | 0.29 | 0.29 | 0.27 | 0.27 | 0.26 | 0.28 | 0.29 | 0.29 | 0.3 | (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 | |
|---|---|---|---|---|---|---|---|---|---|---|
| Windows Type 1 | | | 8.97 | x1/[1/( 1.4 )+ 0.04] | | = | 11.89 | | | (27) |
| Windows Type 2 | | | 2.92 | x1/[1/( 1.4 )+ 0.04] | | = | 3.87 | | | (27) |
| Walls Type1 | 41.51 | 11.89 | 29.62 | x | 0.18 | = | 5.33 | 60 | 1777.2 | (29) |
| Walls Type2 | 16.73 | 0 | 16.73 | x | 0.17 | = | 2.81 | 60 | 1003.8 | (29) |
| Total area of elements, m² | | | 58.24 | | | | | | | (31) |
| Party wall | | | 40.43 | x | 0 | = | 0 | 45 | 1819.35 | (32) |
| Party floor | | | 69.44 | | | | | 40 | 2777.6 | (32a) |
| Party ceiling | | | 69.44 | | | | | 30 | 2083.2 | (32b) |
| Internal wall ** | | | 136.21 | | | | | 9 | 1225.89 | (32c) |

** 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) = 23.9 (33)

Heat capacity Cm = S(A x k ) ((28)…(30) + (32) + (32a)…(32e) = 10687.04 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 153.9 (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 6.99 (36)

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

Total fabric heat loss (33) + (36) = 30.9 (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= | 19.27 | 19.04 | 18.81 | 17.67 | 17.44 | 16.3 | 16.3 | 16.08 | 16.76 | 17.44 | 17.9 | 18.35 | (38) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (39)m= | 50.16 | 49.93 | 49.71 | 48.57 | 48.34 | 47.2 | 47.2 | 46.97 | 47.66 | 48.34 | 48.79 | 49.25 | |

Average = Sum(39)$_{1…12}$ /12= 48.51 (39)

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

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (40)m= | 0.72 | 0.72 | 0.72 | 0.7 | 0.7 | 0.68 | 0.68 | 0.68 | 0.69 | 0.7 | 0.7 | 0.71 |

Average = Sum(40)$_{1…12}$ /12= 0.7 (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 2.23 (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 87.22 (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= | 95.94 | 92.45 | 88.97 | 85.48 | 81.99 | 78.5 | 78.5 | 81.99 | 85.48 | 88.97 | 92.45 | 95.94 | |
| | | | | | | | | | | Total = Sum(44)$_{1…12}$ = | | 1046.65 | (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= | 142.28 | 124.44 | 128.41 | 111.95 | 107.42 | 92.7 | 85.9 | 98.57 | 99.74 | 116.24 | 126.89 | 137.79 | |
| | | | | | | | | | | Total = Sum(45)$_{1…12}$ = | | 1372.32 | (45) |
| *If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)* | | | | | | | | | | | | | |
| (46)m= | 21.34 | 18.67 | 19.26 | 16.79 | 16.11 | 13.9 | 12.88 | 14.78 | 14.96 | 17.44 | 19.03 | 20.67 | (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) = 110 (50)

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

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (56)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (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= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (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= | 23.26 | 21.01 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | (59) |

# DER WorkSheet: New dwelling design stage

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 | (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= | 197.56 | 174.37 | 183.69 | 165.44 | 162.7 | 146.19 | 141.17 | 153.84 | 153.24 | 171.52 | 180.38 | 193.07 | (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= | 197.56 | 174.37 | 183.69 | 165.44 | 162.7 | 146.19 | 141.17 | 153.84 | 153.24 | 171.52 | 180.38 | 193.07 | |

Output from water heater (annual)$_{1...12}$ 2023.16 (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= | 91.53 | 81.32 | 86.92 | 80.02 | 79.94 | 73.62 | 72.78 | 76.99 | 75.96 | 82.87 | 84.98 | 90.04 | (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= | 111.62 | 111.62 | 111.62 | 111.62 | 111.62 | 111.62 | 111.62 | 111.62 | 111.62 | 111.62 | 111.62 | 111.62 | (66) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (67)m= | 18 | 15.98 | 13 | 9.84 | 7.36 | 6.21 | 6.71 | 8.72 | 11.71 | 14.87 | 17.35 | 18.5 | (67) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (68)m= | 195.99 | 198.02 | 192.9 | 181.98 | 168.21 | 155.27 | 146.62 | 144.59 | 149.71 | 160.62 | 174.4 | 187.34 | (68) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (69)m= | 34.16 | 34.16 | 34.16 | 34.16 | 34.16 | 34.16 | 34.16 | 34.16 | 34.16 | 34.16 | 34.16 | 34.16 | (69) |

Pumps and fans gains (Table 5a)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (70)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (70) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (71)m= | -89.3 | -89.3 | -89.3 | -89.3 | -89.3 | -89.3 | -89.3 | -89.3 | -89.3 | -89.3 | -89.3 | -89.3 | (71) |

Water heating gains (Table 5)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (72)m= | 123.02 | 121.01 | 116.83 | 111.14 | 107.44 | 102.24 | 97.82 | 103.49 | 105.5 | 111.39 | 118.03 | 121.02 | (72) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (73)m= | 393.49 | 391.5 | 379.21 | 359.45 | 339.5 | 320.21 | 307.64 | 313.29 | 323.41 | 343.36 | 366.27 | 383.34 | (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 | 8.97 | x | 11.28 | x | 0.63 | x | 0.7 | = | 30.93 | (75) |
| Northeast 0.9x | 0.77 | x | 8.97 | x | 22.97 | x | 0.63 | x | 0.7 | = | 62.96 | (75) |
| Northeast 0.9x | 0.77 | x | 8.97 | x | 41.38 | x | 0.63 | x | 0.7 | = | 113.43 | (75) |
| Northeast 0.9x | 0.77 | x | 8.97 | x | 67.96 | x | 0.63 | x | 0.7 | = | 186.29 | (75) |
| Northeast 0.9x | 0.77 | x | 8.97 | x | 91.35 | x | 0.63 | x | 0.7 | = | 250.41 | (75) |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Northeast 0.9x | 0.77 | x | 8.97 | x | 97.38 | x | 0.63 | x | 0.7 | = | 266.96 | (75) |
| Northeast 0.9x | 0.77 | x | 8.97 | x | 91.1 | x | 0.63 | x | 0.7 | = | 249.74 | (75) |
| Northeast 0.9x | 0.77 | x | 8.97 | x | 72.63 | x | 0.63 | x | 0.7 | = | 199.1 | (75) |
| Northeast 0.9x | 0.77 | x | 8.97 | x | 50.42 | x | 0.63 | x | 0.7 | = | 138.22 | (75) |
| Northeast 0.9x | 0.77 | x | 8.97 | x | 28.07 | x | 0.63 | x | 0.7 | = | 76.94 | (75) |
| Northeast 0.9x | 0.77 | x | 8.97 | x | 14.2 | x | 0.63 | x | 0.7 | = | 38.92 | (75) |
| Northeast 0.9x | 0.77 | x | 8.97 | x | 9.21 | x | 0.63 | x | 0.7 | = | 25.26 | (75) |
| Southwest0.9x | 0.77 | x | 2.92 | x | 36.79 | | 0.63 | x | 0.7 | = | 32.83 | (79) |
| Southwest0.9x | 0.77 | x | 2.92 | x | 62.67 | | 0.63 | x | 0.7 | = | 55.93 | (79) |
| Southwest0.9x | 0.77 | x | 2.92 | x | 85.75 | | 0.63 | x | 0.7 | = | 76.52 | (79) |
| Southwest0.9x | 0.77 | x | 2.92 | x | 106.25 | | 0.63 | x | 0.7 | = | 94.82 | (79) |
| Southwest0.9x | 0.77 | x | 2.92 | x | 119.01 | | 0.63 | x | 0.7 | = | 106.2 | (79) |
| Southwest0.9x | 0.77 | x | 2.92 | x | 118.15 | | 0.63 | x | 0.7 | = | 105.44 | (79) |
| Southwest0.9x | 0.77 | x | 2.92 | x | 113.91 | | 0.63 | x | 0.7 | = | 101.65 | (79) |
| Southwest0.9x | 0.77 | x | 2.92 | x | 104.39 | | 0.63 | x | 0.7 | = | 93.16 | (79) |
| Southwest0.9x | 0.77 | x | 2.92 | x | 92.85 | | 0.63 | x | 0.7 | = | 82.86 | (79) |
| Southwest0.9x | 0.77 | x | 2.92 | x | 69.27 | | 0.63 | x | 0.7 | = | 61.81 | (79) |
| Southwest0.9x | 0.77 | x | 2.92 | x | 44.07 | | 0.63 | x | 0.7 | = | 39.33 | (79) |
| Southwest0.9x | 0.77 | x | 2.92 | x | 31.49 | | 0.63 | x | 0.7 | = | 28.1 | (79) |

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

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (83)m= | 63.76 | 118.89 | 189.96 | 281.11 | 356.62 | 372.4 | 351.39 | 292.25 | 221.08 | 138.76 | 78.25 | 53.36 | (83) |

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

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (84)m= | 457.26 | 510.39 | 569.17 | 640.56 | 696.12 | 692.61 | 659.04 | 605.54 | 544.49 | 482.12 | 444.51 | 436.7 | (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= | 0.98 | 0.96 | 0.91 | 0.8 | 0.62 | 0.43 | 0.31 | 0.36 | 0.59 | 0.85 | 0.96 | 0.98 | (86) |

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

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (87)m= | 20.14 | 20.31 | 20.56 | 20.83 | 20.96 | 20.99 | 21 | 21 | 20.98 | 20.8 | 20.44 | 20.12 | (87) |

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

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (88)m= | 20.32 | 20.32 | 20.33 | 20.34 | 20.34 | 20.36 | 20.36 | 20.36 | 20.35 | 20.34 | 20.34 | 20.33 | (88) |

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

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (89)m= | 0.97 | 0.95 | 0.9 | 0.77 | 0.58 | 0.39 | 0.27 | 0.31 | 0.54 | 0.83 | 0.95 | 0.98 | (89) |

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

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (90)m= | 19.17 | 19.41 | 19.77 | 20.14 | 20.3 | 20.35 | 20.36 | 20.36 | 20.33 | 20.11 | 19.61 | 19.15 | (90) |

fLA = Living area ÷ (4) = 0.34 (91)

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

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (92)m= | 19.51 | 19.72 | 20.04 | 20.38 | 20.53 | 20.57 | 20.58 | 20.58 | 20.55 | 20.35 | 19.9 | 19.48 | (92) |

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

# DER WorkSheet: New dwelling design stage

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (93)m= | 19.51 | 19.72 | 20.04 | 20.38 | 20.53 | 20.57 | 20.58 | 20.58 | 20.55 | 20.35 | 19.9 | 19.48 | (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= | 0.97 | 0.94 | 0.89 | 0.77 | 0.59 | 0.4 | 0.28 | 0.32 | 0.55 | 0.83 | 0.94 | 0.97 | (94) |
| Useful gains, hmGm , W = (94)m x (84)m | | | | | | | | | | | | | |
| (95)m= | 441.94 | 482.27 | 508.95 | 494.78 | 412.34 | 280.41 | 187.58 | 195.95 | 300.31 | 398.27 | 418.19 | 424.3 | (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= | 762.69 | 740.05 | 672.95 | 557.45 | 426.72 | 281.99 | 187.77 | 196.33 | 307.58 | 471.09 | 624.48 | 752.71 | (97) |
| Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m | | | | | | | | | | | | | |
| (98)m= | 238.64 | 173.23 | 122.02 | 45.12 | 10.7 | 0 | 0 | 0 | 0 | 54.18 | 148.53 | 244.34 | |

| | | |
|---|---|---|
| Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = | 1036.76 | (98) |
| Space heating requirement in kWh/m²/year | 14.93 | (99) |

## 9b. Energy requirements – Community heating scheme

| | | | |
|---|---|---|---|
| This part is used for space heating, space cooling or water heating provided by a community scheme. Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none | | 0 | (301) |
| Fraction of space heat from community system 1 – (301) = | | 1 | (302) |

*The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.*

| | | | |
|---|---|---|---|
| Fraction of heat from Community boilers | | 1 | (303a) |
| Fraction of total space heat from Community boilers | (302) x (303a) = | 1 | (304a) |
| Factor for control and charging method (Table 4c(3)) for community heating system | | 1 | (305) |
| Distribution loss factor (Table 12c) for community heating system | | 1.05 | (306) |
| **Space heating** | | **kWh/year** | |
| Annual space heating requirement | | 1036.76 | |
| Space heat from Community boilers | (98) x (304a) x (305) x (306) = | 1088.59 | (307a) |
| Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) | | 0 | (308 |
| Space heating requirement from secondary/supplementary system | (98) x (301) x 100 ÷ (308) = | 0 | (309) |
| **Water heating** | | | |
| Annual water heating requirement | | 2023.16 | |
| If DHW from community scheme: Water heat from Community boilers | (64) x (303a) x (305) x (306) = | 2124.32 | (310a) |
| Electricity used for heat distribution | 0.01 × [(307a)…(307e) + (310a)…(310e)] = | 32.13 | (313) |
| Cooling System Energy Efficiency Ratio | | 0 | (314) |
| Space cooling (if there is a fixed cooling system, if not enter 0) | = (107) ÷ (314) = | 0 | (315) |
| Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside | | 169.72 | (330a) |

# DER WorkSheet: New dwelling design stage

| | | | |
|---|---|---|---|
| warm air heating system fans | | 0 | (330b) |
| pump for solar water heating | | 0 | (330g) |
| Total electricity for the above, kWh/year | =(330a) + (330b) + (330g) = | 169.72 | (331) |
| Energy for lighting (calculated in Appendix L) | | 317.84 | (332) |
| Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) = | | 3700.47 | (338) |

## 12b. CO2 Emissions – Community heating scheme

| | | Energy kWh/year | Emission factor kg CO2/kWh | | Emissions kg CO2/year | |
|---|---|---|---|---|---|---|
| CO2 from other sources of space and water heating (not CHP) | | | | | | |
| Efficiency of heat source 1 (%) | If there is CHP using two fuels repeat (363) to (366) for the second fuel | | | | 96 | (367a) |
| CO2 associated with heat source 1 | [(307b)+(310b)] x 100 ÷ (367b) x | | 0.22 | = | 722.91 | (367) |
| Electrical energy for heat distribution | [(313) x | | 0.52 | = | 16.68 | (372) |
| Total CO2 associated with community systems | (363)…(366) + (368)...(372) | | | = | 739.58 | (373) |
| CO2 associated with space heating (secondary) | (309) x | | 0 | = | 0 | (374) |
| CO2 associated with water from immersion heater or instantaneous heater | (312) x | | 0.22 | = | 0 | (375) |
| Total CO2 associated with space and water heating | (373) + (374) + (375) = | | | | 739.58 | (376) |
| CO2 associated with electricity for pumps and fans within dwelling | (331)) x | | 0.52 | = | 88.09 | (378) |
| CO2 associated with electricity for lighting | (332))) x | | 0.52 | = | 164.96 | (379) |
| **Total CO2, kg/year** | sum of (376)…(382) = | | | | 992.62 | (383) |
| **Dwelling CO2 Emission Rate** | (383) ÷ (4) = | | | | 14.29 | (384) |
| **EI rating (section 14)** | | | | | 88.38 | (385) |

# Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.50
*Printed on 06 December 2021 at 10:55:32*

## Project Information:

**Assessed By:** Neil Ingham (STRO010943) **Building Type:** Flat

## Dwelling Details:

**NEW DWELLING DESIGN STAGE** Total Floor Area: 69.61m²

**Site Reference :** Highgate Road - GREEN **Plot Reference:** 02 - F

**Address :**

## Client Details:

**Name:**

**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 (c)
Fuel factor: 1.00 (mains gas (c))

| | | |
|---|---|---|
| Target Carbon Dioxide Emission Rate (TER) | 16.77 kg/m² | |
| Dwelling Carbon Dioxide Emission Rate (DER) | 14.35 kg/m² | OK |

## 1b TFEE and DFEE

| | | |
|---|---|---|
| Target Fabric Energy Efficiency (TFEE) | 41.9 kWh/m² | |
| Dwelling Fabric Energy Efficiency (DFEE) | 34.0 kWh/m² | |
| | | OK |

## 2 Fabric U-values

| Element | Average | Highest | |
|---|---|---|---|
| External wall | 0.18 (max. 0.30) | 0.18 (max. 0.70) | OK |
| Party wall | 0.00 (max. 0.20) | - | OK |
| Floor | (no floor) | | |
| Roof | (no roof) | | |
| Openings | 1.40 (max. 2.00) | 1.40 (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 | 3.00 (design value) | |
| Maximum | 10.0 | OK |

## 4 Heating efficiency

| | |
|---|---|
| Main Heating system: | Community heating schemes - mains gas |
| Secondary heating system: | None |

## 5 Cylinder insulation

| | |
|---|---|
| Hot water Storage: | No cylinder |

## 6 Controls

| | | |
|---|---|---|
| Space heating controls | Charging system linked to use of community heating, programmer and at least two room thermostats | OK |
| Hot water controls: | No cylinder thermostat<br>No cylinder | |

# Regulations Compliance Report

## 7 Low energy lights

| | | |
|---|---|---|
| Percentage of fixed lights with low-energy fittings | 100.0% | |
| Minimum | 75.0% | **OK** |

## 8 Mechanical ventilation

| | | |
|---|---|---|
| Continuous supply and extract system | | |
| Specific fan power: | 0.54 | |
| Maximum | 1.5 | **OK** |
| MVHR efficiency: | 88% | |
| Minimum | 70% | **OK** |

## 9 Summertime temperature

| | | |
|---|---|---|
| Overheating risk (Thames valley): | Slight | **OK** |
| Based on: | | |
| Overshading: | Average or unknown | |
| Windows facing: North East | $8.97m^2$ | |
| Windows facing: South West | $2.92m^2$ | |
| Ventilation rate: | 6.00 | |

## 10 Key features

| | |
|---|---|
| Air permeablility | $3.0 m^3/m^2h$ |
| Party Walls U-value | $0 W/m^2K$ |
| Community heating, heat from boilers – mains gas | |

# DER WorkSheet: New dwelling design stage

User Details:

| | | | |
|---|---|---|---|
| **Assessor Name:** | Neil Ingham | **Stroma Number:** | STRO010943 |
| **Software Name:** | Stroma FSAP 2012 | **Software Version:** | Version: 1.0.5.50 |

Property Address: 02 - F

**Address :**

## 1. Overall dwelling dimensions:

| | Area(m²) | | | Av. Height(m) | | | Volume(m³) | |
|---|---|---|---|---|---|---|---|---|
| Ground floor | 69.61 | (1a) | x | 2.65 | (2a) | = | 184.47 | (3a) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n) | 69.61 | (4) | | | | | | |
| Dwelling volume | | | | (3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) = | | | 184.47 | (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 | | | | | | | 0 | x 10 = | 0 | (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) = | 0 | ÷ (5) = | 0 | (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 | | 3 | (17) |
| If based on air permeability value, then | (18) = [(17) ÷ 20]+(8), otherwise (18) = (16) | 0.15 | (18) |

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

| | | | |
|---|---|---|---|
| Number of sides sheltered | | 0 | (19) |
| Shelter factor | (20) = 1 - [0.075 x (19)] = | 1 | (20) |
| Infiltration rate incorporating shelter factor | (21) = (18) x (20) = | 0.15 | (21) |

Infiltration rate modified for monthly wind speed

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

# DER WorkSheet: New dwelling design stage

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

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.19 | 0.19 | 0.18 | 0.16 | 0.16 | 0.14 | 0.14 | 0.14 | 0.15 | 0.16 | 0.17 | 0.18 |

*Calculate effective air change rate for the applicable case*

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 74.8 (23c)

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24a)m= | 0.32 | 0.31 | 0.31 | 0.29 | 0.29 | 0.27 | 0.27 | 0.26 | 0.28 | 0.29 | 0.29 | 0.3 | (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 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24d) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (25)m= | 0.32 | 0.31 | 0.31 | 0.29 | 0.29 | 0.27 | 0.27 | 0.26 | 0.28 | 0.29 | 0.29 | 0.3 | (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 | |
|---|---|---|---|---|---|---|---|---|
| Windows Type 1 | | | 8.97 | x1/[1/( 1.4 )+ 0.04] = | 11.89 | | | (27) |
| Windows Type 2 | | | 2.92 | x1/[1/( 1.4 )+ 0.04] = | 3.87 | | | (27) |
| Walls Type1 | 41.59 | 11.89 | 29.7 | x 0.18 = | 5.35 | 60 | 1782 | (29) |
| Walls Type2 | 18.41 | 0 | 18.41 | x 0.17 = | 3.09 | 60 | 1104.6 | (29) |
| Total area of elements, m² | | | 60 | | | | | (31) |
| Party wall | | | 38.68 | x 0 = | 0 | 45 | 1740.6 | (32) |
| Party floor | | | 69.61 | | | 40 | 2784.4 | (32a) |
| Party ceiling | | | 69.61 | | | 30 | 2088.3 | (32b) |
| Internal wall ** | | | 136.21 | | | 9 | 1225.89 | (32c) |

** 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) = 24.2 (33)

Heat capacity Cm = S(A x k ) ((28)…(30) + (32) + (32a)…(32e) = 10725.79 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 154.08 (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 6.99 (36)

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

Total fabric heat loss (33) + (36) = 31.19 (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= | 19.31 | 19.08 | 18.86 | 17.71 | 17.49 | 16.34 | 16.34 | 16.12 | 16.8 | 17.49 | 17.94 | 18.4 | (38) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (39)m= | 50.5 | 50.28 | 50.05 | 48.91 | 48.68 | 47.54 | 47.54 | 47.31 | 47.99 | 48.68 | 49.13 | 49.59 | |

Average = Sum(39)1…12 /12= 48.85 (39)

# DER WorkSheet: New dwelling design stage

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

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (40)m= | 0.73 | 0.72 | 0.72 | 0.7 | 0.7 | 0.68 | 0.68 | 0.68 | 0.69 | 0.7 | 0.71 | 0.71 |

Average = Sum(40)$_{1…12}$ /12= 0.7 (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 2.24 (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 87.32 (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= | 96.05 | 92.56 | 89.07 | 85.57 | 82.08 | 78.59 | 78.59 | 82.08 | 85.57 | 89.07 | 92.56 | 96.05 |

Total = Sum(44)$_{1…12}$ = 1047.84 (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= | 142.44 | 124.58 | 128.56 | 112.08 | 107.54 | 92.8 | 85.99 | 98.68 | 99.86 | 116.37 | 127.03 | 137.95 |

Total = Sum(45)$_{1…12}$ = 1373.88 (45)

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (46)m= | 21.37 | 18.69 | 19.28 | 16.81 | 16.13 | 13.92 | 12.9 | 14.8 | 14.98 | 17.46 | 19.05 | 20.69 | (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) = 110 (50)

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

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (56)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (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= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (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= | 23.26 | 21.01 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | (59) |

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 | (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= | 197.72 | 174.51 | 183.83 | 165.57 | 162.82 | 146.29 | 141.27 | 153.96 | 153.35 | 171.65 | 180.52 | 193.22 | (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= | 197.72 | 174.51 | 183.83 | 165.57 | 162.82 | 146.29 | 141.27 | 153.96 | 153.35 | 171.65 | 180.52 | 193.22 | |

Output from water heater (annual)$_{1...12}$ 2024.72 (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= | 91.58 | 81.36 | 86.97 | 80.06 | 79.98 | 73.65 | 72.81 | 77.03 | 76 | 82.92 | 85.03 | 90.09 | (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= | 111.83 | 111.83 | 111.83 | 111.83 | 111.83 | 111.83 | 111.83 | 111.83 | 111.83 | 111.83 | 111.83 | 111.83 | (66) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (67)m= | 18.04 | 16.02 | 13.03 | 9.87 | 7.37 | 6.23 | 6.73 | 8.74 | 11.74 | 14.9 | 17.39 | 18.54 | (67) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (68)m= | 196.39 | 198.42 | 193.29 | 182.36 | 168.55 | 155.58 | 146.92 | 144.88 | 150.02 | 160.95 | 174.75 | 187.72 | (68) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (69)m= | 34.18 | 34.18 | 34.18 | 34.18 | 34.18 | 34.18 | 34.18 | 34.18 | 34.18 | 34.18 | 34.18 | 34.18 | (69) |

Pumps and fans gains (Table 5a)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (70)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (70) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (71)m= | -89.46 | -89.46 | -89.46 | -89.46 | -89.46 | -89.46 | -89.46 | -89.46 | -89.46 | -89.46 | -89.46 | -89.46 | (71) |

Water heating gains (Table 5)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (72)m= | 123.1 | 121.08 | 116.89 | 111.2 | 107.5 | 102.29 | 97.87 | 103.54 | 105.55 | 111.45 | 118.1 | 121.09 | (72) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (73)m= | 394.07 | 392.08 | 379.76 | 359.97 | 339.98 | 320.65 | 308.06 | 313.71 | 323.86 | 343.85 | 366.79 | 383.9 | (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 | 8.97 | x | 11.28 | x | 0.63 | x | 0.7 | = | 30.93 | (75) |
| Northeast 0.9x | 0.77 | x | 8.97 | x | 22.97 | x | 0.63 | x | 0.7 | = | 62.96 | (75) |
| Northeast 0.9x | 0.77 | x | 8.97 | x | 41.38 | x | 0.63 | x | 0.7 | = | 113.43 | (75) |
| Northeast 0.9x | 0.77 | x | 8.97 | x | 67.96 | x | 0.63 | x | 0.7 | = | 186.29 | (75) |
| Northeast 0.9x | 0.77 | x | 8.97 | x | 91.35 | x | 0.63 | x | 0.7 | = | 250.41 | (75) |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Northeast | 0.9x | 0.77 | x | 8.97 | x | 97.38 | x | 0.63 | x | 0.7 | = | 266.96 | (75) |
| Northeast | 0.9x | 0.77 | x | 8.97 | x | 91.1 | x | 0.63 | x | 0.7 | = | 249.74 | (75) |
| Northeast | 0.9x | 0.77 | x | 8.97 | x | 72.63 | x | 0.63 | x | 0.7 | = | 199.1 | (75) |
| Northeast | 0.9x | 0.77 | x | 8.97 | x | 50.42 | x | 0.63 | x | 0.7 | = | 138.22 | (75) |
| Northeast | 0.9x | 0.77 | x | 8.97 | x | 28.07 | x | 0.63 | x | 0.7 | = | 76.94 | (75) |
| Northeast | 0.9x | 0.77 | x | 8.97 | x | 14.2 | x | 0.63 | x | 0.7 | = | 38.92 | (75) |
| Northeast | 0.9x | 0.77 | x | 8.97 | x | 9.21 | x | 0.63 | x | 0.7 | = | 25.26 | (75) |
| Southwest | 0.9x | 0.77 | x | 2.92 | x | 36.79 | | 0.63 | x | 0.7 | = | 32.83 | (79) |
| Southwest | 0.9x | 0.77 | x | 2.92 | x | 62.67 | | 0.63 | x | 0.7 | = | 55.93 | (79) |
| Southwest | 0.9x | 0.77 | x | 2.92 | x | 85.75 | | 0.63 | x | 0.7 | = | 76.52 | (79) |
| Southwest | 0.9x | 0.77 | x | 2.92 | x | 106.25 | | 0.63 | x | 0.7 | = | 94.82 | (79) |
| Southwest | 0.9x | 0.77 | x | 2.92 | x | 119.01 | | 0.63 | x | 0.7 | = | 106.2 | (79) |
| Southwest | 0.9x | 0.77 | x | 2.92 | x | 118.15 | | 0.63 | x | 0.7 | = | 105.44 | (79) |
| Southwest | 0.9x | 0.77 | x | 2.92 | x | 113.91 | | 0.63 | x | 0.7 | = | 101.65 | (79) |
| Southwest | 0.9x | 0.77 | x | 2.92 | x | 104.39 | | 0.63 | x | 0.7 | = | 93.16 | (79) |
| Southwest | 0.9x | 0.77 | x | 2.92 | x | 92.85 | | 0.63 | x | 0.7 | = | 82.86 | (79) |
| Southwest | 0.9x | 0.77 | x | 2.92 | x | 69.27 | | 0.63 | x | 0.7 | = | 61.81 | (79) |
| Southwest | 0.9x | 0.77 | x | 2.92 | x | 44.07 | | 0.63 | x | 0.7 | = | 39.33 | (79) |
| Southwest | 0.9x | 0.77 | x | 2.92 | x | 31.49 | | 0.63 | x | 0.7 | = | 28.1 | (79) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (83)m= | 63.76 | 118.89 | 189.96 | 281.11 | 356.62 | 372.4 | 351.39 | 292.25 | 221.08 | 138.76 | 78.25 | 53.36 | (83) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (84)m= | 457.84 | 510.96 | 569.72 | 641.07 | 696.59 | 693.05 | 659.46 | 605.97 | 544.94 | 482.6 | 445.04 | 437.26 | (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= | 0.98 | 0.96 | 0.92 | 0.8 | 0.62 | 0.44 | 0.32 | 0.36 | 0.59 | 0.85 | 0.96 | 0.98 | (86) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (87)m= | 20.14 | 20.3 | 20.55 | 20.83 | 20.96 | 20.99 | 21 | 21 | 20.98 | 20.79 | 20.44 | 20.12 | (87) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (88)m= | 20.32 | 20.32 | 20.32 | 20.34 | 20.34 | 20.36 | 20.36 | 20.36 | 20.35 | 20.34 | 20.34 | 20.33 | (88) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (89)m= | 0.97 | 0.95 | 0.9 | 0.77 | 0.58 | 0.39 | 0.27 | 0.31 | 0.54 | 0.83 | 0.95 | 0.98 | (89) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (90)m= | 19.16 | 19.4 | 19.76 | 20.13 | 20.3 | 20.35 | 20.36 | 20.36 | 20.33 | 20.1 | 19.6 | 19.14 | (90) |

fLA = Living area ÷ (4) = 0.38 (91)

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (92)m= | 19.53 | 19.74 | 20.06 | 20.4 | 20.55 | 20.6 | 20.6 | 20.6 | 20.58 | 20.37 | 19.92 | 19.51 | (92) |

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

# DER WorkSheet: New dwelling design stage

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (93)m= | 19.53 | 19.74 | 20.06 | 20.4 | 20.55 | 20.6 | 20.6 | 20.6 | 20.58 | 20.37 | 19.92 | 19.51 | (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= | 0.97 | 0.95 | 0.9 | 0.78 | 0.6 | 0.41 | 0.29 | 0.33 | 0.56 | 0.83 | 0.94 | 0.97 | (94) |
| Useful gains, hmGm , W = (94)m x (84)m | | | | | | | | | | | | | |
| (95)m= | 442.81 | 483.37 | 510.56 | 497.42 | 415.67 | 283.37 | 189.97 | 198.39 | 303.11 | 400.16 | 419.22 | 425.1 | (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= | 769.26 | 746.33 | 678.64 | 562.34 | 430.79 | 285.07 | 190.19 | 198.8 | 310.81 | 475.38 | 629.94 | 759.24 | (97) |
| Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m | | | | | | | | | | | | | |
| (98)m= | 242.87 | 176.71 | 125.05 | 46.74 | 11.25 | 0 | 0 | 0 | 0 | 55.96 | 151.71 | 248.6 | |

| | | | |
|---|---|---|---|
| | Total per year (kWh/year) = $Sum(98)_{1...5,9...12}$ = | 1058.9 | (98) |
| Space heating requirement in kWh/m²/year | | 15.21 | (99) |

## 9b. Energy requirements – Community heating scheme

| | | | |
|---|---|---|---|
| This part is used for space heating, space cooling or water heating provided by a community scheme.<br>Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none | | 0 | (301) |
| Fraction of space heat from community system 1 – (301) = | | 1 | (302) |

*The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.*

| | | | |
|---|---|---|---|
| Fraction of heat from Community boilers | | 1 | (303a) |
| Fraction of total space heat from Community boilers | (302) x (303a) = | 1 | (304a) |
| Factor for control and charging method (Table 4c(3)) for community heating system | | 1 | (305) |
| Distribution loss factor (Table 12c) for community heating system | | 1.05 | (306) |
| **Space heating** | | **kWh/year** | |
| Annual space heating requirement | | 1058.9 | |
| Space heat from Community boilers | (98) x (304a) x (305) x (306) = | 1111.84 | (307a) |
| Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) | | 0 | (308 |
| Space heating requirement from secondary/supplementary system | (98) x (301) x 100 ÷ (308) = | 0 | (309) |
| **Water heating** | | | |
| Annual water heating requirement | | 2024.72 | |
| If DHW from community scheme:<br>Water heat from Community boilers | (64) x (303a) x (305) x (306) = | 2125.95 | (310a) |
| Electricity used for heat distribution | 0.01 × [(307a)…(307e) + (310a)…(310e)] = | 32.38 | (313) |
| Cooling System Energy Efficiency Ratio | | 0 | (314) |
| Space cooling (if there is a fixed cooling system, if not enter 0) | = (107) ÷ (314) = | 0 | (315) |
| Electricity for pumps and fans within dwelling (Table 4f):<br>mechanical ventilation - balanced, extract or positive input from outside | | 170.14 | (330a) |

| | | | |
|---|---|---|---|
| warm air heating system fans | | 0 | (330b) |
| pump for solar water heating | | 0 | (330g) |
| Total electricity for the above, kWh/year | =(330a) + (330b) + (330g) = | 170.14 | (331) |
| Energy for lighting (calculated in Appendix L) | | 318.62 | (332) |
| Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) = | | 3726.56 | (338) |

## 12b. CO2 Emissions – Community heating scheme

| | | Energy kWh/year | Emission factor kg CO2/kWh | | Emissions kg CO2/year | |
|---|---|---|---|---|---|---|
| CO2 from other sources of space and water heating (not CHP) | | | | | | |
| Efficiency of heat source 1 (%) | If there is CHP using two fuels repeat (363) to (366) for the second fuel | | | | 96 | (367a) |
| CO2 associated with heat source 1 | [(307b)+(310b)] x 100 ÷ (367b) x | | 0.22 | = | 728.5 | (367) |
| Electrical energy for heat distribution | [(313) x | | 0.52 | = | 16.8 | (372) |
| Total CO2 associated with community systems | (363)…(366) + (368)...(372) | | | = | 745.31 | (373) |
| CO2 associated with space heating (secondary) | (309) x | | 0 | = | 0 | (374) |
| CO2 associated with water from immersion heater or instantaneous heater | (312) x | | 0.22 | = | 0 | (375) |
| Total CO2 associated with space and water heating | (373) + (374) + (375) = | | | | 745.31 | (376) |
| CO2 associated with electricity for pumps and fans within dwelling | (331)) x | | 0.52 | = | 88.3 | (378) |
| CO2 associated with electricity for lighting | (332))) x | | 0.52 | = | 165.36 | (379) |
| **Total CO2, kg/year** | sum of (376)…(382) = | | | | 998.97 | (383) |
| **Dwelling CO2 Emission Rate** | (383) ÷ (4) = | | | | 14.35 | (384) |
| **EI rating (section 14)** | | | | | 88.32 | (385) |

# Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.50
*Printed on 06 December 2021 at 10:55:20*

## Project Information:

**Assessed By:** Neil Ingham (STRO010943) **Building Type:** Flat

## Dwelling Details:

**NEW DWELLING DESIGN STAGE** Total Floor Area: 50.62m²

**Site Reference :** Highgate Road - GREEN **Plot Reference:** 02 - G

**Address :**

## Client Details:

**Name:**

**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 (c)
Fuel factor: 1.00 (mains gas (c))

| | | |
|---|---|---|
| Target Carbon Dioxide Emission Rate (TER) | 19.64 kg/m² | |
| Dwelling Carbon Dioxide Emission Rate (DER) | 16.45 kg/m² | OK |

## 1b TFEE and DFEE

| | | |
|---|---|---|
| Target Fabric Energy Efficiency (TFEE) | 48.0 kWh/m² | |
| Dwelling Fabric Energy Efficiency (DFEE) | 38.7 kWh/m² | |
| | | OK |

## 2 Fabric U-values

| Element | Average | Highest | |
|---|---|---|---|
| External wall | 0.17 (max. 0.30) | 0.18 (max. 0.70) | OK |
| Party wall | 0.00 (max. 0.20) | - | OK |
| Floor | (no floor) | | |
| Roof | (no roof) | | |
| Openings | 1.40 (max. 2.00) | 1.40 (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 | 3.00 (design value) | |
| Maximum | 10.0 | OK |

## 4 Heating efficiency

Main Heating system: Community heating schemes - mains gas

Secondary heating system: None

## 5 Cylinder insulation

Hot water Storage: No cylinder

## 6 Controls

| | | |
|---|---|---|
| Space heating controls | Charging system linked to use of community heating, programmer and at least two room thermostats | OK |
| Hot water controls: | No cylinder thermostat<br>No cylinder | |

# Regulations Compliance Report

## 7 Low energy lights

| | | |
|---|---|---|
| Percentage of fixed lights with low-energy fittings | 100.0% | |
| Minimum | 75.0% | **OK** |

## 8 Mechanical ventilation

| | | |
|---|---|---|
| Continuous supply and extract system | | |
| Specific fan power: | 0.47 | |
| Maximum | 1.5 | **OK** |
| MVHR efficiency: | 89% | |
| Minimum | 70% | **OK** |

## 9 Summertime temperature

| | | |
|---|---|---|
| Overheating risk (Thames valley): | Medium | **OK** |
| Based on: | | |
| Overshading: | Average or unknown | |
| Windows facing: North East | 8.97m² | |
| Ventilation rate: | 4.00 | |

## 10 Key features

| | |
|---|---|
| Air permeablility | 3.0 m³/m²h |
| Party  Walls U-value | 0 W/m²K |
| Community heating, heat from boilers – mains gas | |

# DER WorkSheet: New dwelling design stage

User Details:

| | | | |
|---|---|---|---|
| **Assessor Name:** | Neil Ingham | **Stroma Number:** | STRO010943 |
| **Software Name:** | Stroma FSAP 2012 | **Software Version:** | Version: 1.0.5.50 |

Property Address: 02 - G

**Address :**

## 1. Overall dwelling dimensions:

| | Area(m²) | | Av. Height(m) | | Volume(m³) | |
|---|---|---|---|---|---|---|
| Ground floor | 50.62 | (1a) x | 2.65 | (2a) = | 134.14 | (3a) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n) | 50.62 | (4) | | | | |
| Dwelling volume | | | (3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) = | | 134.14 | (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 | | | | | | | 0 | x 10 = | 0 | (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) = | 0 | ÷ (5) = | 0 | (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 | | 3 | (17) |
| If based on air permeability value, then | (18) = [(17) ÷ 20]+(8), otherwise (18) = (16) | 0.15 | (18) |
| *Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used* | | | |
| Number of sides sheltered | | 0 | (19) |
| Shelter factor | (20) = 1 - [0.075 x (19)] = | 1 | (20) |
| Infiltration rate incorporating shelter factor | (21) = (18) x (20) = | 0.15 | (21) |

Infiltration rate modified for monthly wind speed

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

# DER WorkSheet: New dwelling design stage

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

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.19 | 0.19 | 0.18 | 0.16 | 0.16 | 0.14 | 0.14 | 0.14 | 0.15 | 0.16 | 0.17 | 0.18 |

*Calculate effective air change rate for the applicable case*

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 75.65 (23c)

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24a)m= | 0.31 | 0.31 | 0.31 | 0.29 | 0.28 | 0.26 | 0.26 | 0.26 | 0.27 | 0.28 | 0.29 | 0.3 | (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 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24d) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (25)m= | 0.31 | 0.31 | 0.31 | 0.29 | 0.28 | 0.26 | 0.26 | 0.26 | 0.27 | 0.28 | 0.29 | 0.3 | (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 | |
|---|---|---|---|---|---|---|---|---|---|---|
| Windows | | | 8.97 | x1/[1/( 1.4 )+ 0.04] | | = | 11.89 | | | (27) |
| Walls Type1 | 31.4 | 8.97 | 22.43 | x | 0.18 | = | 4.04 | 60 | 1345.8 | (29) |
| Walls Type2 | 22.92 | 0 | 22.92 | x | 0.17 | = | 3.85 | 60 | 1375.2 | (29) |
| Total area of elements, m² | | | 54.32 | | | | | | | (31) |
| Party wall | | | 30.08 | x | 0 | = | 0 | 45 | 1353.6 | (32) |
| Party floor | | | 50.62 | | | | | 40 | 2024.8 | (32a) |
| Party ceiling | | | 50.62 | | | | | 30 | 1518.6 | (32b) |
| Internal wall ** | | | 83.2 | | | | | 9 | 748.8 | (32c) |

** 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) = 19.78 (33)

Heat capacity Cm = S(A x k ) ((28)…(30) + (32) + (32a)…(32e) = 8366.8 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 165.29 (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 5.92 (36)

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

Total fabric heat loss (33) + (36) = 25.7 (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= | 13.86 | 13.69 | 13.52 | 12.69 | 12.53 | 11.7 | 11.7 | 11.53 | 12.03 | 12.53 | 12.86 | 13.19 | (38) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (39)m= | 39.55 | 39.39 | 39.22 | 38.39 | 38.22 | 37.39 | 37.39 | 37.23 | 37.73 | 38.22 | 38.56 | 38.89 | |

Average = Sum(39)$_{1…12}$ /12= 38.35 (39)

# DER WorkSheet: New dwelling design stage

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

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (40)m= | 0.78 | 0.78 | 0.77 | 0.76 | 0.76 | 0.74 | 0.74 | 0.74 | 0.75 | 0.76 | 0.76 | 0.77 |

Average = Sum(40)$_{1…12}$ /12= 0.76 (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 1.71 (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 74.77 (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= | 82.25 | 79.26 | 76.27 | 73.28 | 70.29 | 67.3 | 67.3 | 70.29 | 73.28 | 76.27 | 79.26 | 82.25 | |
| | | | | | | | | | | Total = Sum(44)$_{1…12}$ = | | 897.28 | (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= | 121.98 | 106.68 | 110.09 | 95.97 | 92.09 | 79.47 | 73.64 | 84.5 | 85.51 | 99.65 | 108.78 | 118.13 | |
| | | | | | | | | | | Total = Sum(45)$_{1…12}$ = | | 1176.48 | (45) |
| *If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)* | | | | | | | | | | | | | |
| (46)m= | 18.3 | 16 | 16.51 | 14.4 | 13.81 | 11.92 | 11.05 | 12.68 | 12.83 | 14.95 | 16.32 | 17.72 | (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) = 110 (50)

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

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (56)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (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= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (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= | 23.26 | 21.01 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | (59) |

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 | (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= | 177.25 | 156.61 | 165.36 | 149.47 | 147.37 | 132.96 | 128.91 | 139.78 | 139 | 154.93 | 162.27 | 173.4 | (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= | 177.25 | 156.61 | 165.36 | 149.47 | 147.37 | 132.96 | 128.91 | 139.78 | 139 | 154.93 | 162.27 | 173.4 |

Output from water heater (annual)$_{1...12}$ 1827.32 (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= | 84.78 | 75.41 | 80.82 | 74.71 | 74.84 | 69.22 | 68.71 | 72.32 | 71.23 | 77.36 | 78.96 | 83.5 | (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= | 85.42 | 85.42 | 85.42 | 85.42 | 85.42 | 85.42 | 85.42 | 85.42 | 85.42 | 85.42 | 85.42 | 85.42 | (66) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (67)m= | 13.59 | 12.07 | 9.81 | 7.43 | 5.55 | 4.69 | 5.07 | 6.59 | 8.84 | 11.22 | 13.1 | 13.97 | (67) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (68)m= | 148.84 | 150.39 | 146.5 | 138.21 | 127.75 | 117.92 | 111.35 | 109.81 | 113.7 | 121.99 | 132.45 | 142.28 | (68) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (69)m= | 31.54 | 31.54 | 31.54 | 31.54 | 31.54 | 31.54 | 31.54 | 31.54 | 31.54 | 31.54 | 31.54 | 31.54 | (69) |

Pumps and fans gains (Table 5a)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (70)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (70) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (71)m= | -68.33 | -68.33 | -68.33 | -68.33 | -68.33 | -68.33 | -68.33 | -68.33 | -68.33 | -68.33 | -68.33 | -68.33 | (71) |

Water heating gains (Table 5)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (72)m= | 113.95 | 112.22 | 108.64 | 103.76 | 100.59 | 96.14 | 92.35 | 97.2 | 98.93 | 103.97 | 109.67 | 112.23 | (72) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (73)m= | 325.01 | 323.3 | 313.57 | 298.03 | 282.52 | 267.37 | 257.39 | 262.22 | 270.09 | 285.81 | 303.84 | 317.1 | (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 | 8.97 | x | 11.28 | x | 0.63 | x | 0.7 | = | 30.93 | (75) |
| Northeast 0.9x | 0.77 | x | 8.97 | x | 22.97 | x | 0.63 | x | 0.7 | = | 62.96 | (75) |
| Northeast 0.9x | 0.77 | x | 8.97 | x | 41.38 | x | 0.63 | x | 0.7 | = | 113.43 | (75) |
| Northeast 0.9x | 0.77 | x | 8.97 | x | 67.96 | x | 0.63 | x | 0.7 | = | 186.29 | (75) |
| Northeast 0.9x | 0.77 | x | 8.97 | x | 91.35 | x | 0.63 | x | 0.7 | = | 250.41 | (75) |

# DER WorkSheet: New dwelling design stage

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Northeast | 0.9x | 0.77 | x | 8.97 | x | 97.38 | x | 0.63 | x | 0.7 | = | 266.96 | (75) |
| Northeast | 0.9x | 0.77 | x | 8.97 | x | 91.1 | x | 0.63 | x | 0.7 | = | 249.74 | (75) |
| Northeast | 0.9x | 0.77 | x | 8.97 | x | 72.63 | x | 0.63 | x | 0.7 | = | 199.1 | (75) |
| Northeast | 0.9x | 0.77 | x | 8.97 | x | 50.42 | x | 0.63 | x | 0.7 | = | 138.22 | (75) |
| Northeast | 0.9x | 0.77 | x | 8.97 | x | 28.07 | x | 0.63 | x | 0.7 | = | 76.94 | (75) |
| Northeast | 0.9x | 0.77 | x | 8.97 | x | 14.2 | x | 0.63 | x | 0.7 | = | 38.92 | (75) |
| Northeast | 0.9x | 0.77 | x | 8.97 | x | 9.21 | x | 0.63 | x | 0.7 | = | 25.26 | (75) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (83)m= | 30.93 | 62.96 | 113.43 | 186.29 | 250.41 | 266.96 | 249.74 | 199.1 | 138.22 | 76.94 | 38.92 | 25.26 | (83) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (84)m= | 355.94 | 386.26 | 427.01 | 484.32 | 532.94 | 534.34 | 507.13 | 461.32 | 408.31 | 362.75 | 342.76 | 342.36 | (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= | 0.98 | 0.96 | 0.93 | 0.82 | 0.64 | 0.44 | 0.32 | 0.37 | 0.61 | 0.87 | 0.96 | 0.98 | (86) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (87)m= | 20.13 | 20.27 | 20.52 | 20.81 | 20.95 | 20.99 | 21 | 21 | 20.97 | 20.77 | 20.42 | 20.11 | (87) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (88)m= | 20.27 | 20.27 | 20.28 | 20.29 | 20.29 | 20.31 | 20.31 | 20.31 | 20.3 | 20.29 | 20.29 | 20.28 | (88) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (89)m= | 0.97 | 0.96 | 0.91 | 0.79 | 0.59 | 0.4 | 0.27 | 0.31 | 0.56 | 0.84 | 0.95 | 0.98 | (89) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (90)m= | 19.1 | 19.31 | 19.66 | 20.06 | 20.24 | 20.3 | 20.31 | 20.31 | 20.28 | 20.03 | 19.54 | 19.09 | (90) |

fLA = Living area ÷ (4) = 0.49 (91)

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (92)m= | 19.61 | 19.78 | 20.08 | 20.43 | 20.59 | 20.64 | 20.65 | 20.65 | 20.62 | 20.39 | 19.97 | 19.59 | (92) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (93)m= | 19.61 | 19.78 | 20.08 | 20.43 | 20.59 | 20.64 | 20.65 | 20.65 | 20.62 | 20.39 | 19.97 | 19.59 | (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= | 0.97 | 0.95 | 0.91 | 0.79 | 0.61 | 0.42 | 0.3 | 0.34 | 0.58 | 0.85 | 0.95 | 0.97 | (94) |
| Useful gains, hmGm , W = (94)m x (84)m | | | | | | | | | | | | | |
| (95)m= | 344.68 | 367.88 | 388.24 | 384.81 | 326.31 | 224.34 | 151.08 | 157.68 | 238.18 | 307.45 | 324.2 | 332.97 | (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= | 605.37 | 586.05 | 532.59 | 442.53 | 339.89 | 225.9 | 151.29 | 158.09 | 245.86 | 374.26 | 496.17 | 598.46 | (97) |
| Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m | | | | | | | | | | | | | |
| (98)m= | 193.95 | 146.61 | 107.39 | 41.56 | 10.1 | 0 | 0 | 0 | 0 | 49.71 | 123.82 | 197.53 | (98) |

# DER WorkSheet: New dwelling design stage

| | | | |
|---|---|---|---|
| | Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = | 870.67 | (98) |
| Space heating requirement in kWh/m²/year | | 17.2 | (99) |

## 9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

| | | | |
|---|---|---|---|
| Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none | | 0 | (301) |
| Fraction of space heat from community system 1 – (301) = | | 1 | (302) |

*The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.*

| | | | |
|---|---|---|---|
| Fraction of heat from Community boilers | | 1 | (303a) |
| Fraction of total space heat from Community boilers | (302) x (303a) = | 1 | (304a) |
| Factor for control and charging method (Table 4c(3)) for community heating system | | 1 | (305) |
| Distribution loss factor (Table 12c) for community heating system | | 1.05 | (306) |
| **Space heating** | | **kWh/year** | |
| Annual space heating requirement | | 870.67 | |
| Space heat from Community boilers | (98) x (304a) x (305) x (306) = | 914.2 | (307a) |
| Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) | | 0 | (308 |
| Space heating requirement from secondary/supplementary system | (98) x (301) x 100 ÷ (308) = | 0 | (309) |
| **Water heating** | | | |
| Annual water heating requirement | | 1827.32 | |
| If DHW from community scheme: Water heat from Community boilers | (64) x (303a) x (305) x (306) = | 1918.69 | (310a) |
| Electricity used for heat distribution | 0.01 × [(307a)…(307e) + (310a)…(310e)] = | 28.33 | (313) |
| Cooling System Energy Efficiency Ratio | | 0 | (314) |
| Space cooling (if there is a fixed cooling system, if not enter 0) | = (107) ÷ (314) = | 0 | (315) |
| Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside | | 107.68 | (330a) |
| warm air heating system fans | | 0 | (330b) |
| pump for solar water heating | | 0 | (330g) |
| Total electricity for the above, kWh/year | =(330a) + (330b) + (330g) = | 107.68 | (331) |
| Energy for lighting (calculated in Appendix L) | | 239.96 | (332) |
| Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) = | | 3180.53 | (338) |

## 12b. CO2 Emissions – Community heating scheme

| | | Energy kWh/year | Emission factor kg CO2/kWh | | Emissions kg CO2/year | |
|---|---|---|---|---|---|---|
| CO2 from other sources of space and water heating (not CHP) Efficiency of heat source 1 (%) | If there is CHP using two fuels repeat (363) to (366) for the second fuel | | | | 96 | (367a) |
| CO2 associated with heat source 1 | [(307b)+(310b)] x 100 ÷ (367b) x | | 0.22 | = | 637.4 | (367) |
| Electrical energy for heat distribution | [(313) x | | 0.52 | = | 14.7 | (372) |

| | | | | | | |
|---|---|---|---|---|---|---|
| Total CO2 associated with community systems | (363)…(366) + (368)...(372) | | = | 652.1 | (373) |
| CO2 associated with space heating (secondary) | (309) x | 0 | = | 0 | (374) |
| CO2 associated with water from immersion heater or instantaneous heater | (312) x | 0.22 | = | 0 | (375) |
| Total CO2 associated with space and water heating | (373) + (374) + (375) = | | | 652.1 | (376) |
| CO2 associated with electricity for pumps and fans within dwelling | (331)) x | 0.52 | = | 55.89 | (378) |
| CO2 associated with electricity for lighting | (332))) x | 0.52 | = | 124.54 | (379) |
| **Total CO2, kg/year** | sum of (376)…(382) = | | | 832.53 | (383) |
| **Dwelling CO2 Emission Rate** | (383) ÷ (4) = | | | 16.45 | (384) |
| **EI rating (section 14)** | | | | 88.33 | (385) |

# Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.50
*Printed on 06 December 2021 at 10:55:10*

## Project Information:

**Assessed By:** Neil Ingham (STRO010943) **Building Type:** Flat

## Dwelling Details:

**NEW DWELLING DESIGN STAGE** Total Floor Area: 63.92m²

**Site Reference :** Highgate Road - GREEN **Plot Reference:** 02 - H

**Address :**

## Client Details:

**Name:**

**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 (c)
Fuel factor: 1.00 (mains gas (c))

| | | |
|---|---|---|
| Target Carbon Dioxide Emission Rate (TER) | 17.67 kg/m² | |
| Dwelling Carbon Dioxide Emission Rate (DER) | 15.46 kg/m² | OK |

## 1b TFEE and DFEE

| | | |
|---|---|---|
| Target Fabric Energy Efficiency (TFEE) | 45.6 kWh/m² | |
| Dwelling Fabric Energy Efficiency (DFEE) | 38.8 kWh/m² | |
| | | OK |

## 2 Fabric U-values

| Element | Average | Highest | |
|---|---|---|---|
| External wall | 0.18 (max. 0.30) | 0.18 (max. 0.70) | OK |
| Party wall | 0.00 (max. 0.20) | - | OK |
| Floor | (no floor) | | |
| Roof | (no roof) | | |
| Openings | 1.40 (max. 2.00) | 1.40 (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 | 3.00 (design value) | |
| Maximum | 10.0 | OK |

## 4 Heating efficiency

| | |
|---|---|
| Main Heating system: | Community heating schemes - mains gas |
| Secondary heating system: | None |

## 5 Cylinder insulation

| | |
|---|---|
| Hot water Storage: | No cylinder |

## 6 Controls

| | | |
|---|---|---|
| Space heating controls | Charging system linked to use of community heating, programmer and at least two room thermostats | OK |
| Hot water controls: | No cylinder thermostat<br>No cylinder | |

# Regulations Compliance Report

| | | |
|---|---|---|
| **7 Low energy lights** | | |
| Percentage of fixed lights with low-energy fittings | 100.0% | |
| Minimum | 75.0% | **OK** |
| **8 Mechanical ventilation** | | |
| Continuous supply and extract system | | |
| Specific fan power: | 0.47 | |
| Maximum | 1.5 | **OK** |
| MVHR efficiency: | 89% | |
| Minimum | 70% | **OK** |
| **9 Summertime temperature** | | |
| Overheating risk (Thames valley): | Slight | **OK** |
| Based on: | | |
| Overshading: | Average or unknown | |
| Windows facing: North East | 9.56m² | |
| Windows facing: South East | 8.76m² | |
| Ventilation rate: | 6.00 | |
| **10 Key features** | | |
| Air permeablility | 3.0 m³/m²h | |
| Party  Walls U-value | 0 W/m²K | |
| Community heating, heat from boilers – mains gas | | |

# DER WorkSheet: New dwelling design stage

User Details:

| | | | |
|---|---|---|---|
| **Assessor Name:** | Neil Ingham | **Stroma Number:** | STRO010943 |
| **Software Name:** | Stroma FSAP 2012 | **Software Version:** | Version: 1.0.5.50 |

Property Address: 02 - H

**Address :**

## 1. Overall dwelling dimensions:

| | Area(m²) | | Av. Height(m) | | Volume(m³) | |
|---|---|---|---|---|---|---|
| Ground floor | 63.92 | (1a) x | 2.65 | (2a) = | 169.39 | (3a) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n) | 63.92 | (4) | | | | |
| Dwelling volume | | | (3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) = | | 169.39 | (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 | | | | | | | 0 | x 10 = | 0 | (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) = | 0 | ÷ (5) = | 0 | (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 | | 3 | (17) |
| If based on air permeability value, then | (18) = [(17) ÷ 20]+(8), otherwise (18) = (16) | 0.15 | (18) |

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

| | | | |
|---|---|---|---|
| Number of sides sheltered | | 0 | (19) |
| Shelter factor | (20) = 1 - [0.075 x (19)] = | 1 | (20) |
| Infiltration rate incorporating shelter factor | (21) = (18) x (20) = | 0.15 | (21) |

Infiltration rate modified for monthly wind speed

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

# DER WorkSheet: New dwelling design stage

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

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.19 | 0.19 | 0.18 | 0.16 | 0.16 | 0.14 | 0.14 | 0.14 | 0.15 | 0.16 | 0.17 | 0.18 |

*Calculate effective air change rate for the applicable case*

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 75.65 (23c)

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24a)m= | 0.31 | 0.31 | 0.31 | 0.29 | 0.28 | 0.26 | 0.26 | 0.26 | 0.27 | 0.28 | 0.29 | 0.3 | (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 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24d) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (25)m= | 0.31 | 0.31 | 0.31 | 0.29 | 0.28 | 0.26 | 0.26 | 0.26 | 0.27 | 0.28 | 0.29 | 0.3 | (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 | |
|---|---|---|---|---|---|---|---|---|---|---|
| Windows Type 1 | | | 9.56 | x1/[1/( 1.4 )+ 0.04] | | = | 12.67 | | | (27) |
| Windows Type 2 | | | 8.76 | x1/[1/( 1.4 )+ 0.04] | | = | 11.61 | | | (27) |
| Walls Type1 | 61.09 | 18.32 | 42.77 | x | 0.18 | = | 7.7 | 60 | 2566.2 | (29) |
| Walls Type2 | 3.86 | 0 | 3.86 | x | 0.17 | = | 0.65 | 60 | 231.6 | (29) |
| Total area of elements, m² | | | 64.95 | | | | | | | (31) |
| Party wall | | | 37.5 | x | 0 | = | 0 | 45 | 1687.5 | (32) |
| Party floor | | | 63.92 | | | | | 40 | 2556.8 | (32a) |
| Party ceiling | | | 63.92 | | | | | 30 | 1917.6 | (32b) |
| Internal wall ** | | | 113.47 | | | | | 9 | 1021.23 | (32c) |

* *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) = 32.63 (33)

Heat capacity Cm = S(A x k ) ((28)…(30) + (32) + (32a)…(32e) = 9980.93 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 156.15 (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 7.91 (36)

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

Total fabric heat loss (33) + (36) = 40.54 (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= | 17.5 | 17.29 | 17.08 | 16.03 | 15.82 | 14.77 | 14.77 | 14.56 | 15.19 | 15.82 | 16.24 | 16.66 | (38) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (39)m= | 58.04 | 57.83 | 57.62 | 56.57 | 56.36 | 55.32 | 55.32 | 55.11 | 55.73 | 56.36 | 56.78 | 57.2 | |

Average = Sum(39)$_{1…12}$ /12= 56.52 (39)

# DER WorkSheet: New dwelling design stage

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

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (40)m= | 0.91 | 0.9 | 0.9 | 0.89 | 0.88 | 0.87 | 0.87 | 0.86 | 0.87 | 0.88 | 0.89 | 0.89 |

Average = $Sum(40)_{1...12}$ /12= 0.88 (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 2.09 (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 83.84 (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= | 92.22 | 88.87 | 85.51 | 82.16 | 78.81 | 75.45 | 75.45 | 78.81 | 82.16 | 85.51 | 88.87 | 92.22 |

Total = $Sum(44)_{1...12}$ = 1006.06 (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= | 136.76 | 119.61 | 123.43 | 107.61 | 103.25 | 89.1 | 82.56 | 94.74 | 95.88 | 111.73 | 121.97 | 132.45 |

Total = $Sum(45)_{1...12}$ = 1319.1 (45)

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (46)m= | 20.51 | 17.94 | 18.51 | 16.14 | 15.49 | 13.37 | 12.38 | 14.21 | 14.38 | 16.76 | 18.29 | 19.87 | (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) = 110 (50)

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

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (56)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (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= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (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= | 23.26 | 21.01 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | (59) |

# DER WorkSheet: New dwelling design stage

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 | (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= | 192.04 | 169.54 | 178.71 | 161.1 | 158.53 | 142.59 | 137.84 | 150.02 | 149.37 | 167.01 | 175.46 | 187.72 | (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= | 192.04 | 169.54 | 178.71 | 161.1 | 158.53 | 142.59 | 137.84 | 150.02 | 149.37 | 167.01 | 175.46 | 187.72 | |

Output from water heater (annual)$_{1...12}$ 1969.94 (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= | 89.69 | 79.71 | 85.26 | 78.58 | 78.55 | 72.42 | 71.67 | 75.72 | 74.67 | 81.37 | 83.35 | 88.26 | (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= | 104.5 | 104.5 | 104.5 | 104.5 | 104.5 | 104.5 | 104.5 | 104.5 | 104.5 | 104.5 | 104.5 | 104.5 | (66) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (67)m= | 16.29 | 14.47 | 11.77 | 8.91 | 6.66 | 5.62 | 6.07 | 7.9 | 10.6 | 13.46 | 15.7 | 16.74 | (67) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (68)m= | 182.71 | 184.61 | 179.83 | 169.66 | 156.82 | 144.75 | 136.69 | 134.8 | 139.57 | 149.75 | 162.58 | 174.65 | (68) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (69)m= | 33.45 | 33.45 | 33.45 | 33.45 | 33.45 | 33.45 | 33.45 | 33.45 | 33.45 | 33.45 | 33.45 | 33.45 | (69) |

Pumps and fans gains (Table 5a)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (70)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (70) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (71)m= | -83.6 | -83.6 | -83.6 | -83.6 | -83.6 | -83.6 | -83.6 | -83.6 | -83.6 | -83.6 | -83.6 | -83.6 | (71) |

Water heating gains (Table 5)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (72)m= | 120.56 | 118.62 | 114.6 | 109.13 | 105.58 | 100.58 | 96.34 | 101.78 | 103.71 | 109.37 | 115.76 | 118.63 | (72) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (73)m= | 373.91 | 372.05 | 360.55 | 342.05 | 323.41 | 305.31 | 293.45 | 298.82 | 308.23 | 326.92 | 348.4 | 364.37 | (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 | 9.56 | x | 11.28 | x | 0.63 | x | 0.7 | = | 32.96 | (75) |
| Northeast 0.9x | 0.77 | x | 9.56 | x | 22.97 | x | 0.63 | x | 0.7 | = | 67.1 | (75) |
| Northeast 0.9x | 0.77 | x | 9.56 | x | 41.38 | x | 0.63 | x | 0.7 | = | 120.89 | (75) |
| Northeast 0.9x | 0.77 | x | 9.56 | x | 67.96 | x | 0.63 | x | 0.7 | = | 198.54 | (75) |
| Northeast 0.9x | 0.77 | x | 9.56 | x | 91.35 | x | 0.63 | x | 0.7 | = | 266.88 | (75) |

# DER WorkSheet: New dwelling design stage

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Northeast 0.9x | 0.77 | x | 9.56 | x | 97.38 | x | 0.63 | x | 0.7 | = | 284.52 | (75) |
| Northeast 0.9x | 0.77 | x | 9.56 | x | 91.1 | x | 0.63 | x | 0.7 | = | 266.17 | (75) |
| Northeast 0.9x | 0.77 | x | 9.56 | x | 72.63 | x | 0.63 | x | 0.7 | = | 212.19 | (75) |
| Northeast 0.9x | 0.77 | x | 9.56 | x | 50.42 | x | 0.63 | x | 0.7 | = | 147.31 | (75) |
| Northeast 0.9x | 0.77 | x | 9.56 | x | 28.07 | x | 0.63 | x | 0.7 | = | 82 | (75) |
| Northeast 0.9x | 0.77 | x | 9.56 | x | 14.2 | x | 0.63 | x | 0.7 | = | 41.48 | (75) |
| Northeast 0.9x | 0.77 | x | 9.56 | x | 9.21 | x | 0.63 | x | 0.7 | = | 26.92 | (75) |
| Southeast 0.9x | 0.77 | x | 8.76 | x | 36.79 | x | 0.63 | x | 0.7 | = | 98.5 | (77) |
| Southeast 0.9x | 0.77 | x | 8.76 | x | 62.67 | x | 0.63 | x | 0.7 | = | 167.79 | (77) |
| Southeast 0.9x | 0.77 | x | 8.76 | x | 85.75 | x | 0.63 | x | 0.7 | = | 229.57 | (77) |
| Southeast 0.9x | 0.77 | x | 8.76 | x | 106.25 | x | 0.63 | x | 0.7 | = | 284.45 | (77) |
| Southeast 0.9x | 0.77 | x | 8.76 | x | 119.01 | x | 0.63 | x | 0.7 | = | 318.61 | (77) |
| Southeast 0.9x | 0.77 | x | 8.76 | x | 118.15 | x | 0.63 | x | 0.7 | = | 316.31 | (77) |
| Southeast 0.9x | 0.77 | x | 8.76 | x | 113.91 | x | 0.63 | x | 0.7 | = | 304.95 | (77) |
| Southeast 0.9x | 0.77 | x | 8.76 | x | 104.39 | x | 0.63 | x | 0.7 | = | 279.47 | (77) |
| Southeast 0.9x | 0.77 | x | 8.76 | x | 92.85 | x | 0.63 | x | 0.7 | = | 248.58 | (77) |
| Southeast 0.9x | 0.77 | x | 8.76 | x | 69.27 | x | 0.63 | x | 0.7 | = | 185.44 | (77) |
| Southeast 0.9x | 0.77 | x | 8.76 | x | 44.07 | x | 0.63 | x | 0.7 | = | 117.98 | (77) |
| Southeast 0.9x | 0.77 | x | 8.76 | x | 31.49 | x | 0.63 | x | 0.7 | = | 84.3 | (77) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (83)m= | 131.47 | 234.89 | 350.47 | 483 | 585.49 | 600.83 | 571.12 | 491.66 | 395.89 | 267.44 | 159.46 | 111.22 | (83) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (84)m= | 505.38 | 606.94 | 711.02 | 825.05 | 908.91 | 906.14 | 864.57 | 790.48 | 704.13 | 594.37 | 507.86 | 475.59 | (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= | 0.97 | 0.94 | 0.87 | 0.73 | 0.55 | 0.39 | 0.28 | 0.32 | 0.53 | 0.8 | 0.94 | 0.97 | (86) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (87)m= | 19.93 | 20.19 | 20.51 | 20.81 | 20.95 | 20.99 | 21 | 21 | 20.97 | 20.76 | 20.3 | 19.89 | (87) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (88)m= | 20.16 | 20.16 | 20.17 | 20.18 | 20.18 | 20.2 | 20.2 | 20.2 | 20.19 | 20.18 | 20.18 | 20.17 | (88) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (89)m= | 0.96 | 0.92 | 0.85 | 0.69 | 0.51 | 0.34 | 0.23 | 0.26 | 0.47 | 0.77 | 0.93 | 0.97 | (89) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (90)m= | 18.74 | 19.11 | 19.56 | 19.97 | 20.13 | 20.19 | 20.2 | 20.2 | 20.17 | 19.91 | 19.29 | 18.69 | (90) |

fLA = Living area ÷ (4) = 0.38 (91)

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (92)m= | 19.19 | 19.52 | 19.92 | 20.29 | 20.44 | 20.5 | 20.5 | 20.5 | 20.47 | 20.23 | 19.67 | 19.14 | (92) |

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

# DER WorkSheet: New dwelling design stage

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (93)m= | 19.19 | 19.52 | 19.92 | 20.29 | 20.44 | 20.5 | 20.5 | 20.5 | 20.47 | 20.23 | 19.67 | 19.14 | (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= | 0.95 | 0.91 | 0.84 | 0.7 | 0.52 | 0.36 | 0.25 | 0.29 | 0.49 | 0.77 | 0.92 | 0.96 | (94) |
| Useful gains, hmGm , W = (94)m x (84)m | | | | | | | | | | | | | |
| (95)m= | 481.7 | 555.07 | 597.49 | 576.76 | 475.72 | 323.61 | 215.39 | 225.34 | 345.69 | 458.98 | 466.53 | 457.07 | (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= | 864.4 | 845.57 | 773.35 | 644.22 | 492.83 | 326.09 | 215.79 | 226.04 | 355.11 | 542.96 | 713.83 | 854.77 | (97) |
| Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m | | | | | | | | | | | | | |
| (98)m= | 284.73 | 195.21 | 130.84 | 48.57 | 12.73 | 0 | 0 | 0 | 0 | 62.48 | 178.05 | 295.89 | |

| | | |
|---|---|---|
| Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = | 1208.5 | (98) |
| Space heating requirement in kWh/m²/year | 18.91 | (99) |

## 9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

| | | | |
|---|---|---|---|
| Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none | | 0 | (301) |
| Fraction of space heat from community system 1 – (301) = | | 1 | (302) |

*The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.*

| | | | |
|---|---|---|---|
| Fraction of heat from Community boilers | | 1 | (303a) |
| Fraction of total space heat from Community boilers | (302) x (303a) = | 1 | (304a) |
| Factor for control and charging method (Table 4c(3)) for community heating system | | 1 | (305) |
| Distribution loss factor (Table 12c) for community heating system | | 1.05 | (306) |
| **Space heating** | | **kWh/year** | |
| Annual space heating requirement | | 1208.5 | |
| Space heat from Community boilers | (98) x (304a) x (305) x (306) = | 1268.93 | (307a) |
| Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) | | 0 | (308 |
| Space heating requirement from secondary/supplementary system | (98) x (301) x 100 ÷ (308) = | 0 | (309) |
| **Water heating** | | | |
| Annual water heating requirement | | 1969.94 | |
| If DHW from community scheme: Water heat from Community boilers | (64) x (303a) x (305) x (306) = | 2068.44 | (310a) |
| Electricity used for heat distribution | 0.01 × [(307a)…(307e) + (310a)…(310e)] = | 33.37 | (313) |
| Cooling System Energy Efficiency Ratio | | 0 | (314) |
| Space cooling (if there is a fixed cooling system, if not enter 0) | = (107) ÷ (314) = | 0 | (315) |
| Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside | | 135.98 | (330a) |

# DER WorkSheet: New dwelling design stage

| | | | | |
|---|---|---|---|---|
| warm air heating system fans | | | 0 | (330b) |
| pump for solar water heating | | | 0 | (330g) |
| Total electricity for the above, kWh/year | =(330a) + (330b) + (330g) = | | 135.98 | (331) |
| Energy for lighting (calculated in Appendix L) | | | 287.67 | (332) |
| Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) = | | | 3761.01 | (338) |

## 12b. CO2 Emissions – Community heating scheme

| | | Energy kWh/year | Emission factor kg CO2/kWh | | Emissions kg CO2/year | |
|---|---|---|---|---|---|---|
| CO2 from other sources of space and water heating (not CHP) | | | | | | |
| Efficiency of heat source 1 (%) | If there is CHP using two fuels repeat (363) to (366) for the second fuel | | | | 96 | (367a) |
| CO2 associated with heat source 1 | [(307b)+(310b)] x 100 ÷ (367b) x | | 0.22 | = | 750.91 | (367) |
| Electrical energy for heat distribution | [(313) x | | 0.52 | = | 17.32 | (372) |
| Total CO2 associated with community systems | (363)…(366) + (368)...(372) | | | = | 768.23 | (373) |
| CO2 associated with space heating (secondary) | (309) x | | 0 | = | 0 | (374) |
| CO2 associated with water from immersion heater or instantaneous heater | (312) x | | 0.22 | = | 0 | (375) |
| Total CO2 associated with space and water heating | (373) + (374) + (375) = | | | | 768.23 | (376) |
| CO2 associated with electricity for pumps and fans within dwelling | (331)) x | | 0.52 | = | 70.57 | (378) |
| CO2 associated with electricity for lighting | (332))) x | | 0.52 | = | 149.3 | (379) |
| **Total CO2, kg/year** | sum of (376)…(382) = | | | | 988.1 | (383) |
| **Dwelling CO2 Emission Rate** | (383) ÷ (4) = | | | | 15.46 | (384) |
| **EI rating (section 14)** | | | | | 87.84 | (385) |

# Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.50
*Printed on 06 December 2021 at 10:55:00*

## Project Information:

**Assessed By:** Neil Ingham (STRO010943) **Building Type:** Flat

## Dwelling Details:

**NEW DWELLING DESIGN STAGE** Total Floor Area: 60.34m²

**Site Reference :** Highgate Road - GREEN **Plot Reference:** 02 - I

**Address :**

## Client Details:

**Name:**

**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 (c) | | |
| Fuel factor: 1.00 (mains gas (c)) | | |
| Target Carbon Dioxide Emission Rate (TER) | 18.05 kg/m² | |
| Dwelling Carbon Dioxide Emission Rate (DER) | 15.55 kg/m² | **OK** |

## 1b TFEE and DFEE

| | | |
|---|---|---|
| Target Fabric Energy Efficiency (TFEE) | 45.6 kWh/m² | |
| Dwelling Fabric Energy Efficiency (DFEE) | 37.8 kWh/m² | |
| | | **OK** |

## 2 Fabric U-values

| Element | Average | Highest | |
|---|---|---|---|
| External wall | 0.18 (max. 0.30) | 0.18 (max. 0.70) | **OK** |
| Party wall | 0.00 (max. 0.20) | - | **OK** |
| Floor | (no floor) | | |
| Roof | (no roof) | | |
| Openings | 1.40 (max. 2.00) | 1.40 (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 | 3.00 (design value) | |
| Maximum | 10.0 | **OK** |

## 4 Heating efficiency

| | |
|---|---|
| Main Heating system: | Community heating schemes - mains gas |
| Secondary heating system: | None |

## 5 Cylinder insulation

| | |
|---|---|
| Hot water Storage: | No cylinder |

## 6 Controls

| | | |
|---|---|---|
| Space heating controls | Charging system linked to use of community heating, programmer and at least two room thermostats | **OK** |
| Hot water controls: | No cylinder thermostat<br>No cylinder | |

# Regulations Compliance Report

## 7 Low energy lights

| | | |
|---|---|---|
| Percentage of fixed lights with low-energy fittings | 100.0% | |
| Minimum | 75.0% | **OK** |

## 8 Mechanical ventilation

| | | |
|---|---|---|
| Continuous supply and extract system | | |
| Specific fan power: | 0.47 | |
| Maximum | 1.5 | **OK** |
| MVHR efficiency: | 89% | |
| Minimum | 70% | **OK** |

## 9 Summertime temperature

| | | |
|---|---|---|
| Overheating risk (Thames valley): | Slight | **OK** |

Based on:

| | |
|---|---|
| Overshading: | Average or unknown |
| Windows facing: South West | $4.7m^2$ |
| Windows facing: South East | $6.09m^2$ |
| Windows facing: North West | $2.92m^2$ |
| Ventilation rate: | 6.00 |

## 10 Key features

| | |
|---|---|
| Air permeablility | $3.0\ m^3/m^2h$ |
| Party  Walls U-value | $0\ W/m^2K$ |
| Community heating, heat from boilers – mains gas | |

# DER WorkSheet: New dwelling design stage

User Details:

| | | | |
|---|---|---|---|
| **Assessor Name:** | Neil Ingham | **Stroma Number:** | STRO010943 |
| **Software Name:** | Stroma FSAP 2012 | **Software Version:** | Version: 1.0.5.50 |

Property Address: 02 - I

**Address :**

## 1. Overall dwelling dimensions:

| | Area(m²) | | Av. Height(m) | | Volume(m³) | |
|---|---|---|---|---|---|---|
| Ground floor | 60.34 | (1a) x | 2.65 | (2a) = | 159.9 | (3a) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n) | 60.34 | (4) | | | | |
| Dwelling volume | | | (3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) = | | 159.9 | (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 | | | | | | | 0 | x 10 = | 0 | (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) = | 0 | ÷ (5) = | 0 | (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 | | 3 | (17) |
| If based on air permeability value, then | (18) = [(17) ÷ 20]+(8), otherwise (18) = (16) | 0.15 | (18) |
| *Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used* | | | |
| Number of sides sheltered | | 0 | (19) |
| Shelter factor | (20) = 1 - [0.075 x (19)] = | 1 | (20) |
| Infiltration rate incorporating shelter factor | (21) = (18) x (20) = | 0.15 | (21) |

Infiltration rate modified for monthly wind speed

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

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.19 | 0.19 | 0.18 | 0.16 | 0.16 | 0.14 | 0.14 | 0.14 | 0.15 | 0.16 | 0.17 | 0.18 |

*Calculate effective air change rate for the applicable case*

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 75.65 (23c)

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24a)m= | 0.31 | 0.31 | 0.31 | 0.29 | 0.28 | 0.26 | 0.26 | 0.26 | 0.27 | 0.28 | 0.29 | 0.3 | (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 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24d) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (25)m= | 0.31 | 0.31 | 0.31 | 0.29 | 0.28 | 0.26 | 0.26 | 0.26 | 0.27 | 0.28 | 0.29 | 0.3 | (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 | |
|---|---|---|---|---|---|---|---|---|---|
| Windows Type 1 | | | 4.7 | x1/[1/( 1.4 )+ 0.04] | = | 6.23 | | | (27) |
| Windows Type 2 | | | 6.09 | x1/[1/( 1.4 )+ 0.04] | = | 8.07 | | | (27) |
| Windows Type 3 | | | 2.92 | x1/[1/( 1.4 )+ 0.04] | = | 3.87 | | | (27) |
| Walls Type1 | 52.8 | 13.71 | 39.09 | x 0.18 | = | 7.04 | 60 | 2345.4 | (29) |
| Walls Type2 | 27.31 | 0 | 27.31 | x 0.17 | = | 4.59 | 60 | 1638.6 | (29) |
| Total area of elements, m² | | | 80.11 | | | | | | (31) |
| Party wall | | | 16.88 | x 0 | = | 0 | 45 | 759.6 | (32) |
| Party floor | | | 60.34 | | | | 40 | 2413.6 | (32a) |
| Party ceiling | | | 60.34 | | | | 30 | 1810.2 | (32b) |
| Internal wall ** | | | 107.91 | | | | 9 | 971.1901 | (32c) |

** 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) = 29.8 (33)

Heat capacity Cm = S(A x k ) ((28)…(30) + (32) + (32a)…(32e) = 9938.59 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 164.71 (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 7.62 (36)

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

Total fabric heat loss (33) + (36) = 37.42 (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= | 16.52 | 16.32 | 16.12 | 15.13 | 14.93 | 13.94 | 13.94 | 13.75 | 14.34 | 14.93 | 15.33 | 15.72 | (38) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (39)m= | 53.93 | 53.74 | 53.54 | 52.55 | 52.35 | 51.36 | 51.36 | 51.16 | 51.76 | 52.35 | 52.75 | 53.14 | |

Average = Sum(39)$_{1\ldots12}$ /12= 52.5 (39)

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

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (40)m= | 0.89 | 0.89 | 0.89 | 0.87 | 0.87 | 0.85 | 0.85 | 0.85 | 0.86 | 0.87 | 0.87 | 0.88 |

Average = Sum(40)$_{1\ldots12}$ /12= 0.87 (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 1.99 (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 81.49 (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)*

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

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (44)m= | 89.64 | 86.38 | 83.12 | 79.86 | 76.6 | 73.34 | 73.34 | 76.6 | 79.86 | 83.12 | 86.38 | 89.64 |

Total = Sum(44)$_{1\ldots12}$ = 977.9 (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= | 132.93 | 116.27 | 119.98 | 104.6 | 100.36 | 86.61 | 80.25 | 92.09 | 93.19 | 108.61 | 118.55 | 128.74 |

Total = Sum(45)$_{1\ldots12}$ = 1282.18 (45)

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (46)m= | 19.94 | 17.44 | 18 | 15.69 | 15.05 | 12.99 | 12.04 | 13.81 | 13.98 | 16.29 | 17.78 | 19.31 | (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) = 110 (50)

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

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (56)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (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= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (57) |

# DER WorkSheet: New dwelling design stage

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= | 23.26 | 21.01 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | (59) |

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 | (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= | 188.21 | 166.19 | 175.25 | 158.09 | 155.64 | 140.1 | 135.53 | 147.37 | 146.69 | 163.88 | 172.05 | 184.02 | (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= | 188.21 | 166.19 | 175.25 | 158.09 | 155.64 | 140.1 | 135.53 | 147.37 | 146.69 | 163.88 | 172.05 | 184.02 | |

Output from water heater (annual)$_{1...12}$ | 1933.02 | (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= | 88.42 | 78.6 | 84.11 | 77.57 | 77.59 | 71.59 | 70.91 | 74.84 | 73.78 | 80.33 | 82.21 | 87.03 | (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= | 99.56 | 99.56 | 99.56 | 99.56 | 99.56 | 99.56 | 99.56 | 99.56 | 99.56 | 99.56 | 99.56 | 99.56 | (66) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (67)m= | 15.49 | 13.76 | 11.19 | 8.47 | 6.33 | 5.35 | 5.78 | 7.51 | 10.08 | 12.8 | 14.94 | 15.93 | (67) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (68)m= | 173.8 | 175.61 | 171.06 | 161.39 | 149.17 | 137.69 | 130.03 | 128.22 | 132.77 | 142.44 | 154.66 | 166.13 | (68) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (69)m= | 32.96 | 32.96 | 32.96 | 32.96 | 32.96 | 32.96 | 32.96 | 32.96 | 32.96 | 32.96 | 32.96 | 32.96 | (69) |

Pumps and fans gains (Table 5a)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (70)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (70) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (71)m= | -79.65 | -79.65 | -79.65 | -79.65 | -79.65 | -79.65 | -79.65 | -79.65 | -79.65 | -79.65 | -79.65 | -79.65 | (71) |

Water heating gains (Table 5)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (72)m= | 118.85 | 116.96 | 113.06 | 107.74 | 104.29 | 99.43 | 95.3 | 100.59 | 102.47 | 107.97 | 114.19 | 116.97 | (72) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (73)m= | 361.01 | 359.2 | 348.18 | 330.47 | 312.67 | 295.34 | 283.98 | 289.2 | 298.19 | 316.08 | 336.65 | 351.9 | (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) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Southeast | 0.9x | 0.77 | x | 6.09 | x | 36.79 | x | 0.63 | x | 0.7 | = | 68.48 | (77) |
| Southeast | 0.9x | 0.77 | x | 6.09 | x | 62.67 | x | 0.63 | x | 0.7 | = | 116.65 | (77) |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Southeast 0.9x | 0.77 | x | 6.09 | x | 85.75 | x | 0.63 | x | 0.7 | = | 159.6 | (77) |
| Southeast 0.9x | 0.77 | x | 6.09 | x | 106.25 | x | 0.63 | x | 0.7 | = | 197.75 | (77) |
| Southeast 0.9x | 0.77 | x | 6.09 | x | 119.01 | x | 0.63 | x | 0.7 | = | 221.5 | (77) |
| Southeast 0.9x | 0.77 | x | 6.09 | x | 118.15 | x | 0.63 | x | 0.7 | = | 219.9 | (77) |
| Southeast 0.9x | 0.77 | x | 6.09 | x | 113.91 | x | 0.63 | x | 0.7 | = | 212.01 | (77) |
| Southeast 0.9x | 0.77 | x | 6.09 | x | 104.39 | x | 0.63 | x | 0.7 | = | 194.29 | (77) |
| Southeast 0.9x | 0.77 | x | 6.09 | x | 92.85 | x | 0.63 | x | 0.7 | = | 172.81 | (77) |
| Southeast 0.9x | 0.77 | x | 6.09 | x | 69.27 | x | 0.63 | x | 0.7 | = | 128.92 | (77) |
| Southeast 0.9x | 0.77 | x | 6.09 | x | 44.07 | x | 0.63 | x | 0.7 | = | 82.02 | (77) |
| Southeast 0.9x | 0.77 | x | 6.09 | x | 31.49 | x | 0.63 | x | 0.7 | = | 58.6 | (77) |
| Southwest 0.9x | 0.77 | x | 4.7 | x | 36.79 | | 0.63 | x | 0.7 | = | 52.85 | (79) |
| Southwest 0.9x | 0.77 | x | 4.7 | x | 62.67 | | 0.63 | x | 0.7 | = | 90.02 | (79) |
| Southwest 0.9x | 0.77 | x | 4.7 | x | 85.75 | | 0.63 | x | 0.7 | = | 123.17 | (79) |
| Southwest 0.9x | 0.77 | x | 4.7 | x | 106.25 | | 0.63 | x | 0.7 | = | 152.62 | (79) |
| Southwest 0.9x | 0.77 | x | 4.7 | x | 119.01 | | 0.63 | x | 0.7 | = | 170.94 | (79) |
| Southwest 0.9x | 0.77 | x | 4.7 | x | 118.15 | | 0.63 | x | 0.7 | = | 169.71 | (79) |
| Southwest 0.9x | 0.77 | x | 4.7 | x | 113.91 | | 0.63 | x | 0.7 | = | 163.62 | (79) |
| Southwest 0.9x | 0.77 | x | 4.7 | x | 104.39 | | 0.63 | x | 0.7 | = | 149.94 | (79) |
| Southwest 0.9x | 0.77 | x | 4.7 | x | 92.85 | | 0.63 | x | 0.7 | = | 133.37 | (79) |
| Southwest 0.9x | 0.77 | x | 4.7 | x | 69.27 | | 0.63 | x | 0.7 | = | 99.49 | (79) |
| Southwest 0.9x | 0.77 | x | 4.7 | x | 44.07 | | 0.63 | x | 0.7 | = | 63.3 | (79) |
| Southwest 0.9x | 0.77 | x | 4.7 | x | 31.49 | | 0.63 | x | 0.7 | = | 45.23 | (79) |
| Northwest 0.9x | 0.77 | x | 2.92 | x | 11.28 | x | 0.63 | x | 0.7 | = | 10.07 | (81) |
| Northwest 0.9x | 0.77 | x | 2.92 | x | 22.97 | x | 0.63 | x | 0.7 | = | 20.5 | (81) |
| Northwest 0.9x | 0.77 | x | 2.92 | x | 41.38 | x | 0.63 | x | 0.7 | = | 36.93 | (81) |
| Northwest 0.9x | 0.77 | x | 2.92 | x | 67.96 | x | 0.63 | x | 0.7 | = | 60.64 | (81) |
| Northwest 0.9x | 0.77 | x | 2.92 | x | 91.35 | x | 0.63 | x | 0.7 | = | 81.52 | (81) |
| Northwest 0.9x | 0.77 | x | 2.92 | x | 97.38 | x | 0.63 | x | 0.7 | = | 86.9 | (81) |
| Northwest 0.9x | 0.77 | x | 2.92 | x | 91.1 | x | 0.63 | x | 0.7 | = | 81.3 | (81) |
| Northwest 0.9x | 0.77 | x | 2.92 | x | 72.63 | x | 0.63 | x | 0.7 | = | 64.81 | (81) |
| Northwest 0.9x | 0.77 | x | 2.92 | x | 50.42 | x | 0.63 | x | 0.7 | = | 44.99 | (81) |
| Northwest 0.9x | 0.77 | x | 2.92 | x | 28.07 | x | 0.63 | x | 0.7 | = | 25.05 | (81) |
| Northwest 0.9x | 0.77 | x | 2.92 | x | 14.2 | x | 0.63 | x | 0.7 | = | 12.67 | (81) |
| Northwest 0.9x | 0.77 | x | 2.92 | x | 9.21 | x | 0.63 | x | 0.7 | = | 8.22 | (81) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (83)m= | 131.4 | 227.17 | 319.7 | 411.01 | 473.96 | 476.51 | 456.92 | 409.05 | 351.18 | 253.46 | 157.99 | 112.06 | (83) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (84)m= | 492.41 | 586.37 | 667.88 | 741.48 | 786.63 | 771.86 | 740.9 | 698.24 | 649.37 | 569.55 | 494.64 | 463.96 | (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= | 0.97 | 0.93 | 0.87 | 0.75 | 0.59 | 0.42 | 0.3 | 0.34 | 0.53 | 0.8 | 0.94 | 0.97 | (86) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (87)m= | 20.03 | 20.28 | 20.56 | 20.82 | 20.95 | 20.99 | 21 | 21 | 20.97 | 20.8 | 20.38 | 19.99 | (87) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (88)m= | 20.17 | 20.18 | 20.18 | 20.19 | 20.2 | 20.21 | 20.21 | 20.21 | 20.2 | 20.2 | 20.19 | 20.18 | (88) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (89)m= | 0.96 | 0.92 | 0.85 | 0.72 | 0.55 | 0.37 | 0.25 | 0.28 | 0.48 | 0.76 | 0.92 | 0.97 | (89) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (90)m= | 18.9 | 19.24 | 19.63 | 19.99 | 20.14 | 20.2 | 20.21 | 20.21 | 20.18 | 19.97 | 19.41 | 18.84 | (90) |

fLA = Living area ÷ (4) = 0.44 (91)

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (92)m= | 19.4 | 19.7 | 20.04 | 20.35 | 20.5 | 20.55 | 20.56 | 20.56 | 20.53 | 20.34 | 19.84 | 19.35 | (92) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (93)m= | 19.4 | 19.7 | 20.04 | 20.35 | 20.5 | 20.55 | 20.56 | 20.56 | 20.53 | 20.34 | 19.84 | 19.35 | (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= | 0.95 | 0.92 | 0.85 | 0.72 | 0.56 | 0.39 | 0.27 | 0.3 | 0.5 | 0.77 | 0.92 | 0.96 | (94) |
| Useful gains, hmGm , W = (94)m x (84)m | | | | | | | | | | | | | |
| (95)m= | 469.79 | 536.92 | 566.33 | 537.01 | 442.7 | 303.05 | 202.92 | 212.18 | 325.06 | 438.84 | 454.12 | 446.31 | (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= | 814.42 | 795.35 | 725.02 | 601.93 | 460.68 | 305.71 | 203.32 | 212.81 | 333 | 509.67 | 672 | 805.28 | (97) |
| Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m | | | | | | | | | | | | | |
| (98)m= | 256.41 | 173.67 | 118.07 | 46.74 | 13.38 | 0 | 0 | 0 | 0 | 52.7 | 156.87 | 267.08 | |

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1084.92 (98)

Space heating requirement in kWh/m²/year 17.98 (99)

## 9b. Energy requirements – Community heating scheme

| | | |
|---|---|---|
| This part is used for space heating, space cooling or water heating provided by a community scheme. Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none | 0 | (301) |
| Fraction of space heat from community system 1 – (301) = | 1 | (302) |

*The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.*

| | | | |
|---|---|---|---|
| Fraction of heat from Community boilers | | 1 | (303a) |
| Fraction of total space heat from Community boilers | (302) x (303a) = | 1 | (304a) |
| Factor for control and charging method (Table 4c(3)) for community heating system | | 1 | (305) |
| Distribution loss factor (Table 12c) for community heating system | | 1.05 | (306) |
| **Space heating** | | **kWh/year** | |
| Annual space heating requirement | | 1084.92 | |

# DER WorkSheet: New dwelling design stage

| | | | |
|---|---|---|---|
| Space heat from Community boilers | (98) x (304a) x (305) x (306) = | 1139.16 | (307a) |
| Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) | | 0 | (308 |
| Space heating requirement from secondary/supplementary system | (98) x (301) x 100 ÷ (308) = | 0 | (309) |

**Water heating**

| | | | |
|---|---|---|---|
| Annual water heating requirement | | 1933.02 | |
| If DHW from community scheme:<br>Water heat from Community boilers | (64) x (303a) x (305) x (306) = | 2029.67 | (310a) |
| Electricity used for heat distribution | 0.01 × [(307a)…(307e) + (310a)…(310e)] = | 31.69 | (313) |
| Cooling System Energy Efficiency Ratio | | 0 | (314) |
| Space cooling (if there is a fixed cooling system, if not enter 0) | = (107) ÷ (314) = | 0 | (315) |
| Electricity for pumps and fans within dwelling (Table 4f):<br>mechanical ventilation - balanced, extract or positive input from outside | | 128.36 | (330a) |
| warm air heating system fans | | 0 | (330b) |
| pump for solar water heating | | 0 | (330g) |
| Total electricity for the above, kWh/year | =(330a) + (330b) + (330g) = | 128.36 | (331) |
| Energy for lighting (calculated in Appendix L) | | 273.64 | (332) |
| Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) = | | 3570.84 | (338) |

## 12b. CO2 Emissions – Community heating scheme

| | | Energy kWh/year | Emission factor kg CO2/kWh | | Emissions kg CO2/year | |
|---|---|---|---|---|---|---|
| CO2 from other sources of space and water heating (not CHP)<br>Efficiency of heat source 1 (%) | If there is CHP using two fuels repeat (363) to (366) for the second fuel | | | | 96 | (367a) |
| CO2 associated with heat source 1 | [(307b)+(310b)] x 100 ÷ (367b) x | | 0.22 | = | 712.99 | (367) |
| Electrical energy for heat distribution | [(313) x | | 0.52 | = | 16.45 | (372) |
| Total CO2 associated with community systems | (363)…(366) + (368)...(372) | | | = | 729.43 | (373) |
| CO2 associated with space heating (secondary) | (309) x | | 0 | = | 0 | (374) |
| CO2 associated with water from immersion heater or instantaneous heater | (312) x | | 0.22 | = | 0 | (375) |
| Total CO2 associated with space and water heating | (373) + (374) + (375) = | | | | 729.43 | (376) |
| CO2 associated with electricity for pumps and fans within dwelling | (331)) x | | 0.52 | = | 66.62 | (378) |
| CO2 associated with electricity for lighting | (332))) x | | 0.52 | = | 142.02 | (379) |
| **Total CO2, kg/year** | sum of (376)…(382) = | | | | 938.07 | (383) |
| **Dwelling CO2 Emission Rate** | (383) ÷ (4) = | | | | 15.55 | (384) |
| **EI rating (section 14)** | | | | | 88.07 | (385) |

# Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.50
*Printed on 06 December 2021 at 10:54:51*

## Project Information:

**Assessed By:** Neil Ingham (STRO010943) **Building Type:** Flat

## Dwelling Details:

**NEW DWELLING DESIGN STAGE** Total Floor Area: 48.96m²

**Site Reference :** Highgate Road - GREEN **Plot Reference:** 03 - A

**Address :**

## Client Details:

**Name:**

**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 (c) | | |
| Fuel factor: 1.00 (mains gas (c)) | | |
| Target Carbon Dioxide Emission Rate (TER) | 19.27 kg/m² | |
| Dwelling Carbon Dioxide Emission Rate (DER) | 16.43 kg/m² | **OK** |

## 1b TFEE and DFEE

| | | |
|---|---|---|
| Target Fabric Energy Efficiency (TFEE) | 45.7 kWh/m² | |
| Dwelling Fabric Energy Efficiency (DFEE) | 37.5 kWh/m² | |
| | | **OK** |

## 2 Fabric U-values

| Element | Average | Highest | |
|---|---|---|---|
| External wall | 0.17 (max. 0.30) | 0.18 (max. 0.70) | **OK** |
| Party wall | 0.00 (max. 0.20) | - | **OK** |
| Floor | (no floor) | | |
| Roof | (no roof) | | |
| Openings | 1.40 (max. 2.00) | 1.40 (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 | 3.00 (design value) | |
| Maximum | 10.0 | **OK** |

## 4 Heating efficiency

| | |
|---|---|
| Main Heating system: | Community heating schemes - mains gas |
| Secondary heating system: | None |

## 5 Cylinder insulation

| | |
|---|---|
| Hot water Storage: | No cylinder |

## 6 Controls

| | | |
|---|---|---|
| Space heating controls | Charging system linked to use of community heating, programmer and at least two room thermostats | **OK** |
| Hot water controls: | No cylinder thermostat<br>No cylinder | |

# Regulations Compliance Report

## 7 Low energy lights

| | | |
|---|---|---|
| Percentage of fixed lights with low-energy fittings | 100.0% | |
| Minimum | 75.0% | **OK** |

## 8 Mechanical ventilation

| | | |
|---|---|---|
| Continuous supply and extract system | | |
| Specific fan power: | 0.47 | |
| Maximum | 1.5 | **OK** |
| MVHR efficiency: | 89% | |
| Minimum | 70% | **OK** |

## 9 Summertime temperature

| | | |
|---|---|---|
| Overheating risk (Thames valley): | Slight | **OK** |
| Based on: | | |
| Overshading: | Average or unknown | |
| Windows facing: South West | 5.45m² | |
| Windows facing: South East | 6.09m² | |
| Ventilation rate: | 6.00 | |

## 10 Key features

| | |
|---|---|
| Air permeablility | 3.0 m³/m²h |
| Party  Walls U-value | 0 W/m²K |
| Community heating, heat from boilers – mains gas | |

# DER WorkSheet: New dwelling design stage

## User Details:

| | | | |
|---|---|---|---|
| **Assessor Name:** | Neil Ingham | **Stroma Number:** | STRO010943 |
| **Software Name:** | Stroma FSAP 2012 | **Software Version:** | Version: 1.0.5.50 |

Property Address: 03 - A

**Address :**

## 1. Overall dwelling dimensions:

| | Area(m²) | | | Av. Height(m) | | | Volume(m³) | |
|---|---|---|---|---|---|---|---|---|
| Ground floor | 48.96 | (1a) | x | 2.65 | (2a) | = | 129.74 | (3a) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n) | 48.96 | (4) | | | | | | |
| Dwelling volume | | | | (3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) = | | | 129.74 | (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 | | | | | | | 0 | x 10 = | 0 | (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) = | 0 | ÷ (5) = | 0 | (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 | | 3 | (17) |
| If based on air permeability value, then | (18) = [(17) ÷ 20]+(8), otherwise (18) = (16) | 0.15 | (18) |

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

| | | | |
|---|---|---|---|
| Number of sides sheltered | | 0 | (19) |
| Shelter factor | (20) = 1 - [0.075 x (19)] = | 1 | (20) |
| Infiltration rate incorporating shelter factor | (21) = (18) x (20) = | 0.15 | (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 |

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 |

# DER WorkSheet: New dwelling design stage

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

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.19 | 0.19 | 0.18 | 0.16 | 0.16 | 0.14 | 0.14 | 0.14 | 0.15 | 0.16 | 0.17 | 0.18 |

*Calculate effective air change rate for the applicable case*

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 75.65 (23c)

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24a)m= | 0.31 | 0.31 | 0.31 | 0.29 | 0.28 | 0.26 | 0.26 | 0.26 | 0.27 | 0.28 | 0.29 | 0.3 | (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 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24d) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (25)m= | 0.31 | 0.31 | 0.31 | 0.29 | 0.28 | 0.26 | 0.26 | 0.26 | 0.27 | 0.28 | 0.29 | 0.3 | (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 | |
|---|---|---|---|---|---|---|---|---|---|---|
| Windows Type 1 | | | 5.45 | x1/[1/( 1.4 )+ 0.04] | | = | 7.23 | | | (27) |
| Windows Type 2 | | | 6.09 | x1/[1/( 1.4 )+ 0.04] | | = | 8.07 | | | (27) |
| Walls Type1 | 35.3 | 11.54 | 23.76 | x | 0.18 | = | 4.28 | 60 | 1425.6 | (29) |
| Walls Type2 | 35.99 | 0 | 35.99 | x | 0.17 | = | 6.04 | 60 | 2159.4 | (29) |
| Total area of elements, m² | | | 71.29 | | | | | | | (31) |
| Party wall | | | 14.89 | x | 0 | = | 0 | 45 | 670.05 | (32) |
| Party floor | | | 48.96 | | | | | 40 | 1958.4 | (32a) |
| Party ceiling | | | 48.96 | | | | | 30 | 1468.8 | (32b) |
| Internal wall ** | | | 96.46 | | | | | 9 | 868.14 | (32c) |

** 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) = 25.62 (33)

Heat capacity Cm = S(A x k ) ((28)…(30) + (32) + (32a)…(32e) = 8550.39 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 174.64 (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 6.09 (36)

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

Total fabric heat loss (33) + (36) = 31.71 (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= | 13.4 | 13.24 | 13.08 | 12.28 | 12.12 | 11.31 | 11.31 | 11.15 | 11.64 | 12.12 | 12.44 | 12.76 | (38) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (39)m= | 45.11 | 44.95 | 44.79 | 43.99 | 43.83 | 43.03 | 43.03 | 42.87 | 43.35 | 43.83 | 44.15 | 44.47 | |

Average = $Sum(39)_{1…12}$ /12= 43.95 (39)

# DER WorkSheet: New dwelling design stage

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

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (40)m= | 0.92 | 0.92 | 0.91 | 0.9 | 0.9 | 0.88 | 0.88 | 0.88 | 0.89 | 0.9 | 0.9 | 0.91 |

Average = Sum(40)$_{1\ldots12}$ /12= 0.9 (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 1.66 (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 73.61 (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= | 80.98 | 78.03 | 75.09 | 72.14 | 69.2 | 66.25 | 66.25 | 69.2 | 72.14 | 75.09 | 78.03 | 80.98 | |
| | | | | | | | | | | Total = Sum(44)$_{1\ldots12}$ = | | 883.37 | (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= | 120.08 | 105.03 | 108.38 | 94.49 | 90.66 | 78.23 | 72.5 | 83.19 | 84.18 | 98.11 | 107.09 | 116.29 | |
| | | | | | | | | | | Total = Sum(45)$_{1\ldots12}$ = | | 1158.23 | (45) |
| *If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)* | | | | | | | | | | | | | |
| (46)m= | 18.01 | 15.75 | 16.26 | 14.17 | 13.6 | 11.74 | 10.87 | 12.48 | 12.63 | 14.72 | 16.06 | 17.44 | (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) = 110 (50)

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

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (56)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (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= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (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= | 23.26 | 21.01 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | (59) |

# DER WorkSheet: New dwelling design stage

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 | (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= | 175.36 | 154.95 | 163.65 | 147.98 | 145.94 | 131.73 | 127.77 | 138.47 | 137.68 | 153.38 | 160.59 | 171.57 | (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= | 175.36 | 154.95 | 163.65 | 147.98 | 145.94 | 131.73 | 127.77 | 138.47 | 137.68 | 153.38 | 160.59 | 171.57 | |

Output from water heater (annual)$_{1...12}$ 1809.07 (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= | 84.15 | 74.86 | 80.26 | 74.21 | 74.37 | 68.81 | 68.33 | 71.88 | 70.79 | 76.84 | 78.4 | 82.89 | (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= | 82.98 | 82.98 | 82.98 | 82.98 | 82.98 | 82.98 | 82.98 | 82.98 | 82.98 | 82.98 | 82.98 | 82.98 | (66) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (67)m= | 12.89 | 11.44 | 9.31 | 7.05 | 5.27 | 4.45 | 4.8 | 6.25 | 8.38 | 10.64 | 12.42 | 13.24 | (67) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (68)m= | 144.53 | 146.03 | 142.25 | 134.21 | 124.05 | 114.51 | 108.13 | 106.63 | 110.41 | 118.45 | 128.61 | 138.16 | (68) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (69)m= | 31.3 | 31.3 | 31.3 | 31.3 | 31.3 | 31.3 | 31.3 | 31.3 | 31.3 | 31.3 | 31.3 | 31.3 | (69) |

Pumps and fans gains (Table 5a)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (70)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (70) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (71)m= | -66.38 | -66.38 | -66.38 | -66.38 | -66.38 | -66.38 | -66.38 | -66.38 | -66.38 | -66.38 | -66.38 | -66.38 | (71) |

Water heating gains (Table 5)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (72)m= | 113.1 | 111.4 | 107.87 | 103.07 | 99.95 | 95.57 | 91.84 | 96.62 | 98.31 | 103.28 | 108.89 | 111.41 | (72) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (73)m= | 318.42 | 316.77 | 307.33 | 292.22 | 277.17 | 262.41 | 252.66 | 257.38 | 265 | 280.27 | 297.82 | 310.7 | (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) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Southeast 0.9x | 0.77 | x | 6.09 | x | 36.79 | x | 0.63 | x | 0.7 | = | 68.48 | (77) |
| Southeast 0.9x | 0.77 | x | 6.09 | x | 62.67 | x | 0.63 | x | 0.7 | = | 116.65 | (77) |
| Southeast 0.9x | 0.77 | x | 6.09 | x | 85.75 | x | 0.63 | x | 0.7 | = | 159.6 | (77) |
| Southeast 0.9x | 0.77 | x | 6.09 | x | 106.25 | x | 0.63 | x | 0.7 | = | 197.75 | (77) |
| Southeast 0.9x | 0.77 | x | 6.09 | x | 119.01 | x | 0.63 | x | 0.7 | = | 221.5 | (77) |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Southeast 0.9x | 0.77 | x | 6.09 | x | 118.15 | x | 0.63 | x | 0.7 | = | 219.9 | (77) |
| Southeast 0.9x | 0.77 | x | 6.09 | x | 113.91 | x | 0.63 | x | 0.7 | = | 212.01 | (77) |
| Southeast 0.9x | 0.77 | x | 6.09 | x | 104.39 | x | 0.63 | x | 0.7 | = | 194.29 | (77) |
| Southeast 0.9x | 0.77 | x | 6.09 | x | 92.85 | x | 0.63 | x | 0.7 | = | 172.81 | (77) |
| Southeast 0.9x | 0.77 | x | 6.09 | x | 69.27 | x | 0.63 | x | 0.7 | = | 128.92 | (77) |
| Southeast 0.9x | 0.77 | x | 6.09 | x | 44.07 | x | 0.63 | x | 0.7 | = | 82.02 | (77) |
| Southeast 0.9x | 0.77 | x | 6.09 | x | 31.49 | x | 0.63 | x | 0.7 | = | 58.6 | (77) |
| Southwest 0.9x | 0.77 | x | 5.45 | x | 36.79 | | 0.63 | x | 0.7 | = | 61.28 | (79) |
| Southwest 0.9x | 0.77 | x | 5.45 | x | 62.67 | | 0.63 | x | 0.7 | = | 104.39 | (79) |
| Southwest 0.9x | 0.77 | x | 5.45 | x | 85.75 | | 0.63 | x | 0.7 | = | 142.83 | (79) |
| Southwest 0.9x | 0.77 | x | 5.45 | x | 106.25 | | 0.63 | x | 0.7 | = | 176.97 | (79) |
| Southwest 0.9x | 0.77 | x | 5.45 | x | 119.01 | | 0.63 | x | 0.7 | = | 198.22 | (79) |
| Southwest 0.9x | 0.77 | x | 5.45 | x | 118.15 | | 0.63 | x | 0.7 | = | 196.79 | (79) |
| Southwest 0.9x | 0.77 | x | 5.45 | x | 113.91 | | 0.63 | x | 0.7 | = | 189.73 | (79) |
| Southwest 0.9x | 0.77 | x | 5.45 | x | 104.39 | | 0.63 | x | 0.7 | = | 173.87 | (79) |
| Southwest 0.9x | 0.77 | x | 5.45 | x | 92.85 | | 0.63 | x | 0.7 | = | 154.65 | (79) |
| Southwest 0.9x | 0.77 | x | 5.45 | x | 69.27 | | 0.63 | x | 0.7 | = | 115.37 | (79) |
| Southwest 0.9x | 0.77 | x | 5.45 | x | 44.07 | | 0.63 | x | 0.7 | = | 73.4 | (79) |
| Southwest 0.9x | 0.77 | x | 5.45 | x | 31.49 | | 0.63 | x | 0.7 | = | 52.45 | (79) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (83)m= | 129.76 | 221.04 | 302.43 | 374.73 | 419.72 | 416.69 | 401.73 | 368.16 | 327.47 | 244.29 | 155.43 | 111.05 | (83) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (84)m= | 448.18 | 537.81 | 609.76 | 666.94 | 696.89 | 679.1 | 654.39 | 625.54 | 592.46 | 524.56 | 453.25 | 421.75 | (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= | 0.96 | 0.92 | 0.84 | 0.72 | 0.56 | 0.4 | 0.29 | 0.31 | 0.49 | 0.76 | 0.92 | 0.97 | (86) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (87)m= | 20.14 | 20.38 | 20.64 | 20.86 | 20.96 | 20.99 | 21 | 21 | 20.98 | 20.85 | 20.47 | 20.09 | (87) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (88)m= | 20.15 | 20.15 | 20.15 | 20.17 | 20.17 | 20.19 | 20.19 | 20.19 | 20.18 | 20.17 | 20.17 | 20.16 | (88) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (89)m= | 0.95 | 0.9 | 0.82 | 0.68 | 0.52 | 0.35 | 0.24 | 0.26 | 0.44 | 0.72 | 0.9 | 0.96 | (89) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (90)m= | 19.02 | 19.37 | 19.72 | 20.01 | 20.13 | 20.18 | 20.19 | 20.19 | 20.17 | 20.01 | 19.51 | 18.97 | (90) |

fLA = Living area ÷ (4) = 0.5 (91)

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (92)m= | 19.58 | 19.87 | 20.18 | 20.43 | 20.54 | 20.58 | 20.59 | 20.59 | 20.57 | 20.42 | 19.99 | 19.53 | (92) |

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

# DER WorkSheet: New dwelling design stage

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (93)m= | 19.58 | 19.87 | 20.18 | 20.43 | 20.54 | 20.58 | 20.59 | 20.59 | 20.57 | 20.42 | 19.99 | 19.53 | (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= | 0.94 | 0.9 | 0.82 | 0.69 | 0.54 | 0.38 | 0.26 | 0.29 | 0.47 | 0.73 | 0.9 | 0.95 | (94) |
| Useful gains, hmGm , W = (94)m x (84)m | | | | | | | | | | | | | |
| (95)m= | 423.35 | 482.65 | 500.76 | 463.26 | 375.66 | 255.76 | 171.39 | 179.24 | 275.91 | 384.24 | 408.09 | 402.4 | (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= | 689.14 | 673.12 | 612.61 | 507.26 | 387.6 | 257.47 | 171.63 | 179.6 | 280.53 | 430.55 | 569.04 | 681.54 | (97) |
| Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m | | | | | | | | | | | | | |
| (98)m= | 197.75 | 127.99 | 83.22 | 31.68 | 8.88 | 0 | 0 | 0 | 0 | 34.46 | 115.88 | 207.69 | |

| | | |
|---|---|---|
| Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = | 807.54 | (98) |
| Space heating requirement in kWh/m²/year | 16.49 | (99) |

## 9b. Energy requirements – Community heating scheme

| | | | |
|---|---|---|---|
| This part is used for space heating, space cooling or water heating provided by a community scheme.<br>Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none | | 0 | (301) |
| Fraction of space heat from community system 1 – (301) = | | 1 | (302) |

*The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.*

| | | | |
|---|---|---|---|
| Fraction of heat from Community boilers | | 1 | (303a) |
| Fraction of total space heat from Community boilers | (302) x (303a) = | 1 | (304a) |
| Factor for control and charging method (Table 4c(3)) for community heating system | | 1 | (305) |
| Distribution loss factor (Table 12c) for community heating system | | 1.05 | (306) |
| **Space heating** | | **kWh/year** | |
| Annual space heating requirement | | 807.54 | |
| Space heat from Community boilers | (98) x (304a) x (305) x (306) = | 847.92 | (307a) |
| Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) | | 0 | (308 |
| Space heating requirement from secondary/supplementary system | (98) x (301) x 100 ÷ (308) = | 0 | (309) |
| **Water heating** | | | |
| Annual water heating requirement | | 1809.07 | |
| If DHW from community scheme:<br>Water heat from Community boilers | (64) x (303a) x (305) x (306) = | 1899.52 | (310a) |
| Electricity used for heat distribution | 0.01 × [(307a)…(307e) + (310a)…(310e)] = | 27.47 | (313) |
| Cooling System Energy Efficiency Ratio | | 0 | (314) |
| Space cooling (if there is a fixed cooling system, if not enter 0) | = (107) ÷ (314) = | 0 | (315) |
| Electricity for pumps and fans within dwelling (Table 4f):<br>mechanical ventilation - balanced, extract or positive input from outside | | 104.15 | (330a) |

| | | | |
|---|---|---|---|
| warm air heating system fans | | 0 | (330b) |
| pump for solar water heating | | 0 | (330g) |
| Total electricity for the above, kWh/year | =(330a) + (330b) + (330g) = | 104.15 | (331) |
| Energy for lighting (calculated in Appendix L) | | 227.56 | (332) |
| Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) = | | 3079.16 | (338) |

## 12b. CO2 Emissions – Community heating scheme

| | | Energy kWh/year | Emission factor kg CO2/kWh | | Emissions kg CO2/year | |
|---|---|---|---|---|---|---|
| CO2 from other sources of space and water heating (not CHP) | | | | | | |
| Efficiency of heat source 1 (%) | If there is CHP using two fuels repeat (363) to (366) for the second fuel | | | | 96 | (367a) |
| CO2 associated with heat source 1 | [(307b)+(310b)] x 100 ÷ (367b) x | | 0.22 | = | 618.18 | (367) |
| Electrical energy for heat distribution | [(313) x | | 0.52 | = | 14.26 | (372) |
| Total CO2 associated with community systems | (363)…(366) + (368)...(372) | | | = | 632.43 | (373) |
| CO2 associated with space heating (secondary) | (309) x | | 0 | = | 0 | (374) |
| CO2 associated with water from immersion heater or instantaneous heater | (312) x | | 0.22 | = | 0 | (375) |
| Total CO2 associated with space and water heating | (373) + (374) + (375) = | | | | 632.43 | (376) |
| CO2 associated with electricity for pumps and fans within dwelling | (331)) x | | 0.52 | = | 54.06 | (378) |
| CO2 associated with electricity for lighting | (332))) x | | 0.52 | = | 118.1 | (379) |
| **Total CO2, kg/year** | sum of (376)…(382) = | | | | 804.59 | (383) |
| **Dwelling CO2 Emission Rate** | (383) ÷ (4) = | | | | 16.43 | (384) |
| **EI rating (section 14)** | | | | | 88.53 | (385) |

# Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.50
*Printed on 06 December 2021 at 10:54:42*

## Project Information:

**Assessed By:** Neil Ingham (STRO010943) **Building Type:** Flat

## Dwelling Details:

**NEW DWELLING DESIGN STAGE** Total Floor Area: 53.46m²

**Site Reference :** Highgate Road - GREEN **Plot Reference:** 03 - B

**Address :**

## Client Details:

**Name:**

**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 (c)
Fuel factor: 1.00 (mains gas (c))

| | | |
|---|---|---|
| Target Carbon Dioxide Emission Rate (TER) | 18.07 kg/m² | |
| Dwelling Carbon Dioxide Emission Rate (DER) | 15.38 kg/m² | OK |

## 1b TFEE and DFEE

| | | |
|---|---|---|
| Target Fabric Energy Efficiency (TFEE) | 42.5 kWh/m² | |
| Dwelling Fabric Energy Efficiency (DFEE) | 35.0 kWh/m² | |
| | | OK |

## 2 Fabric U-values

| Element | Average | Highest | |
|---|---|---|---|
| External wall | 0.18 (max. 0.30) | 0.18 (max. 0.70) | OK |
| Party wall | 0.00 (max. 0.20) | - | OK |
| Floor | (no floor) | | |
| Roof | (no roof) | | |
| Openings | 1.40 (max. 2.00) | 1.40 (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 | 3.00 (design value) | |
| Maximum | 10.0 | OK |

## 4 Heating efficiency

| | |
|---|---|
| Main Heating system: | Community heating schemes - mains gas |
| Secondary heating system: | None |

## 5 Cylinder insulation

| | |
|---|---|
| Hot water Storage: | No cylinder |

## 6 Controls

| | | |
|---|---|---|
| Space heating controls | Charging system linked to use of community heating, programmer and at least two room thermostats | OK |
| Hot water controls: | No cylinder thermostat<br>No cylinder | |

# Regulations Compliance Report

## 7 Low energy lights

| | | |
|---|---|---|
| Percentage of fixed lights with low-energy fittings | 100.0% | |
| Minimum | 75.0% | **OK** |

## 8 Mechanical ventilation

| | | |
|---|---|---|
| Continuous supply and extract system | | |
| Specific fan power: | 0.47 | |
| Maximum | 1.5 | **OK** |
| MVHR efficiency: | 89% | |
| Minimum | 70% | **OK** |

## 9 Summertime temperature

| | | |
|---|---|---|
| Overheating risk (Thames valley): | Slight | **OK** |
| Based on: | | |
| Overshading: | Average or unknown | |
| Windows facing: South West | 9.56m² | |
| Windows facing: North West | 3.98m² | |
| Ventilation rate: | 6.00 | |

## 10 Key features

| | |
|---|---|
| Air permeablility | 3.0 m³/m²h |
| Party Walls U-value | 0 W/m²K |
| Community heating, heat from boilers – mains gas | |

# DER WorkSheet: New dwelling design stage

User Details:

| | | | |
|---|---|---|---|
| **Assessor Name:** | Neil Ingham | **Stroma Number:** | STRO010943 |
| **Software Name:** | Stroma FSAP 2012 | **Software Version:** | Version: 1.0.5.50 |

Property Address: 03 - B

**Address :**

## 1. Overall dwelling dimensions:

| | Area(m²) | | Av. Height(m) | | Volume(m³) | |
|---|---|---|---|---|---|---|
| Ground floor | 53.46 | (1a) x | 2.65 | (2a) = | 141.67 | (3a) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n) | 53.46 | (4) | | | | |
| Dwelling volume | | | | (3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) = | 141.67 | (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 | | | | | | | 0 | x 10 = | 0 | (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) = | 0 ÷ (5) = | 0 | (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 | | 3 | (17) |
| If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16) | | 0.15 | (18) |
| *Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used* | | | |
| Number of sides sheltered | | 0 | (19) |
| Shelter factor | (20) = 1 - [0.075 x (19)] = | 1 | (20) |
| Infiltration rate incorporating shelter factor | (21) = (18) x (20) = | 0.15 | (21) |

Infiltration rate modified for monthly wind speed

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

# DER WorkSheet: New dwelling design stage

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

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.19 | 0.19 | 0.18 | 0.16 | 0.16 | 0.14 | 0.14 | 0.14 | 0.15 | 0.16 | 0.17 | 0.18 |

*Calculate effective air change rate for the applicable case*

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 75.65 (23c)

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24a)m= | 0.31 | 0.31 | 0.31 | 0.29 | 0.28 | 0.26 | 0.26 | 0.26 | 0.27 | 0.28 | 0.29 | 0.3 | (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 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24d) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (25)m= | 0.31 | 0.31 | 0.31 | 0.29 | 0.28 | 0.26 | 0.26 | 0.26 | 0.27 | 0.28 | 0.29 | 0.3 | (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 | |
|---|---|---|---|---|---|---|---|---|
| Windows Type 1 | | | 9.56 | x1/[1/( 1.4 )+ 0.04] = | 12.67 | | | (27) |
| Windows Type 2 | | | 3.98 | x1/[1/( 1.4 )+ 0.04] = | 5.28 | | | (27) |
| Walls Type1 | 40.04 | 13.54 | 26.5 | x 0.18 = | 4.77 | 60 | 1590 | (29) |
| Walls Type2 | 12.16 | 0 | 12.16 | x 0.17 = | 2.04 | 60 | 729.6 | (29) |
| Total area of elements, m² | | | 52.2 | | | | | (31) |
| Party wall | | | 27.88 | x 0 = | 0 | 45 | 1254.6 | (32) |
| Party floor | | | 53.46 | | | 70 | 3742.2 | (32a) |
| Party ceiling | | | 53.46 | | | 30 | 1603.8 | (32b) |
| Internal wall ** | | | 102.03 | | | 9 | 918.27 | (32c) |

** 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) = 24.76 (33)

Heat capacity Cm = S(A x k ) ((28)…(30) + (32) + (32a)…(32e) = 9838.47 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 184.03 (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 6.09 (36)

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

Total fabric heat loss (33) + (36) = 30.85 (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= | 14.63 | 14.46 | 14.28 | 13.41 | 13.23 | 12.35 | 12.35 | 12.18 | 12.7 | 13.23 | 13.58 | 13.93 | (38) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (39)m= | 45.49 | 45.31 | 45.14 | 44.26 | 44.08 | 43.21 | 43.21 | 43.03 | 43.56 | 44.08 | 44.43 | 44.78 | |

Average = Sum(39)$_{1…12}$ /12= 44.21 (39)

# DER WorkSheet: New dwelling design stage

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

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (40)m= | 0.85 | 0.85 | 0.84 | 0.83 | 0.82 | 0.81 | 0.81 | 0.8 | 0.81 | 0.82 | 0.83 | 0.84 |

Average = Sum(40)$_{1…12}$ /12= 0.83 (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    1.79 (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    76.76 (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= | 84.44 | 81.37 | 78.3 | 75.23 | 72.16 | 69.09 | 69.09 | 72.16 | 75.23 | 78.3 | 81.37 | 84.44 | |

Total = Sum(44)$_{1…12}$ = 921.15 (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= | 125.22 | 109.52 | 113.01 | 98.53 | 94.54 | 81.58 | 75.6 | 86.75 | 87.78 | 102.3 | 111.67 | 121.27 |

Total = Sum(45)$_{1…12}$ = 1207.78 (45)

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (46)m= | 18.78 | 16.43 | 16.95 | 14.78 | 14.18 | 12.24 | 11.34 | 13.01 | 13.17 | 15.35 | 16.75 | 18.19 | (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) =    110 (50)

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

Hot water storage loss factor from Table 2 (kWh/litre/day)    0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a    1.03 (52)

Temperature factor from Table 2b    0.6 (53)

Energy lost from water storage, kWh/year    (47) x (51) x (52) x (53) =    1.03 (54)

Enter (50) or (54) in (55)    1.03 (55)

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (56)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (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= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (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= | 23.26 | 21.01 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | (59) |

# DER WorkSheet: New dwelling design stage

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 | (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= | 180.5 | 159.45 | 168.29 | 152.02 | 149.82 | 135.07 | 130.87 | 142.02 | 141.28 | 157.58 | 165.17 | 176.55 | (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= | 180.5 | 159.45 | 168.29 | 152.02 | 149.82 | 135.07 | 130.87 | 142.02 | 141.28 | 157.58 | 165.17 | 176.55 | |

Output from water heater (annual)$_{1...12}$ 1858.62 (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= | 85.86 | 76.36 | 81.8 | 75.56 | 75.66 | 69.92 | 69.36 | 73.07 | 71.98 | 78.24 | 79.93 | 84.54 | (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= | 89.61 | 89.61 | 89.61 | 89.61 | 89.61 | 89.61 | 89.61 | 89.61 | 89.61 | 89.61 | 89.61 | 89.61 | (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5 | | | | | | | | | | | | | |
| (67)m= | 13.93 | 12.37 | 10.06 | 7.62 | 5.69 | 4.81 | 5.19 | 6.75 | 9.06 | 11.5 | 13.43 | 14.31 | (67) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | | | | | | | | | | | | | |
| (68)m= | 156.21 | 157.83 | 153.74 | 145.05 | 134.07 | 123.75 | 116.86 | 115.24 | 119.33 | 128.02 | 139 | 149.32 | (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 | | | | | | | | | | | | | |
| (69)m= | 31.96 | 31.96 | 31.96 | 31.96 | 31.96 | 31.96 | 31.96 | 31.96 | 31.96 | 31.96 | 31.96 | 31.96 | (69) |
| Pumps and fans gains (Table 5a) | | | | | | | | | | | | | |
| (70)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (70) |
| Losses e.g. evaporation (negative values) (Table 5) | | | | | | | | | | | | | |
| (71)m= | -71.68 | -71.68 | -71.68 | -71.68 | -71.68 | -71.68 | -71.68 | -71.68 | -71.68 | -71.68 | -71.68 | -71.68 | (71) |
| Water heating gains (Table 5) | | | | | | | | | | | | | |
| (72)m= | 115.4 | 113.63 | 109.94 | 104.94 | 101.69 | 97.11 | 93.22 | 98.21 | 99.98 | 105.16 | 111.01 | 113.63 | (72) |
| **Total internal gains =** (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m | | | | | | | | | | | | | |
| (73)m= | 335.42 | 333.71 | 323.63 | 307.48 | 291.33 | 275.55 | 265.16 | 270.08 | 278.24 | 294.57 | 313.32 | 327.14 | (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) | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Southwest 0.9x | 0.77 | x | 9.56 | x | 36.79 | 0.63 | x | 0.7 | = | 107.5 | (79) |
| Southwest 0.9x | 0.77 | x | 9.56 | x | 62.67 | 0.63 | x | 0.7 | = | 183.11 | (79) |
| Southwest 0.9x | 0.77 | x | 9.56 | x | 85.75 | 0.63 | x | 0.7 | = | 250.54 | (79) |
| Southwest 0.9x | 0.77 | x | 9.56 | x | 106.25 | 0.63 | x | 0.7 | = | 310.43 | (79) |
| Southwest 0.9x | 0.77 | x | 9.56 | x | 119.01 | 0.63 | x | 0.7 | = | 347.71 | (79) |

# DER WorkSheet: New dwelling design stage

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Southwest | 0.9x | 0.77 | x | 9.56 | x | 118.15 | | 0.63 | x | 0.7 | = | 345.19 | (79) |
| Southwest | 0.9x | 0.77 | x | 9.56 | x | 113.91 | | 0.63 | x | 0.7 | = | 332.8 | (79) |
| Southwest | 0.9x | 0.77 | x | 9.56 | x | 104.39 | | 0.63 | x | 0.7 | = | 304.99 | (79) |
| Southwest | 0.9x | 0.77 | x | 9.56 | x | 92.85 | | 0.63 | x | 0.7 | = | 271.28 | (79) |
| Southwest | 0.9x | 0.77 | x | 9.56 | x | 69.27 | | 0.63 | x | 0.7 | = | 202.38 | (79) |
| Southwest | 0.9x | 0.77 | x | 9.56 | x | 44.07 | | 0.63 | x | 0.7 | = | 128.76 | (79) |
| Southwest | 0.9x | 0.77 | x | 9.56 | x | 31.49 | | 0.63 | x | 0.7 | = | 92 | (79) |
| Northwest | 0.9x | 0.77 | x | 3.98 | x | 11.28 | x | 0.63 | x | 0.7 | = | 13.72 | (81) |
| Northwest | 0.9x | 0.77 | x | 3.98 | x | 22.97 | x | 0.63 | x | 0.7 | = | 27.94 | (81) |
| Northwest | 0.9x | 0.77 | x | 3.98 | x | 41.38 | x | 0.63 | x | 0.7 | = | 50.33 | (81) |
| Northwest | 0.9x | 0.77 | x | 3.98 | x | 67.96 | x | 0.63 | x | 0.7 | = | 82.66 | (81) |
| Northwest | 0.9x | 0.77 | x | 3.98 | x | 91.35 | x | 0.63 | x | 0.7 | = | 111.11 | (81) |
| Northwest | 0.9x | 0.77 | x | 3.98 | x | 97.38 | x | 0.63 | x | 0.7 | = | 118.45 | (81) |
| Northwest | 0.9x | 0.77 | x | 3.98 | x | 91.1 | x | 0.63 | x | 0.7 | = | 110.81 | (81) |
| Northwest | 0.9x | 0.77 | x | 3.98 | x | 72.63 | x | 0.63 | x | 0.7 | = | 88.34 | (81) |
| Northwest | 0.9x | 0.77 | x | 3.98 | x | 50.42 | x | 0.63 | x | 0.7 | = | 61.33 | (81) |
| Northwest | 0.9x | 0.77 | x | 3.98 | x | 28.07 | x | 0.63 | x | 0.7 | = | 34.14 | (81) |
| Northwest | 0.9x | 0.77 | x | 3.98 | x | 14.2 | x | 0.63 | x | 0.7 | = | 17.27 | (81) |
| Northwest | 0.9x | 0.77 | x | 3.98 | x | 9.21 | x | 0.63 | x | 0.7 | = | 11.21 | (81) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (83)m= | 121.22 | 211.05 | 300.87 | 393.09 | 458.82 | 463.65 | 443.61 | 393.33 | 332.61 | 236.52 | 146.03 | 103.2 | (83) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (84)m= | 456.64 | 544.75 | 624.5 | 700.57 | 750.15 | 739.2 | 708.77 | 663.41 | 610.85 | 531.08 | 459.34 | 430.35 | (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= | 0.97 | 0.93 | 0.85 | 0.71 | 0.54 | 0.37 | 0.27 | 0.3 | 0.49 | 0.77 | 0.93 | 0.97 | (86) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (87)m= | 20.24 | 20.47 | 20.71 | 20.91 | 20.98 | 21 | 21 | 21 | 20.99 | 20.88 | 20.55 | 20.2 | (87) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (88)m= | 20.21 | 20.21 | 20.22 | 20.23 | 20.23 | 20.25 | 20.25 | 20.25 | 20.24 | 20.23 | 20.23 | 20.22 | (88) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (89)m= | 0.96 | 0.92 | 0.83 | 0.67 | 0.49 | 0.33 | 0.22 | 0.25 | 0.43 | 0.73 | 0.92 | 0.97 | (89) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (90)m= | 19.21 | 19.53 | 19.86 | 20.13 | 20.21 | 20.24 | 20.25 | 20.25 | 20.23 | 20.1 | 19.66 | 19.17 | (90) |

fLA = Living area ÷ (4) = | 0.45 | (91)

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (92)m= | 19.68 | 19.95 | 20.25 | 20.48 | 20.56 | 20.58 | 20.59 | 20.59 | 20.57 | 20.46 | 20.06 | 19.63 | (92) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (93)m= | 19.68 | 19.95 | 20.25 | 20.48 | 20.56 | 20.58 | 20.59 | 20.59 | 20.57 | 20.46 | 20.06 | 19.63 | (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= | 0.96 | 0.91 | 0.83 | 0.68 | 0.51 | 0.35 | 0.24 | 0.27 | 0.46 | 0.74 | 0.91 | 0.96 | (94) |
| Useful gains, hmGm , W = (94)m x (84)m | | | | | | | | | | | | | |
| (95)m= | 436.32 | 496.94 | 519.33 | 479.81 | 383.83 | 257.86 | 172.14 | 180.05 | 279.24 | 394.63 | 420.13 | 414.76 | (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= | 699.49 | 682.13 | 620.42 | 512.39 | 390.52 | 258.56 | 172.22 | 180.19 | 282.03 | 434.44 | 575.85 | 691.24 | (97) |
| Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m | | | | | | | | | | | | | |
| (98)m= | 195.8 | 124.45 | 75.21 | 23.46 | 4.97 | 0 | 0 | 0 | 0 | 29.62 | 112.12 | 205.7 | |

| | | |
|---|---|---|
| Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = | 771.33 | (98) |
| Space heating requirement in kWh/m²/year | 14.43 | (99) |

## 9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

| | | | |
|---|---|---|---|
| Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none | | 0 | (301) |
| Fraction of space heat from community system 1 – (301) = | | 1 | (302) |

*The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.*

| | | | |
|---|---|---|---|
| Fraction of heat from Community boilers | | 1 | (303a) |
| Fraction of total space heat from Community boilers | (302) x (303a) = | 1 | (304a) |
| Factor for control and charging method (Table 4c(3)) for community heating system | | 1 | (305) |
| Distribution loss factor (Table 12c) for community heating system | | 1.05 | (306) |
| **Space heating** | | **kWh/year** | |
| Annual space heating requirement | | 771.33 | |
| Space heat from Community boilers | (98) x (304a) x (305) x (306) = | 809.9 | (307a) |
| Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) | | 0 | (308 |
| Space heating requirement from secondary/supplementary system | (98) x (301) x 100 ÷ (308) = | 0 | (309) |
| **Water heating** | | | |
| Annual water heating requirement | | 1858.62 | |
| If DHW from community scheme:<br>Water heat from Community boilers | (64) x (303a) x (305) x (306) = | 1951.55 | (310a) |
| Electricity used for heat distribution | 0.01 × [(307a)…(307e) + (310a)…(310e)] = | 27.61 | (313) |
| Cooling System Energy Efficiency Ratio | | 0 | (314) |
| Space cooling (if there is a fixed cooling system, if not enter 0) | = (107) ÷ (314) = | 0 | (315) |
| Electricity for pumps and fans within dwelling (Table 4f):<br>mechanical ventilation - balanced, extract or positive input from outside | | 113.73 | (330a) |

| | | | | |
|---|---|---|---|---|
| warm air heating system fans | | | 0 | (330b) |
| pump for solar water heating | | | 0 | (330g) |
| Total electricity for the above, kWh/year | =(330a) + (330b) + (330g) = | | 113.73 | (331) |
| Energy for lighting (calculated in Appendix L) | | | 245.94 | (332) |
| Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) = | | | 3121.11 | (338) |

## 12b. CO2 Emissions – Community heating scheme

| | | Energy kWh/year | Emission factor kg CO2/kWh | | Emissions kg CO2/year | |
|---|---|---|---|---|---|---|
| CO2 from other sources of space and water heating (not CHP) | | | | | | |
| Efficiency of heat source 1 (%) | If there is CHP using two fuels repeat (363) to (366) for the second fuel | | | | 96 | (367a) |
| CO2 associated with heat source 1 | [(307b)+(310b)] x 100 ÷ (367b) x | | 0.22 | = | 621.32 | (367) |
| Electrical energy for heat distribution | [(313) x | | 0.52 | = | 14.33 | (372) |
| Total CO2 associated with community systems | (363)…(366) + (368)...(372) | | | = | 635.66 | (373) |
| CO2 associated with space heating (secondary) | (309) x | | 0 | = | 0 | (374) |
| CO2 associated with water from immersion heater or instantaneous heater | (312) x | | 0.22 | = | 0 | (375) |
| Total CO2 associated with space and water heating | (373) + (374) + (375) = | | | | 635.66 | (376) |
| CO2 associated with electricity for pumps and fans within dwelling | (331)) x | | 0.52 | = | 59.02 | (378) |
| CO2 associated with electricity for lighting | (332))) x | | 0.52 | = | 127.64 | (379) |
| **Total CO2, kg/year** | sum of (376)…(382) = | | | | 822.32 | (383) |
| **Dwelling CO2 Emission Rate** | (383) ÷ (4) = | | | | 15.38 | (384) |
| **EI rating (section 14)** | | | | | 88.81 | (385) |

# Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.50
*Printed on 06 December 2021 at 10:54:35*

## Project Information:

**Assessed By:** Neil Ingham (STRO010943) **Building Type:** Flat

## Dwelling Details:

**NEW DWELLING DESIGN STAGE** Total Floor Area: 72.62m²

**Site Reference :** Highgate Road - GREEN **Plot Reference:** 03 - C

**Address :**

## Client Details:

**Name:**

**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 (c)
Fuel factor: 1.00 (mains gas (c))

| | | |
|---|---|---|
| Target Carbon Dioxide Emission Rate (TER) | 18.46 kg/m² | |
| Dwelling Carbon Dioxide Emission Rate (DER) | 15.74 kg/m² | OK |

## 1b TFEE and DFEE

| | | |
|---|---|---|
| Target Fabric Energy Efficiency (TFEE) | 52.6 kWh/m² | |
| Dwelling Fabric Energy Efficiency (DFEE) | 42.5 kWh/m² | |
| | | OK |

## 2 Fabric U-values

| Element | Average | Highest | |
|---|---|---|---|
| External wall | 0.18 (max. 0.30) | 0.18 (max. 0.70) | OK |
| Party wall | 0.00 (max. 0.20) | - | OK |
| Floor | (no floor) | | |
| Roof | (no roof) | | |
| Openings | 1.40 (max. 2.00) | 1.40 (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 | 3.00 (design value) | |
| Maximum | 10.0 | OK |

## 4 Heating efficiency

| | |
|---|---|
| Main Heating system: | Community heating schemes - mains gas |
| Secondary heating system: | None |

## 5 Cylinder insulation

| | |
|---|---|
| Hot water Storage: | No cylinder |

## 6 Controls

| | | |
|---|---|---|
| Space heating controls | Charging system linked to use of community heating, programmer and at least two room thermostats | OK |
| Hot water controls: | No cylinder thermostat<br>No cylinder | |

# Regulations Compliance Report

## 7 Low energy lights

| | | |
|---|---|---|
| Percentage of fixed lights with low-energy fittings | 100.0% | |
| Minimum | 75.0% | **OK** |

## 8 Mechanical ventilation

| | | |
|---|---|---|
| Continuous supply and extract system | | |
| Specific fan power: | 0.54 | |
| Maximum | 1.5 | **OK** |
| MVHR efficiency: | 88% | |
| Minimum | 70% | **OK** |

## 9 Summertime temperature

| | | |
|---|---|---|
| Overheating risk (Thames valley): | Slight | **OK** |
| Based on: | | |
| Overshading: | Average or unknown | |
| Windows facing: North East | 12.71m² | |
| Windows facing: North West | 3.46m² | |
| Ventilation rate: | 6.00 | |

## 10 Key features

| | |
|---|---|
| Air permeablility | 3.0 m³/m²h |
| Party Walls U-value | 0 W/m²K |
| Community heating, heat from boilers – mains gas | |

# DER WorkSheet: New dwelling design stage

User Details:

| | | | |
|---|---|---|---|
| **Assessor Name:** | Neil Ingham | **Stroma Number:** | STRO010943 |
| **Software Name:** | Stroma FSAP 2012 | **Software Version:** | Version: 1.0.5.50 |

Property Address: 03 - C

**Address :**

## 1. Overall dwelling dimensions:

| | Area(m²) | | Av. Height(m) | | Volume(m³) | |
|---|---|---|---|---|---|---|
| Ground floor | 72.62 | (1a) x | 2.65 | (2a) = | 192.44 | (3a) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n) | 72.62 | (4) | | | | |
| Dwelling volume | | | | (3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) = | 192.44 | (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 | | | | | | | 0 | x 10 = | 0 | (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) = | 0 | ÷ (5) = | 0 | (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 | | 3 | (17) |
| If based on air permeability value, then | (18) = [(17) ÷ 20]+(8), otherwise (18) = (16) | 0.15 | (18) |

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

| | | | |
|---|---|---|---|
| Number of sides sheltered | | 0 | (19) |
| Shelter factor | (20) = 1 - [0.075 x (19)] = | 1 | (20) |
| Infiltration rate incorporating shelter factor | (21) = (18) x (20) = | 0.15 | (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 |

Wind Factor (22a)m = (22)m ÷ 4

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (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 |

# DER WorkSheet: New dwelling design stage

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

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.19 | 0.19 | 0.18 | 0.16 | 0.16 | 0.14 | 0.14 | 0.14 | 0.15 | 0.16 | 0.17 | 0.18 |

*Calculate effective air change rate for the applicable case*

| | | |
|---|---|---|
| If mechanical ventilation: | 0.5 | (23a) |
| If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) | 0.5 | (23b) |
| If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = | 74.8 | (23c) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24a)m= | 0.32 | 0.31 | 0.31 | 0.29 | 0.29 | 0.27 | 0.27 | 0.26 | 0.28 | 0.29 | 0.29 | 0.3 | (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 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24d) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (25)m= | 0.32 | 0.31 | 0.31 | 0.29 | 0.29 | 0.27 | 0.27 | 0.26 | 0.28 | 0.29 | 0.29 | 0.3 | (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 | |
|---|---|---|---|---|---|---|---|---|---|---|
| Windows Type 1 | | | 12.71 | x1/[1/( 1.4 )+ 0.04] | | = | 16.85 | | | (27) |
| Windows Type 2 | | | 3.46 | x1/[1/( 1.4 )+ 0.04] | | = | 4.59 | | | (27) |
| Walls Type1 | 72.62 | 16.17 | 56.45 | x | 0.18 | = | 10.16 | 60 | 3387 | (29) |
| Walls Type2 | 17.78 | 0 | 17.78 | x | 0.17 | = | 2.99 | 60 | 1066.8 | (29) |
| Total area of elements, m² | | | 90.4 | | | | | | | (31) |
| Party wall | | | 30.32 | x | 0 | = | 0 | 45 | 1364.4 | (32) |
| Party floor | | | 72.62 | | | | | 40 | 2904.8 | (32a) |
| Party ceiling | | | 72.62 | | | | | 30 | 2178.6 | (32b) |
| Internal wall ** | | | 146.17 | | | | | 9 | 1315.53 | (32c) |

** 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) = | 34.58 | (33) |
| Heat capacity Cm = S(A x k ) | ((28)…(30) + (32) + (32a)…(32e) = | 12217.13 | (34) |
| Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K | = (34) ÷ (4) = | 168.23 | (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 | | 7.11 | (36) |

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

| | | | |
|---|---|---|---|
| Total fabric heat loss | (33) + (36) = | 41.69 | (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= | 20.15 | 19.91 | 19.67 | 18.48 | 18.24 | 17.05 | 17.05 | 16.81 | 17.53 | 18.24 | 18.72 | 19.19 | (38) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (39)m= | 61.84 | 61.6 | 61.36 | 60.17 | 59.93 | 58.74 | 58.74 | 58.51 | 59.22 | 59.93 | 60.41 | 60.89 | |

Average = $Sum(39)_{1…12}$ /12= 60.11 (39)

# DER WorkSheet: New dwelling design stage

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

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (40)m= | 0.85 | 0.85 | 0.84 | 0.83 | 0.83 | 0.81 | 0.81 | 0.81 | 0.82 | 0.83 | 0.83 | 0.84 |

Average = Sum(40)$_{1\ldots12}$ /12= 0.83 (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 2.31 (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 89.02 (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= | 97.92 | 94.36 | 90.8 | 87.24 | 83.67 | 80.11 | 80.11 | 83.67 | 87.24 | 90.8 | 94.36 | 97.92 | |
| | | | | | | | | | | Total = Sum(44)$_{1\ldots12}$ = | | 1068.18 | (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= | 145.21 | 127 | 131.05 | 114.25 | 109.63 | 94.6 | 87.66 | 100.59 | 101.8 | 118.63 | 129.5 | 140.63 | |
| | | | | | | | | | | Total = Sum(45)$_{1\ldots12}$ = | | 1400.56 | (45) |
| *If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)* | | | | | | | | | | | | | |
| (46)m= | 21.78 | 19.05 | 19.66 | 17.14 | 16.44 | 14.19 | 13.15 | 15.09 | 15.27 | 17.8 | 19.42 | 21.09 | (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) = 110 (50)

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

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (56)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (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= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (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= | 23.26 | 21.01 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | (59) |

# DER WorkSheet: New dwelling design stage

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 | (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= | 200.48 | 176.93 | 186.33 | 167.75 | 164.91 | 148.1 | 142.94 | 155.87 | 155.29 | 173.91 | 182.99 | 195.9 | (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= | 200.48 | 176.93 | 186.33 | 167.75 | 164.91 | 148.1 | 142.94 | 155.87 | 155.29 | 173.91 | 182.99 | 195.9 | |

Output from water heater (annual)$_{1...12}$ 2051.4 (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= | 92.5 | 82.17 | 87.8 | 80.78 | 80.67 | 74.25 | 73.37 | 77.67 | 76.64 | 83.67 | 85.85 | 90.98 | (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= | 115.4 | 115.4 | 115.4 | 115.4 | 115.4 | 115.4 | 115.4 | 115.4 | 115.4 | 115.4 | 115.4 | 115.4 | (66) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (67)m= | 18.13 | 16.1 | 13.09 | 9.91 | 7.41 | 6.26 | 6.76 | 8.79 | 11.79 | 14.97 | 17.48 | 18.63 | (67) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (68)m= | 203.33 | 205.44 | 200.13 | 188.81 | 174.52 | 161.09 | 152.12 | 150.01 | 155.32 | 166.64 | 180.93 | 194.36 | (68) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (69)m= | 34.54 | 34.54 | 34.54 | 34.54 | 34.54 | 34.54 | 34.54 | 34.54 | 34.54 | 34.54 | 34.54 | 34.54 | (69) |

Pumps and fans gains (Table 5a)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (70)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (70) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (71)m= | -92.32 | -92.32 | -92.32 | -92.32 | -92.32 | -92.32 | -92.32 | -92.32 | -92.32 | -92.32 | -92.32 | -92.32 | (71) |

Water heating gains (Table 5)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (72)m= | 124.33 | 122.28 | 118.01 | 112.2 | 108.43 | 103.13 | 98.61 | 104.39 | 106.45 | 112.46 | 119.24 | 122.28 | (72) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (73)m= | 403.41 | 401.44 | 388.85 | 368.54 | 347.98 | 328.09 | 315.11 | 320.81 | 331.19 | 351.69 | 375.27 | 392.9 | (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 | 12.71 | x | 11.28 | x | 0.63 | x | 0.7 | = | 43.83 | (75) |
| Northeast 0.9x | 0.77 | x | 12.71 | x | 22.97 | x | 0.63 | x | 0.7 | = | 89.21 | (75) |
| Northeast 0.9x | 0.77 | x | 12.71 | x | 41.38 | x | 0.63 | x | 0.7 | = | 160.73 | (75) |
| Northeast 0.9x | 0.77 | x | 12.71 | x | 67.96 | x | 0.63 | x | 0.7 | = | 263.96 | (75) |
| Northeast 0.9x | 0.77 | x | 12.71 | x | 91.35 | x | 0.63 | x | 0.7 | = | 354.82 | (75) |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Northeast | 0.9x | 0.77 | x | 12.71 | x | 97.38 | x | 0.63 | x | 0.7 | = | 378.27 | (75) |
| Northeast | 0.9x | 0.77 | x | 12.71 | x | 91.1 | x | 0.63 | x | 0.7 | = | 353.87 | (75) |
| Northeast | 0.9x | 0.77 | x | 12.71 | x | 72.63 | x | 0.63 | x | 0.7 | = | 282.11 | (75) |
| Northeast | 0.9x | 0.77 | x | 12.71 | x | 50.42 | x | 0.63 | x | 0.7 | = | 195.85 | (75) |
| Northeast | 0.9x | 0.77 | x | 12.71 | x | 28.07 | x | 0.63 | x | 0.7 | = | 109.02 | (75) |
| Northeast | 0.9x | 0.77 | x | 12.71 | x | 14.2 | x | 0.63 | x | 0.7 | = | 55.15 | (75) |
| Northeast | 0.9x | 0.77 | x | 12.71 | x | 9.21 | x | 0.63 | x | 0.7 | = | 35.79 | (75) |
| Northwest | 0.9x | 0.77 | x | 3.46 | x | 11.28 | x | 0.63 | x | 0.7 | = | 11.93 | (81) |
| Northwest | 0.9x | 0.77 | x | 3.46 | x | 22.97 | x | 0.63 | x | 0.7 | = | 24.29 | (81) |
| Northwest | 0.9x | 0.77 | x | 3.46 | x | 41.38 | x | 0.63 | x | 0.7 | = | 43.75 | (81) |
| Northwest | 0.9x | 0.77 | x | 3.46 | x | 67.96 | x | 0.63 | x | 0.7 | = | 71.86 | (81) |
| Northwest | 0.9x | 0.77 | x | 3.46 | x | 91.35 | x | 0.63 | x | 0.7 | = | 96.59 | (81) |
| Northwest | 0.9x | 0.77 | x | 3.46 | x | 97.38 | x | 0.63 | x | 0.7 | = | 102.98 | (81) |
| Northwest | 0.9x | 0.77 | x | 3.46 | x | 91.1 | x | 0.63 | x | 0.7 | = | 96.33 | (81) |
| Northwest | 0.9x | 0.77 | x | 3.46 | x | 72.63 | x | 0.63 | x | 0.7 | = | 76.8 | (81) |
| Northwest | 0.9x | 0.77 | x | 3.46 | x | 50.42 | x | 0.63 | x | 0.7 | = | 53.32 | (81) |
| Northwest | 0.9x | 0.77 | x | 3.46 | x | 28.07 | x | 0.63 | x | 0.7 | = | 29.68 | (81) |
| Northwest | 0.9x | 0.77 | x | 3.46 | x | 14.2 | x | 0.63 | x | 0.7 | = | 15.01 | (81) |
| Northwest | 0.9x | 0.77 | x | 3.46 | x | 9.21 | x | 0.63 | x | 0.7 | = | 9.74 | (81) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (83)m= | 55.76 | 113.5 | 204.48 | 335.82 | 451.41 | 481.25 | 450.2 | 358.9 | 249.17 | 138.7 | 70.16 | 45.53 | (83) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (84)m= | 459.17 | 514.94 | 593.33 | 704.36 | 799.39 | 809.34 | 765.31 | 679.71 | 580.35 | 490.4 | 445.43 | 438.43 | (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= | 0.99 | 0.98 | 0.94 | 0.84 | 0.65 | 0.46 | 0.34 | 0.39 | 0.66 | 0.91 | 0.98 | 0.99 | (86) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (87)m= | 19.91 | 20.08 | 20.38 | 20.74 | 20.93 | 20.99 | 21 | 21 | 20.95 | 20.66 | 20.23 | 19.89 | (87) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (88)m= | 20.21 | 20.21 | 20.21 | 20.23 | 20.23 | 20.25 | 20.25 | 20.25 | 20.24 | 20.23 | 20.23 | 20.22 | (88) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (89)m= | 0.98 | 0.97 | 0.93 | 0.81 | 0.61 | 0.41 | 0.28 | 0.33 | 0.6 | 0.89 | 0.97 | 0.99 | (89) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (90)m= | 18.74 | 18.99 | 19.42 | 19.93 | 20.17 | 20.24 | 20.24 | 20.25 | 20.2 | 19.84 | 19.23 | 18.72 | (90) |

fLA = Living area ÷ (4) = | 0.38 | (91)

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (92)m= | 19.19 | 19.41 | 19.79 | 20.24 | 20.46 | 20.53 | 20.53 | 20.54 | 20.49 | 20.15 | 19.61 | 19.17 | (92) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (93)m= | 19.19 | 19.41 | 19.79 | 20.24 | 20.46 | 20.53 | 20.53 | 20.54 | 20.49 | 20.15 | 19.61 | 19.17 | (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= | 0.98 | 0.97 | 0.93 | 0.81 | 0.62 | 0.43 | 0.3 | 0.35 | 0.62 | 0.88 | 0.96 | 0.98 | (94) |
| Useful gains, hmGm , W = (94)m x (84)m | | | | | | | | | | | | | |
| (95)m= | 449.99 | 497.58 | 549.78 | 572.64 | 498.55 | 344.88 | 230.65 | 240.9 | 360.02 | 433.61 | 429.81 | 431.1 | (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= | 920.89 | 893.8 | 815.46 | 682.31 | 525.12 | 348.22 | 231.14 | 241.92 | 378.27 | 572.65 | 755.98 | 911.39 | (97) |
| Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m | | | | | | | | | | | | | |
| (98)m= | 350.35 | 266.26 | 197.66 | 78.97 | 19.77 | 0 | 0 | 0 | 0 | 103.45 | 234.84 | 357.33 | |

| | | |
|---|---|---|
| Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = | 1608.62 | (98) |
| Space heating requirement in kWh/m²/year | 22.15 | (99) |

## 9b. Energy requirements – Community heating scheme

| | | | |
|---|---|---|---|
| This part is used for space heating, space cooling or water heating provided by a community scheme.<br>Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none | | 0 | (301) |
| Fraction of space heat from community system 1 – (301) = | | 1 | (302) |

*The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.*

| | | | |
|---|---|---|---|
| Fraction of heat from Community boilers | | 1 | (303a) |
| Fraction of total space heat from Community boilers | (302) x (303a) = | 1 | (304a) |
| Factor for control and charging method (Table 4c(3)) for community heating system | | 1 | (305) |
| Distribution loss factor (Table 12c) for community heating system | | 1.05 | (306) |
| **Space heating** | | **kWh/year** | |
| Annual space heating requirement | | 1608.62 | |
| Space heat from Community boilers | (98) x (304a) x (305) x (306) = | 1689.05 | (307a) |
| Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) | | 0 | (308 |
| Space heating requirement from secondary/supplementary system | (98) x (301) x 100 ÷ (308) = | 0 | (309) |
| **Water heating** | | | |
| Annual water heating requirement | | 2051.4 | |
| If DHW from community scheme:<br>Water heat from Community boilers | (64) x (303a) x (305) x (306) = | 2153.97 | (310a) |
| Electricity used for heat distribution | 0.01 × [(307a)…(307e) + (310a)…(310e)] = | 38.43 | (313) |
| Cooling System Energy Efficiency Ratio | | 0 | (314) |
| Space cooling (if there is a fixed cooling system, if not enter 0) | = (107) ÷ (314) = | 0 | (315) |
| Electricity for pumps and fans within dwelling (Table 4f):<br>mechanical ventilation - balanced, extract or positive input from outside | | 177.49 | (330a) |

# DER WorkSheet: New dwelling design stage

| | | | |
|---|---|---|---|
| warm air heating system fans | | 0 | (330b) |
| pump for solar water heating | | 0 | (330g) |
| Total electricity for the above, kWh/year | =(330a) + (330b) + (330g) = | 177.49 | (331) |
| Energy for lighting (calculated in Appendix L) | | 320.14 | (332) |
| Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) = | | 4340.66 | (338) |

## 12b. CO2 Emissions – Community heating scheme

| | | Energy kWh/year | Emission factor kg CO2/kWh | | Emissions kg CO2/year | |
|---|---|---|---|---|---|---|
| CO2 from other sources of space and water heating (not CHP) | | | | | | |
| Efficiency of heat source 1 (%) | If there is CHP using two fuels repeat (363) to (366) for the second fuel | | | | 96 | (367a) |
| CO2 associated with heat source 1 | [(307b)+(310b)] x 100 ÷ (367b) x | | 0.22 | = | 864.68 | (367) |
| Electrical energy for heat distribution | [(313) x | | 0.52 | = | 19.95 | (372) |
| Total CO2 associated with community systems | (363)…(366) + (368)...(372) | | | = | 884.62 | (373) |
| CO2 associated with space heating (secondary) | (309) x | | 0 | = | 0 | (374) |
| CO2 associated with water from immersion heater or instantaneous heater | (312) x | | 0.22 | = | 0 | (375) |
| Total CO2 associated with space and water heating | (373) + (374) + (375) = | | | | 884.62 | (376) |
| CO2 associated with electricity for pumps and fans within dwelling | (331)) x | | 0.52 | = | 92.12 | (378) |
| CO2 associated with electricity for lighting | (332))) x | | 0.52 | = | 166.15 | (379) |
| **Total CO2, kg/year** | sum of (376)…(382) = | | | | 1142.9 | (383) |
| **Dwelling CO2 Emission Rate** | (383) ÷ (4) = | | | | 15.74 | (384) |
| **EI rating (section 14)** | | | | | 86.98 | (385) |

# Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.50
*Printed on 06 December 2021 at 10:54:26*

## Project Information:

**Assessed By:** Neil Ingham (STRO010943) **Building Type:** Flat

## Dwelling Details:

**NEW DWELLING DESIGN STAGE** Total Floor Area: 53.96m²

**Site Reference :** Highgate Road - GREEN **Plot Reference:** 03 - D

**Address :**

## Client Details:

**Name:**

**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 (c) | | |
| Fuel factor: 1.00 (mains gas (c)) | | |
| Target Carbon Dioxide Emission Rate (TER) | 19.25 kg/m² | |
| Dwelling Carbon Dioxide Emission Rate (DER) | 16.23 kg/m² | OK |

## 1b TFEE and DFEE

| | | |
|---|---|---|
| Target Fabric Energy Efficiency (TFEE) | 48.6 kWh/m² | |
| Dwelling Fabric Energy Efficiency (DFEE) | 39.2 kWh/m² | |
| | | OK |

## 2 Fabric U-values

| Element | Average | Highest | |
|---|---|---|---|
| External wall | 0.17 (max. 0.30) | 0.18 (max. 0.70) | OK |
| Party wall | 0.00 (max. 0.20) | - | OK |
| Floor | (no floor) | | |
| Roof | (no roof) | | |
| Openings | 1.40 (max. 2.00) | 1.40 (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 | 3.00 (design value) | |
| Maximum | 10.0 | OK |

## 4 Heating efficiency

| | |
|---|---|
| Main Heating system: | Community heating schemes - mains gas |
| Secondary heating system: | None |

## 5 Cylinder insulation

| | |
|---|---|
| Hot water Storage: | No cylinder |

## 6 Controls

| | | |
|---|---|---|
| Space heating controls | Charging system linked to use of community heating, programmer and at least two room thermostats | OK |
| Hot water controls: | No cylinder thermostat<br>No cylinder | |

# Regulations Compliance Report

| | | |
|---|---|---|
| **7 Low energy lights** | | |
| Percentage of fixed lights with low-energy fittings | 100.0% | |
| Minimum | 75.0% | **OK** |
| **8 Mechanical ventilation** | | |
| Continuous supply and extract system | | |
| Specific fan power: | 0.47 | |
| Maximum | 1.5 | **OK** |
| MVHR efficiency: | 89% | |
| Minimum | 70% | **OK** |
| **9 Summertime temperature** | | |
| Overheating risk (Thames valley): | Medium | **OK** |
| Based on: | | |
| Overshading: | Average or unknown | |
| Windows facing: North East | $12.07m^2$ | |
| Ventilation rate: | 4.00 | |
| **10 Key features** | | |
| Air permeablility | $3.0\ m^3/m^2h$ | |
| Party  Walls U-value | $0\ W/m^2K$ | |
| Community heating, heat from boilers – mains gas | | |

# DER WorkSheet: New dwelling design stage

User Details:

| | | | |
|---|---|---|---|
| **Assessor Name:** | Neil Ingham | **Stroma Number:** | STRO010943 |
| **Software Name:** | Stroma FSAP 2012 | **Software Version:** | Version: 1.0.5.50 |

Property Address: 03 - D

**Address :**

## 1. Overall dwelling dimensions:

| | Area(m²) | | Av. Height(m) | | Volume(m³) | |
|---|---|---|---|---|---|---|
| Ground floor | 53.96 | (1a) x | 2.65 | (2a) = | 142.99 | (3a) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n) | 53.96 | (4) | | | | |
| Dwelling volume | | | | (3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) = | 142.99 | (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 | | | | | | | 0 | x 10 = | 0 | (7a) |
| Number of passive vents | | | | | | | 0 | x 10 = | 0 | (7b) |
| Number of flueless gas fires | | | | | | | 0 | x 40 = | 0 | (7c) |

**Air changes per hour**

| | | | Air changes per hour | |
|---|---|---|---|---|
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = | 0 | ÷ (5) = | 0 | (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 | | 3 | (17) |
| If based on air permeability value, then | (18) = [(17) ÷ 20]+(8), otherwise (18) = (16) | 0.15 | (18) |

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

| | | | |
|---|---|---|---|
| Number of sides sheltered | | 0 | (19) |
| Shelter factor | (20) = 1 - [0.075 x (19)] = | 1 | (20) |
| Infiltration rate incorporating shelter factor | (21) = (18) x (20) = | 0.15 | (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 |

Wind Factor (22a)m = (22)m ÷ 4

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (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 |

# DER WorkSheet: New dwelling design stage

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

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.19 | 0.19 | 0.18 | 0.16 | 0.16 | 0.14 | 0.14 | 0.14 | 0.15 | 0.16 | 0.17 | 0.18 |

*Calculate effective air change rate for the applicable case*

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 75.65 (23c)

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24a)m= | 0.31 | 0.31 | 0.31 | 0.29 | 0.28 | 0.26 | 0.26 | 0.26 | 0.27 | 0.28 | 0.29 | 0.3 | (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 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24d) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (25)m= | 0.31 | 0.31 | 0.31 | 0.29 | 0.28 | 0.26 | 0.26 | 0.26 | 0.27 | 0.28 | 0.29 | 0.3 | (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 | |
|---|---|---|---|---|---|---|---|---|---|---|
| Windows | | | 12.07 | x1/[1/( 1.4 )+ 0.04] | | = | 16 | | | (27) |
| Walls Type1 | 27.66 | 12.07 | 15.59 | x | 0.18 | = | 2.81 | 60 | 935.4 | (29) |
| Walls Type2 | 24.24 | 0 | 24.24 | x | 0.17 | = | 4.07 | 60 | 1454.4 | (29) |
| Total area of elements, m² | | | 51.9 | | | | | | | (31) |
| Party wall | | | 31.67 | x | 0 | = | 0 | 45 | 1425.15 | (32) |
| Party floor | | | 53.96 | | | | | 40 | 2158.4 | (32a) |
| Party ceiling | | | 53.96 | | | | | 30 | 1618.8 | (32b) |
| Internal wall ** | | | 95.03 | | | | | 9 | 855.27 | (32c) |

** 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) = 22.88 (33)

Heat capacity Cm = S(A x k ) ((28)…(30) + (32) + (32a)…(32e) = 8447.42 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 156.55 (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 6.04 (36)

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

Total fabric heat loss (33) + (36) = 28.91 (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= | 14.77 | 14.59 | 14.42 | 13.53 | 13.35 | 12.47 | 12.47 | 12.29 | 12.82 | 13.35 | 13.71 | 14.06 | (38) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (39)m= | 43.68 | 43.51 | 43.33 | 42.45 | 42.27 | 41.38 | 41.38 | 41.21 | 41.74 | 42.27 | 42.62 | 42.98 | |

Average = Sum(39)$_{1…12}$ /12= 42.4 (39)

# DER WorkSheet: New dwelling design stage

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

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (40)m= | 0.81 | 0.81 | 0.8 | 0.79 | 0.78 | 0.77 | 0.77 | 0.76 | 0.77 | 0.78 | 0.79 | 0.8 |

Average = Sum(40)$_{1…12}$ /12= 0.79 (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 1.81 (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 77.11 (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= | 84.82 | 81.74 | 78.65 | 75.57 | 72.49 | 69.4 | 69.4 | 72.49 | 75.57 | 78.65 | 81.74 | 84.82 | |
| | | | | | | | | | | Total = Sum(44)$_{1…12}$ = | | 925.35 | (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= | 125.79 | 110.02 | 113.53 | 98.98 | 94.97 | 81.95 | 75.94 | 87.14 | 88.18 | 102.77 | 112.18 | 121.82 | |
| | | | | | | | | | | Total = Sum(45)$_{1…12}$ = | | 1213.27 | (45) |
| *If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)* | | | | | | | | | | | | | |
| (46)m= | 18.87 | 16.5 | 17.03 | 14.85 | 14.25 | 12.29 | 11.39 | 13.07 | 13.23 | 15.42 | 16.83 | 18.27 | (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) = 110 (50)

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

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (56)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (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= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (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= | 23.26 | 21.01 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | (59) |

# DER WorkSheet: New dwelling design stage

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 | (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= | 181.07 | 159.94 | 168.8 | 152.47 | 150.25 | 135.45 | 131.22 | 142.42 | 141.68 | 158.05 | 165.67 | 177.1 | (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= | 181.07 | 159.94 | 168.8 | 152.47 | 150.25 | 135.45 | 131.22 | 142.42 | 141.68 | 158.05 | 165.67 | 177.1 | |

Output from water heater (annual)$_{1\ldots12}$ 1864.11 (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= | 86.05 | 76.52 | 81.97 | 75.7 | 75.8 | 70.04 | 69.47 | 73.2 | 72.12 | 78.39 | 80.1 | 84.73 | (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= | 90.34 | 90.34 | 90.34 | 90.34 | 90.34 | 90.34 | 90.34 | 90.34 | 90.34 | 90.34 | 90.34 | 90.34 | (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5 | | | | | | | | | | | | | |
| (67)m= | 14.04 | 12.47 | 10.14 | 7.68 | 5.74 | 4.85 | 5.24 | 6.81 | 9.13 | 11.6 | 13.54 | 14.43 | (67) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | | | | | | | | | | | | | |
| (68)m= | 157.5 | 159.14 | 155.02 | 146.25 | 135.18 | 124.78 | 117.83 | 116.2 | 120.31 | 129.08 | 140.15 | 150.55 | (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 | | | | | | | | | | | | | |
| (69)m= | 32.03 | 32.03 | 32.03 | 32.03 | 32.03 | 32.03 | 32.03 | 32.03 | 32.03 | 32.03 | 32.03 | 32.03 | (69) |
| Pumps and fans gains (Table 5a) | | | | | | | | | | | | | |
| (70)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (70) |
| Losses e.g. evaporation (negative values) (Table 5) | | | | | | | | | | | | | |
| (71)m= | -72.27 | -72.27 | -72.27 | -72.27 | -72.27 | -72.27 | -72.27 | -72.27 | -72.27 | -72.27 | -72.27 | -72.27 | (71) |
| Water heating gains (Table 5) | | | | | | | | | | | | | |
| (72)m= | 115.65 | 113.87 | 110.17 | 105.15 | 101.88 | 97.28 | 93.38 | 98.38 | 100.16 | 105.37 | 111.24 | 113.88 | (72) |
| **Total internal gains =** (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m | | | | | | | | | | | | | |
| (73)m= | 337.3 | 335.58 | 325.44 | 309.18 | 292.9 | 277.01 | 266.54 | 271.49 | 279.71 | 296.15 | 315.03 | 328.97 | (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 | 12.07 | x | 11.28 | x | 0.63 | x | 0.7 | = | 41.62 | (75) |
| Northeast 0.9x | 0.77 | x | 12.07 | x | 22.97 | x | 0.63 | x | 0.7 | = | 84.72 | (75) |
| Northeast 0.9x | 0.77 | x | 12.07 | x | 41.38 | x | 0.63 | x | 0.7 | = | 152.64 | (75) |
| Northeast 0.9x | 0.77 | x | 12.07 | x | 67.96 | x | 0.63 | x | 0.7 | = | 250.67 | (75) |
| Northeast 0.9x | 0.77 | x | 12.07 | x | 91.35 | x | 0.63 | x | 0.7 | = | 336.95 | (75) |

# DER WorkSheet: New dwelling design stage

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Northeast | 0.9x | 0.77 | x | 12.07 | x | 97.38 | x | 0.63 | x | 0.7 | = | 359.23 | (75) |
| Northeast | 0.9x | 0.77 | x | 12.07 | x | 91.1 | x | 0.63 | x | 0.7 | = | 336.05 | (75) |
| Northeast | 0.9x | 0.77 | x | 12.07 | x | 72.63 | x | 0.63 | x | 0.7 | = | 267.9 | (75) |
| Northeast | 0.9x | 0.77 | x | 12.07 | x | 50.42 | x | 0.63 | x | 0.7 | = | 185.99 | (75) |
| Northeast | 0.9x | 0.77 | x | 12.07 | x | 28.07 | x | 0.63 | x | 0.7 | = | 103.53 | (75) |
| Northeast | 0.9x | 0.77 | x | 12.07 | x | 14.2 | x | 0.63 | x | 0.7 | = | 52.37 | (75) |
| Northeast | 0.9x | 0.77 | x | 12.07 | x | 9.21 | x | 0.63 | x | 0.7 | = | 33.99 | (75) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (83)m= | 41.62 | 84.72 | 152.64 | 250.67 | 336.95 | 359.23 | 336.05 | 267.9 | 185.99 | 103.53 | 52.37 | 33.99 | (83) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (84)m= | 378.92 | 420.3 | 478.07 | 559.85 | 629.86 | 636.24 | 602.59 | 539.39 | 465.7 | 399.68 | 367.4 | 362.95 | (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= | 0.98 | 0.96 | 0.91 | 0.79 | 0.6 | 0.41 | 0.3 | 0.35 | 0.59 | 0.86 | 0.96 | 0.98 | (86) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (87)m= | 20.03 | 20.19 | 20.48 | 20.8 | 20.95 | 20.99 | 21 | 21 | 20.97 | 20.74 | 20.34 | 20 | (87) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (88)m= | 20.25 | 20.25 | 20.25 | 20.26 | 20.27 | 20.28 | 20.28 | 20.28 | 20.28 | 20.27 | 20.26 | 20.26 | (88) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (89)m= | 0.97 | 0.95 | 0.9 | 0.76 | 0.56 | 0.37 | 0.25 | 0.3 | 0.54 | 0.83 | 0.95 | 0.98 | (89) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (90)m= | 18.94 | 19.19 | 19.59 | 20.03 | 20.22 | 20.28 | 20.28 | 20.28 | 20.25 | 19.97 | 19.41 | 18.92 | (90) |

fLA = Living area ÷ (4) = 0.47 (91)

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (92)m= | 19.45 | 19.66 | 20.01 | 20.4 | 20.57 | 20.62 | 20.62 | 20.62 | 20.59 | 20.33 | 19.85 | 19.43 | (92) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (93)m= | 19.45 | 19.66 | 20.01 | 20.4 | 20.57 | 20.62 | 20.62 | 20.62 | 20.59 | 20.33 | 19.85 | 19.43 | (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= | 0.97 | 0.95 | 0.89 | 0.76 | 0.57 | 0.39 | 0.28 | 0.32 | 0.56 | 0.84 | 0.94 | 0.97 | (94) |
| Useful gains, hmGm , W = (94)m x (84)m | | | | | | | | | | | | | |
| (95)m= | 365.75 | 397.48 | 427.33 | 427.25 | 360.81 | 247.22 | 166.11 | 173.41 | 261.73 | 334.22 | 345.95 | 352.08 | (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= | 661.94 | 642.24 | 585.42 | 487.92 | 374.76 | 248.93 | 166.37 | 173.92 | 270.77 | 411.33 | 543.52 | 654.55 | (97) |
| Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m | | | | | | | | | | | | | |
| (98)m= | 220.37 | 164.48 | 117.62 | 43.69 | 10.37 | 0 | 0 | 0 | 0 | 57.37 | 142.25 | 225.03 | |

# DER WorkSheet: New dwelling design stage

| | | | |
|---|---|---|---|
| | Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = | 981.18 | (98) |
| Space heating requirement in kWh/m²/year | | 18.18 | (99) |

## 9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

| | | | |
|---|---|---|---|
| Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none | | 0 | (301) |
| Fraction of space heat from community system 1 – (301) = | | 1 | (302) |

*The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.*

| | | | |
|---|---|---|---|
| Fraction of heat from Community boilers | | 1 | (303a) |
| Fraction of total space heat from Community boilers | (302) x (303a) = | 1 | (304a) |
| Factor for control and charging method (Table 4c(3)) for community heating system | | 1 | (305) |
| Distribution loss factor (Table 12c) for community heating system | | 1.05 | (306) |
| **Space heating** | | **kWh/year** | |
| Annual space heating requirement | | 981.18 | |
| Space heat from Community boilers | (98) x (304a) x (305) x (306) = | 1030.24 | (307a) |
| Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) | | 0 | (308 |
| Space heating requirement from secondary/supplementary system | (98) x (301) x 100 ÷ (308) = | 0 | (309) |
| **Water heating** | | | |
| Annual water heating requirement | | 1864.11 | |
| If DHW from community scheme: Water heat from Community boilers | (64) x (303a) x (305) x (306) = | 1957.32 | (310a) |
| Electricity used for heat distribution | 0.01 × [(307a)…(307e) + (310a)…(310e)] = | 29.88 | (313) |
| Cooling System Energy Efficiency Ratio | | 0 | (314) |
| Space cooling (if there is a fixed cooling system, if not enter 0) | = (107) ÷ (314) = | 0 | (315) |
| Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside | | 114.79 | (330a) |
| warm air heating system fans | | 0 | (330b) |
| pump for solar water heating | | 0 | (330g) |
| Total electricity for the above, kWh/year | =(330a) + (330b) + (330g) = | 114.79 | (331) |
| Energy for lighting (calculated in Appendix L) | | 247.96 | (332) |
| Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) = | | 3350.31 | (338) |

## 12b. CO2 Emissions – Community heating scheme

| | | Energy kWh/year | Emission factor kg CO2/kWh | | Emissions kg CO2/year | |
|---|---|---|---|---|---|---|
| CO2 from other sources of space and water heating (not CHP) Efficiency of heat source 1 (%) | If there is CHP using two fuels repeat (363) to (366) for the second fuel | | | | 96 | (367a) |
| CO2 associated with heat source 1 | [(307b)+(310b)] x 100 ÷ (367b) x | | 0.22 | = | 672.2 | (367) |
| Electrical energy for heat distribution | [(313) x | | 0.52 | = | 15.51 | (372) |

# DER WorkSheet: New dwelling design stage

| | | | | | |
|---|---|---|---|---|---|
| Total CO2 associated with community systems | (363)…(366) + (368)...(372) | | = | 687.71 | (373) |
| CO2 associated with space heating (secondary) | (309) x | 0 | = | 0 | (374) |
| CO2 associated with water from immersion heater or instantaneous heater | (312) x | 0.22 | = | 0 | (375) |
| Total CO2 associated with space and water heating | (373) + (374) + (375) = | | | 687.71 | (376) |
| CO2 associated with electricity for pumps and fans within dwelling | (331)) x | 0.52 | = | 59.58 | (378) |
| CO2 associated with electricity for lighting | (332))) x | 0.52 | = | 128.69 | (379) |
| **Total CO2, kg/year** | sum of (376)…(382) = | | | 875.97 | (383) |
| **Dwelling CO2 Emission Rate** | (383) ÷ (4) = | | | 16.23 | (384) |
| **EI rating (section 14)** | | | | 88.14 | (385) |

# Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.50
*Printed on 06 December 2021 at 10:54:20*

## Project Information:

| | | | |
|---|---|---|---|
| **Assessed By:** | Neil Ingham (STRO010943) | **Building Type:** | Flat |

## Dwelling Details:

| | | | |
|---|---|---|---|
| **NEW DWELLING DESIGN STAGE** | | Total Floor Area: 69.44m² | |
| **Site Reference :** | Highgate Road - GREEN | **Plot Reference:** | 03 - E |
| **Address :** | | | |

## Client Details:

**Name:**
**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 (c) | | |
| Fuel factor: 1.00 (mains gas (c)) | | |
| Target Carbon Dioxide Emission Rate (TER) | 16.69 kg/m² | |
| Dwelling Carbon Dioxide Emission Rate (DER) | 14.29 kg/m² | **OK** |

## 1b TFEE and DFEE

| | | |
|---|---|---|
| Target Fabric Energy Efficiency (TFEE) | 41.5 kWh/m² | |
| Dwelling Fabric Energy Efficiency (DFEE) | 33.7 kWh/m² | |
| | | **OK** |

## 2 Fabric U-values

| Element | Average | Highest | |
|---|---|---|---|
| External wall | 0.18 (max. 0.30) | 0.18 (max. 0.70) | **OK** |
| Party wall | 0.00 (max. 0.20) | - | **OK** |
| Floor | (no floor) | | |
| Roof | (no roof) | | |
| Openings | 1.40 (max. 2.00) | 1.40 (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 | 3.00 (design value) | |
| Maximum | 10.0 | **OK** |

## 4 Heating efficiency

| | |
|---|---|
| Main Heating system: | Community heating schemes - mains gas |
| Secondary heating system: | None |

## 5 Cylinder insulation

| | |
|---|---|
| Hot water Storage: | No cylinder |

## 6 Controls

| | | |
|---|---|---|
| Space heating controls | Charging system linked to use of community heating, programmer and at least two room thermostats | **OK** |
| Hot water controls: | No cylinder thermostat<br>No cylinder | |

# Regulations Compliance Report

## 7 Low energy lights

| | | |
|---|---|---|
| Percentage of fixed lights with low-energy fittings | 100.0% | |
| Minimum | 75.0% | **OK** |

## 8 Mechanical ventilation

| | | |
|---|---|---|
| Continuous supply and extract system | | |
| Specific fan power: | 0.54 | |
| Maximum | 1.5 | **OK** |
| MVHR efficiency: | 88% | |
| Minimum | 70% | **OK** |

## 9 Summertime temperature

| | | |
|---|---|---|
| Overheating risk (Thames valley): | Slight | **OK** |
| Based on: | | |
| Overshading: | Average or unknown | |
| Windows facing: North East | 8.97m² | |
| Windows facing: South West | 2.92m² | |
| Ventilation rate: | 6.00 | |

## 10 Key features

| | |
|---|---|
| Air permeablility | 3.0 m³/m²h |
| Party Walls U-value | 0 W/m²K |
| Community heating, heat from boilers – mains gas | |

# DER WorkSheet: New dwelling design stage

User Details:

**Assessor Name:** Neil Ingham
**Stroma Number:** STRO010943
**Software Name:** Stroma FSAP 2012
**Software Version:** Version: 1.0.5.50

Property Address: 03 - E

**Address :**

## 1. Overall dwelling dimensions:

| | Area(m²) | | Av. Height(m) | | Volume(m³) | |
|---|---|---|---|---|---|---|
| Ground floor | 69.44 | (1a) x | 2.65 | (2a) = | 184.02 | (3a) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n) | 69.44 | (4) | | | | |
| Dwelling volume | | | | (3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) = | 184.02 | (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 | | | | | | | 0 | x 10 = | 0 | (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) = | 0 | ÷ (5) = | 0 | (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 | | | 3 | (17) |
| If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16) | | | 0.15 | (18) |
| *Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used* | | | | |
| Number of sides sheltered | | | 0 | (19) |
| Shelter factor | (20) = 1 - [0.075 x (19)] = | | 1 | (20) |
| Infiltration rate incorporating shelter factor | (21) = (18) x (20) = | | 0.15 | (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 |

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 |

# DER WorkSheet: New dwelling design stage

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

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.19 | 0.19 | 0.18 | 0.16 | 0.16 | 0.14 | 0.14 | 0.14 | 0.15 | 0.16 | 0.17 | 0.18 |

*Calculate effective air change rate for the applicable case*

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 74.8 (23c)

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24a)m= | 0.32 | 0.31 | 0.31 | 0.29 | 0.29 | 0.27 | 0.27 | 0.26 | 0.28 | 0.29 | 0.29 | 0.3 | (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 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24d) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (25)m= | 0.32 | 0.31 | 0.31 | 0.29 | 0.29 | 0.27 | 0.27 | 0.26 | 0.28 | 0.29 | 0.29 | 0.3 | (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 | |
|---|---|---|---|---|---|---|---|---|---|---|
| Windows Type 1 | | | 8.97 | x1/[1/( 1.4 )+ 0.04] | | = | 11.89 | | | (27) |
| Windows Type 2 | | | 2.92 | x1/[1/( 1.4 )+ 0.04] | | = | 3.87 | | | (27) |
| Walls Type1 | 41.51 | 11.89 | 29.62 | x | 0.18 | = | 5.33 | 60 | 1777.2 | (29) |
| Walls Type2 | 16.73 | 0 | 16.73 | x | 0.17 | = | 2.81 | 60 | 1003.8 | (29) |
| Total area of elements, m² | | | 58.24 | | | | | | | (31) |
| Party wall | | | 40.43 | x | 0 | = | 0 | 45 | 1819.35 | (32) |
| Party floor | | | 69.44 | | | | | 40 | 2777.6 | (32a) |
| Party ceiling | | | 69.44 | | | | | 30 | 2083.2 | (32b) |
| Internal wall ** | | | 136.21 | | | | | 9 | 1225.89 | (32c) |

** 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) = 23.9 (33)

Heat capacity Cm = S(A x k ) ((28)…(30) + (32) + (32a)…(32e) = 10687.04 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 153.9 (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 6.99 (36)

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

Total fabric heat loss (33) + (36) = 30.9 (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= | 19.27 | 19.04 | 18.81 | 17.67 | 17.44 | 16.3 | 16.3 | 16.08 | 16.76 | 17.44 | 17.9 | 18.35 | (38) |

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

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (39)m= | 50.16 | 49.93 | 49.71 | 48.57 | 48.34 | 47.2 | 47.2 | 46.97 | 47.66 | 48.34 | 48.79 | 49.25 |

Average = Sum(39)$_{1…12}$ /12= 48.51 (39)

# DER WorkSheet: New dwelling design stage

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

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (40)m= | 0.72 | 0.72 | 0.72 | 0.7 | 0.7 | 0.68 | 0.68 | 0.68 | 0.69 | 0.7 | 0.7 | 0.71 |

Average = Sum(40)$_{1…12}$ /12= 0.7 (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 — 2.23 (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 — 87.22 (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= | 95.94 | 92.45 | 88.97 | 85.48 | 81.99 | 78.5 | 78.5 | 81.99 | 85.48 | 88.97 | 92.45 | 95.94 |

Total = Sum(44)$_{1…12}$ = 1046.65 (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= | 142.28 | 124.44 | 128.41 | 111.95 | 107.42 | 92.7 | 85.9 | 98.57 | 99.74 | 116.24 | 126.89 | 137.79 |

Total = Sum(45)$_{1…12}$ = 1372.32 (45)

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (46)m= | 21.34 | 18.67 | 19.26 | 16.79 | 16.11 | 13.9 | 12.88 | 14.78 | 14.96 | 17.44 | 19.03 | 20.67 | (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) = 110 (50)

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

Hot water storage loss factor from Table 2 (kWh/litre/day) — 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a — 1.03 (52)

Temperature factor from Table 2b — 0.6 (53)

Energy lost from water storage, kWh/year — (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) — 1.03 (55)

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (56)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (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= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (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= | 23.26 | 21.01 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | (59) |

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 | (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= | 197.56 | 174.37 | 183.69 | 165.44 | 162.7 | 146.19 | 141.17 | 153.84 | 153.24 | 171.52 | 180.38 | 193.07 | (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= | 197.56 | 174.37 | 183.69 | 165.44 | 162.7 | 146.19 | 141.17 | 153.84 | 153.24 | 171.52 | 180.38 | 193.07 | |

Output from water heater (annual)$_{1...12}$ 2023.16 (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= | 91.53 | 81.32 | 86.92 | 80.02 | 79.94 | 73.62 | 72.78 | 76.99 | 75.96 | 82.87 | 84.98 | 90.04 | (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= | 111.62 | 111.62 | 111.62 | 111.62 | 111.62 | 111.62 | 111.62 | 111.62 | 111.62 | 111.62 | 111.62 | 111.62 | (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5 | | | | | | | | | | | | | |
| (67)m= | 18 | 15.98 | 13 | 9.84 | 7.36 | 6.21 | 6.71 | 8.72 | 11.71 | 14.87 | 17.35 | 18.5 | (67) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | | | | | | | | | | | | | |
| (68)m= | 195.99 | 198.02 | 192.9 | 181.98 | 168.21 | 155.27 | 146.62 | 144.59 | 149.71 | 160.62 | 174.4 | 187.34 | (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 | | | | | | | | | | | | | |
| (69)m= | 34.16 | 34.16 | 34.16 | 34.16 | 34.16 | 34.16 | 34.16 | 34.16 | 34.16 | 34.16 | 34.16 | 34.16 | (69) |
| Pumps and fans gains (Table 5a) | | | | | | | | | | | | | |
| (70)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (70) |
| Losses e.g. evaporation (negative values) (Table 5) | | | | | | | | | | | | | |
| (71)m= | -89.3 | -89.3 | -89.3 | -89.3 | -89.3 | -89.3 | -89.3 | -89.3 | -89.3 | -89.3 | -89.3 | -89.3 | (71) |
| Water heating gains (Table 5) | | | | | | | | | | | | | |
| (72)m= | 123.02 | 121.01 | 116.83 | 111.14 | 107.44 | 102.24 | 97.82 | 103.49 | 105.5 | 111.39 | 118.03 | 121.02 | (72) |
| **Total internal gains =** (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m | | | | | | | | | | | | | |
| (73)m= | 393.49 | 391.5 | 379.21 | 359.45 | 339.5 | 320.21 | 307.64 | 313.29 | 323.41 | 343.36 | 366.27 | 383.34 | (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 | 8.97 | x | 11.28 | x | 0.63 | x | 0.7 | = | 30.93 | (75) |
| Northeast 0.9x | 0.77 | x | 8.97 | x | 22.97 | x | 0.63 | x | 0.7 | = | 62.96 | (75) |
| Northeast 0.9x | 0.77 | x | 8.97 | x | 41.38 | x | 0.63 | x | 0.7 | = | 113.43 | (75) |
| Northeast 0.9x | 0.77 | x | 8.97 | x | 67.96 | x | 0.63 | x | 0.7 | = | 186.29 | (75) |
| Northeast 0.9x | 0.77 | x | 8.97 | x | 91.35 | x | 0.63 | x | 0.7 | = | 250.41 | (75) |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Northeast | 0.9x | 0.77 | x | 8.97 | x | 97.38 | x | 0.63 | x | 0.7 | = | 266.96 | (75) |
| Northeast | 0.9x | 0.77 | x | 8.97 | x | 91.1 | x | 0.63 | x | 0.7 | = | 249.74 | (75) |
| Northeast | 0.9x | 0.77 | x | 8.97 | x | 72.63 | x | 0.63 | x | 0.7 | = | 199.1 | (75) |
| Northeast | 0.9x | 0.77 | x | 8.97 | x | 50.42 | x | 0.63 | x | 0.7 | = | 138.22 | (75) |
| Northeast | 0.9x | 0.77 | x | 8.97 | x | 28.07 | x | 0.63 | x | 0.7 | = | 76.94 | (75) |
| Northeast | 0.9x | 0.77 | x | 8.97 | x | 14.2 | x | 0.63 | x | 0.7 | = | 38.92 | (75) |
| Northeast | 0.9x | 0.77 | x | 8.97 | x | 9.21 | x | 0.63 | x | 0.7 | = | 25.26 | (75) |
| Southwest | 0.9x | 0.77 | x | 2.92 | x | 36.79 | | 0.63 | x | 0.7 | = | 32.83 | (79) |
| Southwest | 0.9x | 0.77 | x | 2.92 | x | 62.67 | | 0.63 | x | 0.7 | = | 55.93 | (79) |
| Southwest | 0.9x | 0.77 | x | 2.92 | x | 85.75 | | 0.63 | x | 0.7 | = | 76.52 | (79) |
| Southwest | 0.9x | 0.77 | x | 2.92 | x | 106.25 | | 0.63 | x | 0.7 | = | 94.82 | (79) |
| Southwest | 0.9x | 0.77 | x | 2.92 | x | 119.01 | | 0.63 | x | 0.7 | = | 106.2 | (79) |
| Southwest | 0.9x | 0.77 | x | 2.92 | x | 118.15 | | 0.63 | x | 0.7 | = | 105.44 | (79) |
| Southwest | 0.9x | 0.77 | x | 2.92 | x | 113.91 | | 0.63 | x | 0.7 | = | 101.65 | (79) |
| Southwest | 0.9x | 0.77 | x | 2.92 | x | 104.39 | | 0.63 | x | 0.7 | = | 93.16 | (79) |
| Southwest | 0.9x | 0.77 | x | 2.92 | x | 92.85 | | 0.63 | x | 0.7 | = | 82.86 | (79) |
| Southwest | 0.9x | 0.77 | x | 2.92 | x | 69.27 | | 0.63 | x | 0.7 | = | 61.81 | (79) |
| Southwest | 0.9x | 0.77 | x | 2.92 | x | 44.07 | | 0.63 | x | 0.7 | = | 39.33 | (79) |
| Southwest | 0.9x | 0.77 | x | 2.92 | x | 31.49 | | 0.63 | x | 0.7 | = | 28.1 | (79) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (83)m= | 63.76 | 118.89 | 189.96 | 281.11 | 356.62 | 372.4 | 351.39 | 292.25 | 221.08 | 138.76 | 78.25 | 53.36 | (83) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (84)m= | 457.26 | 510.39 | 569.17 | 640.56 | 696.12 | 692.61 | 659.04 | 605.54 | 544.49 | 482.12 | 444.51 | 436.7 | (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= | 0.98 | 0.96 | 0.91 | 0.8 | 0.62 | 0.43 | 0.31 | 0.36 | 0.59 | 0.85 | 0.96 | 0.98 | (86) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (87)m= | 20.14 | 20.31 | 20.56 | 20.83 | 20.96 | 20.99 | 21 | 21 | 20.98 | 20.8 | 20.44 | 20.12 | (87) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (88)m= | 20.32 | 20.32 | 20.33 | 20.34 | 20.34 | 20.36 | 20.36 | 20.36 | 20.35 | 20.34 | 20.34 | 20.33 | (88) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (89)m= | 0.97 | 0.95 | 0.9 | 0.77 | 0.58 | 0.39 | 0.27 | 0.31 | 0.54 | 0.83 | 0.95 | 0.98 | (89) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (90)m= | 19.17 | 19.41 | 19.77 | 20.14 | 20.3 | 20.35 | 20.36 | 20.36 | 20.33 | 20.11 | 19.61 | 19.15 | (90) |

fLA = Living area ÷ (4) = 0.34 (91)

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (92)m= | 19.51 | 19.72 | 20.04 | 20.38 | 20.53 | 20.57 | 20.58 | 20.58 | 20.55 | 20.35 | 19.9 | 19.48 | (92) |

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

# DER WorkSheet: New dwelling design stage

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (93)m= | 19.51 | 19.72 | 20.04 | 20.38 | 20.53 | 20.57 | 20.58 | 20.58 | 20.55 | 20.35 | 19.9 | 19.48 | (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= | 0.97 | 0.94 | 0.89 | 0.77 | 0.59 | 0.4 | 0.28 | 0.32 | 0.55 | 0.83 | 0.94 | 0.97 | (94) |
| Useful gains, hmGm , W = (94)m x (84)m | | | | | | | | | | | | | |
| (95)m= | 441.94 | 482.27 | 508.95 | 494.78 | 412.34 | 280.41 | 187.58 | 195.95 | 300.31 | 398.27 | 418.19 | 424.3 | (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= | 762.69 | 740.05 | 672.95 | 557.45 | 426.72 | 281.99 | 187.77 | 196.33 | 307.58 | 471.09 | 624.48 | 752.71 | (97) |
| Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m | | | | | | | | | | | | | |
| (98)m= | 238.64 | 173.23 | 122.02 | 45.12 | 10.7 | 0 | 0 | 0 | 0 | 54.18 | 148.53 | 244.34 | |

| | | |
|---|---|---|
| Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = | 1036.76 | (98) |
| Space heating requirement in kWh/m²/year | 14.93 | (99) |

## 9b. Energy requirements – Community heating scheme

| | | | |
|---|---|---|---|
| This part is used for space heating, space cooling or water heating provided by a community scheme.<br>Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none | | 0 | (301) |
| Fraction of space heat from community system 1 – (301) = | | 1 | (302) |

*The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.*

| | | | |
|---|---|---|---|
| Fraction of heat from Community boilers | | 1 | (303a) |
| Fraction of total space heat from Community boilers | (302) x (303a) = | 1 | (304a) |
| Factor for control and charging method (Table 4c(3)) for community heating system | | 1 | (305) |
| Distribution loss factor (Table 12c) for community heating system | | 1.05 | (306) |
| **Space heating** | | **kWh/year** | |
| Annual space heating requirement | | 1036.76 | |
| Space heat from Community boilers | (98) x (304a) x (305) x (306) = | 1088.59 | (307a) |
| Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) | | 0 | (308 |
| Space heating requirement from secondary/supplementary system | (98) x (301) x 100 ÷ (308) = | 0 | (309) |
| **Water heating** | | | |
| Annual water heating requirement | | 2023.16 | |
| If DHW from community scheme:<br>Water heat from Community boilers | (64) x (303a) x (305) x (306) = | 2124.32 | (310a) |
| Electricity used for heat distribution | 0.01 × [(307a)…(307e) + (310a)…(310e)] = | 32.13 | (313) |
| Cooling System Energy Efficiency Ratio | | 0 | (314) |
| Space cooling (if there is a fixed cooling system, if not enter 0) | = (107) ÷ (314) = | 0 | (315) |
| Electricity for pumps and fans within dwelling (Table 4f):<br>mechanical ventilation - balanced, extract or positive input from outside | | 169.72 | (330a) |

| | | | |
|---|---|---|---|
| warm air heating system fans | | 0 | (330b) |
| pump for solar water heating | | 0 | (330g) |
| Total electricity for the above, kWh/year | =(330a) + (330b) + (330g) = | 169.72 | (331) |
| Energy for lighting (calculated in Appendix L) | | 317.84 | (332) |
| Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) = | | 3700.47 | (338) |

## 12b. CO2 Emissions – Community heating scheme

| | | Energy kWh/year | Emission factor kg CO2/kWh | | Emissions kg CO2/year | |
|---|---|---|---|---|---|---|
| CO2 from other sources of space and water heating (not CHP) | | | | | | |
| Efficiency of heat source 1 (%) | If there is CHP using two fuels repeat (363) to (366) for the second fuel | | | | 96 | (367a) |
| CO2 associated with heat source 1 | [(307b)+(310b)] x 100 ÷ (367b) x | | 0.22 | = | 722.91 | (367) |
| Electrical energy for heat distribution | [(313) x | | 0.52 | = | 16.68 | (372) |
| Total CO2 associated with community systems | (363)…(366) + (368)...(372) | | | = | 739.58 | (373) |
| CO2 associated with space heating (secondary) | (309) x | | 0 | = | 0 | (374) |
| CO2 associated with water from immersion heater or instantaneous heater | (312) x | | 0.22 | = | 0 | (375) |
| Total CO2 associated with space and water heating | (373) + (374) + (375) = | | | | 739.58 | (376) |
| CO2 associated with electricity for pumps and fans within dwelling | (331)) x | | 0.52 | = | 88.09 | (378) |
| CO2 associated with electricity for lighting | (332))) x | | 0.52 | = | 164.96 | (379) |
| **Total CO2, kg/year** | sum of (376)…(382) = | | | | 992.62 | (383) |
| **Dwelling CO2 Emission Rate** | (383) ÷ (4) = | | | | 14.29 | (384) |
| **EI rating (section 14)** | | | | | 88.38 | (385) |

# Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.50
*Printed on 06 December 2021 at 10:54:13*

## Project Information:

**Assessed By:** Neil Ingham (STRO010943) **Building Type:** Flat

## Dwelling Details:

**NEW DWELLING DESIGN STAGE** Total Floor Area: 69.61m²

**Site Reference :** Highgate Road - GREEN **Plot Reference:** 03 - F

**Address :**

## Client Details:

**Name:**

**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 (c) | | |
| Fuel factor: 1.00 (mains gas (c)) | | |
| Target Carbon Dioxide Emission Rate (TER) | 16.77 kg/m² | |
| Dwelling Carbon Dioxide Emission Rate (DER) | 14.35 kg/m² | **OK** |

## 1b TFEE and DFEE

| | | |
|---|---|---|
| Target Fabric Energy Efficiency (TFEE) | 41.9 kWh/m² | |
| Dwelling Fabric Energy Efficiency (DFEE) | 34.0 kWh/m² | |
| | | **OK** |

## 2 Fabric U-values

| Element | Average | Highest | |
|---|---|---|---|
| External wall | 0.18 (max. 0.30) | 0.18 (max. 0.70) | **OK** |
| Party wall | 0.00 (max. 0.20) | - | **OK** |
| Floor | (no floor) | | |
| Roof | (no roof) | | |
| Openings | 1.40 (max. 2.00) | 1.40 (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 | 3.00 (design value) | |
| Maximum | 10.0 | **OK** |

## 4 Heating efficiency

| | |
|---|---|
| Main Heating system: | Community heating schemes - mains gas |
| Secondary heating system: | None |

## 5 Cylinder insulation

| | |
|---|---|
| Hot water Storage: | No cylinder |

## 6 Controls

| | | |
|---|---|---|
| Space heating controls | Charging system linked to use of community heating, programmer and at least two room thermostats | **OK** |
| Hot water controls: | No cylinder thermostat<br>No cylinder | |

# Regulations Compliance Report

| | | |
|---|---|---|
| **7 Low energy lights** | | |
| Percentage of fixed lights with low-energy fittings | 100.0% | |
| Minimum | 75.0% | **OK** |
| **8 Mechanical ventilation** | | |
| Continuous supply and extract system | | |
| Specific fan power: | 0.54 | |
| Maximum | 1.5 | **OK** |
| MVHR efficiency: | 88% | |
| Minimum | 70% | **OK** |
| **9 Summertime temperature** | | |
| Overheating risk (Thames valley): | Slight | **OK** |
| Based on: | | |
| Overshading: | Average or unknown | |
| Windows facing: North East | 8.97m² | |
| Windows facing: South West | 2.92m² | |
| Ventilation rate: | 6.00 | |
| **10 Key features** | | |
| Air permeablility | 3.0 m³/m²h | |
| Party  Walls U-value | 0 W/m²K | |
| Community heating, heat from boilers – mains gas | | |

# DER WorkSheet: New dwelling design stage

## User Details:

| | | | |
|---|---|---|---|
| **Assessor Name:** | Neil Ingham | **Stroma Number:** | STRO010943 |
| **Software Name:** | Stroma FSAP 2012 | **Software Version:** | Version: 1.0.5.50 |

## Property Address: 03 - F

**Address :**

## 1. Overall dwelling dimensions:

| | Area(m²) | | Av. Height(m) | | Volume(m³) | |
|---|---|---|---|---|---|---|
| Ground floor | 69.61 | (1a) x | 2.65 | (2a) = | 184.47 | (3a) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n) | 69.61 | (4) | | | | |
| Dwelling volume | | | | (3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) = | 184.47 | (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 | | | | | | | 0 | x 10 = | 0 | (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) = | 0 | ÷ (5) = | 0 | (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 | | 3 | (17) |
| If based on air permeability value, then | (18) = [(17) ÷ 20]+(8), otherwise (18) = (16) | 0.15 | (18) |

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

| | | | |
|---|---|---|---|
| Number of sides sheltered | | 0 | (19) |
| Shelter factor | (20) = 1 - [0.075 x (19)] = | 1 | (20) |
| Infiltration rate incorporating shelter factor | (21) = (18) x (20) = | 0.15 | (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 |

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 |

# DER WorkSheet: New dwelling design stage

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

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.19 | 0.19 | 0.18 | 0.16 | 0.16 | 0.14 | 0.14 | 0.14 | 0.15 | 0.16 | 0.17 | 0.18 |

*Calculate effective air change rate for the applicable case*

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 74.8 (23c)

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24a)m= | 0.32 | 0.31 | 0.31 | 0.29 | 0.29 | 0.27 | 0.27 | 0.26 | 0.28 | 0.29 | 0.29 | 0.3 | (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 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24d) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (25)m= | 0.32 | 0.31 | 0.31 | 0.29 | 0.29 | 0.27 | 0.27 | 0.26 | 0.28 | 0.29 | 0.29 | 0.3 | (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 | |
|---|---|---|---|---|---|---|---|---|---|---|
| Windows Type 1 | | | 8.97 | x1/[1/( 1.4 )+ 0.04] | | = | 11.89 | | | (27) |
| Windows Type 2 | | | 2.92 | x1/[1/( 1.4 )+ 0.04] | | = | 3.87 | | | (27) |
| Walls Type1 | 41.59 | 11.89 | 29.7 | x | 0.18 | = | 5.35 | 60 | 1782 | (29) |
| Walls Type2 | 18.41 | 0 | 18.41 | x | 0.17 | = | 3.09 | 60 | 1104.6 | (29) |
| Total area of elements, m² | | | 60 | | | | | | | (31) |
| Party wall | | | 38.68 | x | 0 | = | 0 | 45 | 1740.6 | (32) |
| Party floor | | | 69.61 | | | | | 40 | 2784.4 | (32a) |
| Party ceiling | | | 69.61 | | | | | 30 | 2088.3 | (32b) |
| Internal wall ** | | | 136.21 | | | | | 9 | 1225.89 | (32c) |

** 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) = 24.2 (33)

Heat capacity Cm = S(A x k ) ((28)…(30) + (32) + (32a)…(32e) = 10725.79 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 154.08 (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 6.99 (36)

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

Total fabric heat loss (33) + (36) = 31.19 (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= | 19.31 | 19.08 | 18.86 | 17.71 | 17.49 | 16.34 | 16.34 | 16.12 | 16.8 | 17.49 | 17.94 | 18.4 | (38) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (39)m= | 50.5 | 50.28 | 50.05 | 48.91 | 48.68 | 47.54 | 47.54 | 47.31 | 47.99 | 48.68 | 49.13 | 49.59 | |

Average = Sum(39)$_{1…12}$ /12= 48.85 (39)

# DER WorkSheet: New dwelling design stage

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

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (40)m= | 0.73 | 0.72 | 0.72 | 0.7 | 0.7 | 0.68 | 0.68 | 0.68 | 0.69 | 0.7 | 0.71 | 0.71 |

Average = Sum(40)$_{1…12}$ /12= 0.7 (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 2.24 (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 87.32 (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= | 96.05 | 92.56 | 89.07 | 85.57 | 82.08 | 78.59 | 78.59 | 82.08 | 85.57 | 89.07 | 92.56 | 96.05 |

Total = Sum(44)$_{1…12}$ = 1047.84 (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= | 142.44 | 124.58 | 128.56 | 112.08 | 107.54 | 92.8 | 85.99 | 98.68 | 99.86 | 116.37 | 127.03 | 137.95 |

Total = Sum(45)$_{1…12}$ = 1373.88 (45)

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (46)m= | 21.37 | 18.69 | 19.28 | 16.81 | 16.13 | 13.92 | 12.9 | 14.8 | 14.98 | 17.46 | 19.05 | 20.69 | (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) = 110 (50)

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

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (56)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (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= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (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= | 23.26 | 21.01 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | (59) |

# DER WorkSheet: New dwelling design stage

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 | (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= | 197.72 | 174.51 | 183.83 | 165.57 | 162.82 | 146.29 | 141.27 | 153.96 | 153.35 | 171.65 | 180.52 | 193.22 | (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= | 197.72 | 174.51 | 183.83 | 165.57 | 162.82 | 146.29 | 141.27 | 153.96 | 153.35 | 171.65 | 180.52 | 193.22 | |

Output from water heater (annual)$_{1...12}$ 2024.72 (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= | 91.58 | 81.36 | 86.97 | 80.06 | 79.98 | 73.65 | 72.81 | 77.03 | 76 | 82.92 | 85.03 | 90.09 | (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= | 111.83 | 111.83 | 111.83 | 111.83 | 111.83 | 111.83 | 111.83 | 111.83 | 111.83 | 111.83 | 111.83 | 111.83 | (66) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (67)m= | 18.04 | 16.02 | 13.03 | 9.87 | 7.37 | 6.23 | 6.73 | 8.74 | 11.74 | 14.9 | 17.39 | 18.54 | (67) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (68)m= | 196.39 | 198.42 | 193.29 | 182.36 | 168.55 | 155.58 | 146.92 | 144.88 | 150.02 | 160.95 | 174.75 | 187.72 | (68) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (69)m= | 34.18 | 34.18 | 34.18 | 34.18 | 34.18 | 34.18 | 34.18 | 34.18 | 34.18 | 34.18 | 34.18 | 34.18 | (69) |

Pumps and fans gains (Table 5a)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (70)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (70) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (71)m= | -89.46 | -89.46 | -89.46 | -89.46 | -89.46 | -89.46 | -89.46 | -89.46 | -89.46 | -89.46 | -89.46 | -89.46 | (71) |

Water heating gains (Table 5)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (72)m= | 123.1 | 121.08 | 116.89 | 111.2 | 107.5 | 102.29 | 97.87 | 103.54 | 105.55 | 111.45 | 118.1 | 121.09 | (72) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (73)m= | 394.07 | 392.08 | 379.76 | 359.97 | 339.98 | 320.65 | 308.06 | 313.71 | 323.86 | 343.85 | 366.79 | 383.9 | (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 | 8.97 | x | 11.28 | x | 0.63 | x | 0.7 | = | 30.93 | (75) |
| Northeast | 0.9x | 0.77 | x | 8.97 | x | 22.97 | x | 0.63 | x | 0.7 | = | 62.96 | (75) |
| Northeast | 0.9x | 0.77 | x | 8.97 | x | 41.38 | x | 0.63 | x | 0.7 | = | 113.43 | (75) |
| Northeast | 0.9x | 0.77 | x | 8.97 | x | 67.96 | x | 0.63 | x | 0.7 | = | 186.29 | (75) |
| Northeast | 0.9x | 0.77 | x | 8.97 | x | 91.35 | x | 0.63 | x | 0.7 | = | 250.41 | (75) |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Northeast | 0.9x | 0.77 | x | 8.97 | x | 97.38 | x | 0.63 | x | 0.7 | = | 266.96 | (75) |
| Northeast | 0.9x | 0.77 | x | 8.97 | x | 91.1 | x | 0.63 | x | 0.7 | = | 249.74 | (75) |
| Northeast | 0.9x | 0.77 | x | 8.97 | x | 72.63 | x | 0.63 | x | 0.7 | = | 199.1 | (75) |
| Northeast | 0.9x | 0.77 | x | 8.97 | x | 50.42 | x | 0.63 | x | 0.7 | = | 138.22 | (75) |
| Northeast | 0.9x | 0.77 | x | 8.97 | x | 28.07 | x | 0.63 | x | 0.7 | = | 76.94 | (75) |
| Northeast | 0.9x | 0.77 | x | 8.97 | x | 14.2 | x | 0.63 | x | 0.7 | = | 38.92 | (75) |
| Northeast | 0.9x | 0.77 | x | 8.97 | x | 9.21 | x | 0.63 | x | 0.7 | = | 25.26 | (75) |
| Southwest | 0.9x | 0.77 | x | 2.92 | x | 36.79 | | 0.63 | x | 0.7 | = | 32.83 | (79) |
| Southwest | 0.9x | 0.77 | x | 2.92 | x | 62.67 | | 0.63 | x | 0.7 | = | 55.93 | (79) |
| Southwest | 0.9x | 0.77 | x | 2.92 | x | 85.75 | | 0.63 | x | 0.7 | = | 76.52 | (79) |
| Southwest | 0.9x | 0.77 | x | 2.92 | x | 106.25 | | 0.63 | x | 0.7 | = | 94.82 | (79) |
| Southwest | 0.9x | 0.77 | x | 2.92 | x | 119.01 | | 0.63 | x | 0.7 | = | 106.2 | (79) |
| Southwest | 0.9x | 0.77 | x | 2.92 | x | 118.15 | | 0.63 | x | 0.7 | = | 105.44 | (79) |
| Southwest | 0.9x | 0.77 | x | 2.92 | x | 113.91 | | 0.63 | x | 0.7 | = | 101.65 | (79) |
| Southwest | 0.9x | 0.77 | x | 2.92 | x | 104.39 | | 0.63 | x | 0.7 | = | 93.16 | (79) |
| Southwest | 0.9x | 0.77 | x | 2.92 | x | 92.85 | | 0.63 | x | 0.7 | = | 82.86 | (79) |
| Southwest | 0.9x | 0.77 | x | 2.92 | x | 69.27 | | 0.63 | x | 0.7 | = | 61.81 | (79) |
| Southwest | 0.9x | 0.77 | x | 2.92 | x | 44.07 | | 0.63 | x | 0.7 | = | 39.33 | (79) |
| Southwest | 0.9x | 0.77 | x | 2.92 | x | 31.49 | | 0.63 | x | 0.7 | = | 28.1 | (79) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (83)m= | 63.76 | 118.89 | 189.96 | 281.11 | 356.62 | 372.4 | 351.39 | 292.25 | 221.08 | 138.76 | 78.25 | 53.36 | (83) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (84)m= | 457.84 | 510.96 | 569.72 | 641.07 | 696.59 | 693.05 | 659.46 | 605.97 | 544.94 | 482.6 | 445.04 | 437.26 | (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= | 0.98 | 0.96 | 0.92 | 0.8 | 0.62 | 0.44 | 0.32 | 0.36 | 0.59 | 0.85 | 0.96 | 0.98 | (86) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (87)m= | 20.14 | 20.3 | 20.55 | 20.83 | 20.96 | 20.99 | 21 | 21 | 20.98 | 20.79 | 20.44 | 20.12 | (87) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (88)m= | 20.32 | 20.32 | 20.32 | 20.34 | 20.34 | 20.36 | 20.36 | 20.36 | 20.35 | 20.34 | 20.34 | 20.33 | (88) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (89)m= | 0.97 | 0.95 | 0.9 | 0.77 | 0.58 | 0.39 | 0.27 | 0.31 | 0.54 | 0.83 | 0.95 | 0.98 | (89) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (90)m= | 19.16 | 19.4 | 19.76 | 20.13 | 20.3 | 20.35 | 20.36 | 20.36 | 20.33 | 20.1 | 19.6 | 19.14 | (90) |

fLA = Living area ÷ (4) = 0.38 (91)

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (92)m= | 19.53 | 19.74 | 20.06 | 20.4 | 20.55 | 20.6 | 20.6 | 20.6 | 20.58 | 20.37 | 19.92 | 19.51 | (92) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (93)m= | 19.53 | 19.74 | 20.06 | 20.4 | 20.55 | 20.6 | 20.6 | 20.6 | 20.58 | 20.37 | 19.92 | 19.51 | (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= | 0.97 | 0.95 | 0.9 | 0.78 | 0.6 | 0.41 | 0.29 | 0.33 | 0.56 | 0.83 | 0.94 | 0.97 | (94) |
| Useful gains, hmGm , W = (94)m x (84)m | | | | | | | | | | | | | |
| (95)m= | 442.81 | 483.37 | 510.56 | 497.42 | 415.67 | 283.37 | 189.97 | 198.39 | 303.11 | 400.16 | 419.22 | 425.1 | (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= | 769.26 | 746.33 | 678.64 | 562.34 | 430.79 | 285.07 | 190.19 | 198.8 | 310.81 | 475.38 | 629.94 | 759.24 | (97) |
| Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m | | | | | | | | | | | | | |
| (98)m= | 242.87 | 176.71 | 125.05 | 46.74 | 11.25 | 0 | 0 | 0 | 0 | 55.96 | 151.71 | 248.6 | |

| | | |
|---|---|---|
| Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = | 1058.9 | (98) |
| Space heating requirement in kWh/m²/year | 15.21 | (99) |

## 9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

| | | | |
|---|---|---|---|
| Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none | | 0 | (301) |
| Fraction of space heat from community system 1 – (301) = | | 1 | (302) |

*The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.*

| | | | |
|---|---|---|---|
| Fraction of heat from Community boilers | | 1 | (303a) |
| Fraction of total space heat from Community boilers | (302) x (303a) = | 1 | (304a) |
| Factor for control and charging method (Table 4c(3)) for community heating system | | 1 | (305) |
| Distribution loss factor (Table 12c) for community heating system | | 1.05 | (306) |
| **Space heating** | | **kWh/year** | |
| Annual space heating requirement | | 1058.9 | |
| Space heat from Community boilers | (98) x (304a) x (305) x (306) = | 1111.84 | (307a) |
| Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) | | 0 | (308 |
| Space heating requirement from secondary/supplementary system | (98) x (301) x 100 ÷ (308) = | 0 | (309) |
| **Water heating** | | | |
| Annual water heating requirement | | 2024.72 | |
| If DHW from community scheme: Water heat from Community boilers | (64) x (303a) x (305) x (306) = | 2125.95 | (310a) |
| Electricity used for heat distribution | 0.01 × [(307a)…(307e) + (310a)…(310e)] = | 32.38 | (313) |
| Cooling System Energy Efficiency Ratio | | 0 | (314) |
| Space cooling (if there is a fixed cooling system, if not enter 0) | = (107) ÷ (314) = | 0 | (315) |
| Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside | | 170.14 | (330a) |

| | | | | |
|---|---|---|---|---|
| warm air heating system fans | | | 0 | (330b) |
| pump for solar water heating | | | 0 | (330g) |
| Total electricity for the above, kWh/year | =(330a) + (330b) + (330g) = | | 170.14 | (331) |
| Energy for lighting (calculated in Appendix L) | | | 318.62 | (332) |
| Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) = | | | 3726.56 | (338) |

## 12b. CO2 Emissions – Community heating scheme

| | | Energy kWh/year | Emission factor kg CO2/kWh | | Emissions kg CO2/year | |
|---|---|---|---|---|---|---|
| CO2 from other sources of space and water heating (not CHP) | | | | | | |
| Efficiency of heat source 1 (%) | If there is CHP using two fuels repeat (363) to (366) for the second fuel | | | | 96 | (367a) |
| CO2 associated with heat source 1 | [(307b)+(310b)] x 100 ÷ (367b) x | | 0.22 | = | 728.5 | (367) |
| Electrical energy for heat distribution | [(313) x | | 0.52 | = | 16.8 | (372) |
| Total CO2 associated with community systems | (363)…(366) + (368)...(372) | | | = | 745.31 | (373) |
| CO2 associated with space heating (secondary) | (309) x | | 0 | = | 0 | (374) |
| CO2 associated with water from immersion heater or instantaneous heater | (312) x | | 0.22 | = | 0 | (375) |
| Total CO2 associated with space and water heating | (373) + (374) + (375) = | | | | 745.31 | (376) |
| CO2 associated with electricity for pumps and fans within dwelling | (331)) x | | 0.52 | = | 88.3 | (378) |
| CO2 associated with electricity for lighting | (332))) x | | 0.52 | = | 165.36 | (379) |
| **Total CO2, kg/year** | sum of (376)…(382) = | | | | 998.97 | (383) |
| **Dwelling CO2 Emission Rate** | (383) ÷ (4) = | | | | 14.35 | (384) |
| **EI rating (section 14)** | | | | | 88.32 | (385) |

# Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.50
*Printed on 06 December 2021 at 10:54:08*

## Project Information:

**Assessed By:** Neil Ingham (STRO010943) **Building Type:** Flat

## Dwelling Details:

**NEW DWELLING DESIGN STAGE** Total Floor Area: 50.62m²

**Site Reference :** Highgate Road - GREEN **Plot Reference:** 03 - G

**Address :**

## Client Details:

**Name:**

**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 (c) | | |
| Fuel factor: 1.00 (mains gas (c)) | | |
| Target Carbon Dioxide Emission Rate (TER) | 19.64 kg/m² | |
| Dwelling Carbon Dioxide Emission Rate (DER) | 16.45 kg/m² | OK |

## 1b TFEE and DFEE

| | | |
|---|---|---|
| Target Fabric Energy Efficiency (TFEE) | 48.0 kWh/m² | |
| Dwelling Fabric Energy Efficiency (DFEE) | 38.7 kWh/m² | |
| | | OK |

## 2 Fabric U-values

| Element | Average | Highest | |
|---|---|---|---|
| External wall | 0.17 (max. 0.30) | 0.18 (max. 0.70) | OK |
| Party wall | 0.00 (max. 0.20) | - | OK |
| Floor | (no floor) | | |
| Roof | (no roof) | | |
| Openings | 1.40 (max. 2.00) | 1.40 (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 | 3.00 (design value) | |
| Maximum | 10.0 | OK |

## 4 Heating efficiency

| | |
|---|---|
| Main Heating system: | Community heating schemes - mains gas |
| Secondary heating system: | None |

## 5 Cylinder insulation

| | |
|---|---|
| Hot water Storage: | No cylinder |

## 6 Controls

| | | |
|---|---|---|
| Space heating controls | Charging system linked to use of community heating, programmer and at least two room thermostats | OK |
| Hot water controls: | No cylinder thermostat<br>No cylinder | |

# Regulations Compliance Report

| 7 Low energy lights | | |
|---|---|---|
| Percentage of fixed lights with low-energy fittings | 100.0% | |
| Minimum | 75.0% | **OK** |

| 8 Mechanical ventilation | | |
|---|---|---|
| Continuous supply and extract system | | |
| Specific fan power: | 0.47 | |
| Maximum | 1.5 | **OK** |
| MVHR efficiency: | 89% | |
| Minimum | 70% | **OK** |

| 9 Summertime temperature | | |
|---|---|---|
| Overheating risk (Thames valley): | Medium | **OK** |
| Based on: | | |
| Overshading: | Average or unknown | |
| Windows facing: North East | 8.97m² | |
| Ventilation rate: | 4.00 | |

| 10 Key features | |
|---|---|
| Air permeablility | 3.0 m³/m²h |
| Party  Walls U-value | 0 W/m²K |
| Community heating, heat from boilers – mains gas | |

# DER WorkSheet: New dwelling design stage

## User Details:

| | | | |
|---|---|---|---|
| **Assessor Name:** | Neil Ingham | **Stroma Number:** | STRO010943 |
| **Software Name:** | Stroma FSAP 2012 | **Software Version:** | Version: 1.0.5.50 |

Property Address: 03 - G

**Address :**

## 1. Overall dwelling dimensions:

| | Area(m²) | | Av. Height(m) | | Volume(m³) | |
|---|---|---|---|---|---|---|
| Ground floor | 50.62 | (1a) x | 2.65 | (2a) = | 134.14 | (3a) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n) | 50.62 | (4) | | | | |
| Dwelling volume | | | (3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) = | | 134.14 | (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 | | | | | | | 0 | x 10 = | 0 | (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) = | 0 | ÷ (5) = | 0 | (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 | | 3 | (17) |
| If based on air permeability value, then | (18) = [(17) ÷ 20]+(8), otherwise (18) = (16) | 0.15 | (18) |

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

| | | | |
|---|---|---|---|
| Number of sides sheltered | | 0 | (19) |
| Shelter factor | (20) = 1 - [0.075 x (19)] = | 1 | (20) |
| Infiltration rate incorporating shelter factor | (21) = (18) x (20) = | 0.15 | (21) |

Infiltration rate modified for monthly wind speed

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

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.19 | 0.19 | 0.18 | 0.16 | 0.16 | 0.14 | 0.14 | 0.14 | 0.15 | 0.16 | 0.17 | 0.18 |

*Calculate effective air change rate for the applicable case*

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 75.65 (23c)

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24a)m= | 0.31 | 0.31 | 0.31 | 0.29 | 0.28 | 0.26 | 0.26 | 0.26 | 0.27 | 0.28 | 0.29 | 0.3 | (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 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24d) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (25)m= | 0.31 | 0.31 | 0.31 | 0.29 | 0.28 | 0.26 | 0.26 | 0.26 | 0.27 | 0.28 | 0.29 | 0.3 | (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 | |
|---|---|---|---|---|---|---|---|---|---|---|
| Windows | | | 8.97 | x1/[1/( 1.4 )+ 0.04] | | = | 11.89 | | | (27) |
| Walls Type1 | 31.4 | 8.97 | 22.43 | x | 0.18 | = | 4.04 | 60 | 1345.8 | (29) |
| Walls Type2 | 22.92 | 0 | 22.92 | x | 0.17 | = | 3.85 | 60 | 1375.2 | (29) |
| Total area of elements, m² | | | 54.32 | | | | | | | (31) |
| Party wall | | | 30.08 | x | 0 | = | 0 | 45 | 1353.6 | (32) |
| Party floor | | | 50.62 | | | | | 40 | 2024.8 | (32a) |
| Party ceiling | | | 50.62 | | | | | 30 | 1518.6 | (32b) |
| Internal wall ** | | | 83.2 | | | | | 9 | 748.8 | (32c) |

** 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) = 19.78 (33)

Heat capacity Cm = S(A x k ) ((28)…(30) + (32) + (32a)…(32e) = 8366.8 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 165.29 (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 5.92 (36)

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

Total fabric heat loss (33) + (36) = 25.7 (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= | 13.86 | 13.69 | 13.52 | 12.69 | 12.53 | 11.7 | 11.7 | 11.53 | 12.03 | 12.53 | 12.86 | 13.19 | (38) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (39)m= | 39.55 | 39.39 | 39.22 | 38.39 | 38.22 | 37.39 | 37.39 | 37.23 | 37.73 | 38.22 | 38.56 | 38.89 | |

Average = Sum(39)$_{1…12}$ /12= 38.35 (39)

# DER WorkSheet: New dwelling design stage

Heat loss parameter (HLP), W/m²K $(40)m = (39)m \div (4)$

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (40)m= | 0.78 | 0.78 | 0.77 | 0.76 | 0.76 | 0.74 | 0.74 | 0.74 | 0.75 | 0.76 | 0.76 | 0.77 |

Average = Sum(40)$_{1…12}$ /12= 0.76 (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 1.71 (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 74.77 (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= | 82.25 | 79.26 | 76.27 | 73.28 | 70.29 | 67.3 | 67.3 | 70.29 | 73.28 | 76.27 | 79.26 | 82.25 | |
| | | | | | | | | | | | Total = Sum(44)$_{1…12}$ = | 897.28 | (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= | 121.98 | 106.68 | 110.09 | 95.97 | 92.09 | 79.47 | 73.64 | 84.5 | 85.51 | 99.65 | 108.78 | 118.13 | |
| | | | | | | | | | | | Total = Sum(45)$_{1…12}$ = | 1176.48 | (45) |
| *If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)* | | | | | | | | | | | | | |
| (46)m= | 18.3 | 16 | 16.51 | 14.4 | 13.81 | 11.92 | 11.05 | 12.68 | 12.83 | 14.95 | 16.32 | 17.72 | (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) = 110 (50)

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

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (56)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (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= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (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= | 23.26 | 21.01 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | (59) |

# DER WorkSheet: New dwelling design stage

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 | (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= | 177.25 | 156.61 | 165.36 | 149.47 | 147.37 | 132.96 | 128.91 | 139.78 | 139 | 154.93 | 162.27 | 173.4 | (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= | 177.25 | 156.61 | 165.36 | 149.47 | 147.37 | 132.96 | 128.91 | 139.78 | 139 | 154.93 | 162.27 | 173.4 | |

Output from water heater (annual)$_{1…12}$ 1827.32 (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= | 84.78 | 75.41 | 80.82 | 74.71 | 74.84 | 69.22 | 68.71 | 72.32 | 71.23 | 77.36 | 78.96 | 83.5 | (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= | 85.42 | 85.42 | 85.42 | 85.42 | 85.42 | 85.42 | 85.42 | 85.42 | 85.42 | 85.42 | 85.42 | 85.42 | (66) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (67)m= | 13.59 | 12.07 | 9.81 | 7.43 | 5.55 | 4.69 | 5.07 | 6.59 | 8.84 | 11.22 | 13.1 | 13.97 | (67) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (68)m= | 148.84 | 150.39 | 146.5 | 138.21 | 127.75 | 117.92 | 111.35 | 109.81 | 113.7 | 121.99 | 132.45 | 142.28 | (68) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (69)m= | 31.54 | 31.54 | 31.54 | 31.54 | 31.54 | 31.54 | 31.54 | 31.54 | 31.54 | 31.54 | 31.54 | 31.54 | (69) |

Pumps and fans gains (Table 5a)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (70)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (70) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (71)m= | -68.33 | -68.33 | -68.33 | -68.33 | -68.33 | -68.33 | -68.33 | -68.33 | -68.33 | -68.33 | -68.33 | -68.33 | (71) |

Water heating gains (Table 5)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (72)m= | 113.95 | 112.22 | 108.64 | 103.76 | 100.59 | 96.14 | 92.35 | 97.2 | 98.93 | 103.97 | 109.67 | 112.23 | (72) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (73)m= | 325.01 | 323.3 | 313.57 | 298.03 | 282.52 | 267.37 | 257.39 | 262.22 | 270.09 | 285.81 | 303.84 | 317.1 | (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 | 8.97 | x | 11.28 | x | 0.63 | x | 0.7 | = | 30.93 | (75) |
| Northeast 0.9x | 0.77 | x | 8.97 | x | 22.97 | x | 0.63 | x | 0.7 | = | 62.96 | (75) |
| Northeast 0.9x | 0.77 | x | 8.97 | x | 41.38 | x | 0.63 | x | 0.7 | = | 113.43 | (75) |
| Northeast 0.9x | 0.77 | x | 8.97 | x | 67.96 | x | 0.63 | x | 0.7 | = | 186.29 | (75) |
| Northeast 0.9x | 0.77 | x | 8.97 | x | 91.35 | x | 0.63 | x | 0.7 | = | 250.41 | (75) |

# DER WorkSheet: New dwelling design stage

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Northeast | 0.9x | 0.77 | x | 8.97 | x | 97.38 | x | 0.63 | x | 0.7 | = | 266.96 | (75) |
| Northeast | 0.9x | 0.77 | x | 8.97 | x | 91.1 | x | 0.63 | x | 0.7 | = | 249.74 | (75) |
| Northeast | 0.9x | 0.77 | x | 8.97 | x | 72.63 | x | 0.63 | x | 0.7 | = | 199.1 | (75) |
| Northeast | 0.9x | 0.77 | x | 8.97 | x | 50.42 | x | 0.63 | x | 0.7 | = | 138.22 | (75) |
| Northeast | 0.9x | 0.77 | x | 8.97 | x | 28.07 | x | 0.63 | x | 0.7 | = | 76.94 | (75) |
| Northeast | 0.9x | 0.77 | x | 8.97 | x | 14.2 | x | 0.63 | x | 0.7 | = | 38.92 | (75) |
| Northeast | 0.9x | 0.77 | x | 8.97 | x | 9.21 | x | 0.63 | x | 0.7 | = | 25.26 | (75) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (83)m= | 30.93 | 62.96 | 113.43 | 186.29 | 250.41 | 266.96 | 249.74 | 199.1 | 138.22 | 76.94 | 38.92 | 25.26 | (83) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (84)m= | 355.94 | 386.26 | 427.01 | 484.32 | 532.94 | 534.34 | 507.13 | 461.32 | 408.31 | 362.75 | 342.76 | 342.36 | (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= | 0.98 | 0.96 | 0.93 | 0.82 | 0.64 | 0.44 | 0.32 | 0.37 | 0.61 | 0.87 | 0.96 | 0.98 | (86) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (87)m= | 20.13 | 20.27 | 20.52 | 20.81 | 20.95 | 20.99 | 21 | 21 | 20.97 | 20.77 | 20.42 | 20.11 | (87) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (88)m= | 20.27 | 20.27 | 20.28 | 20.29 | 20.29 | 20.31 | 20.31 | 20.31 | 20.3 | 20.29 | 20.29 | 20.28 | (88) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (89)m= | 0.97 | 0.96 | 0.91 | 0.79 | 0.59 | 0.4 | 0.27 | 0.31 | 0.56 | 0.84 | 0.95 | 0.98 | (89) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (90)m= | 19.1 | 19.31 | 19.66 | 20.06 | 20.24 | 20.3 | 20.31 | 20.31 | 20.28 | 20.03 | 19.54 | 19.09 | (90) |

fLA = Living area ÷ (4) = 0.49 (91)

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (92)m= | 19.61 | 19.78 | 20.08 | 20.43 | 20.59 | 20.64 | 20.65 | 20.65 | 20.62 | 20.39 | 19.97 | 19.59 | (92) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (93)m= | 19.61 | 19.78 | 20.08 | 20.43 | 20.59 | 20.64 | 20.65 | 20.65 | 20.62 | 20.39 | 19.97 | 19.59 | (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= | 0.97 | 0.95 | 0.91 | 0.79 | 0.61 | 0.42 | 0.3 | 0.34 | 0.58 | 0.85 | 0.95 | 0.97 | (94) |
| Useful gains, hmGm , W = (94)m x (84)m | | | | | | | | | | | | | |
| (95)m= | 344.68 | 367.88 | 388.24 | 384.81 | 326.31 | 224.34 | 151.08 | 157.68 | 238.18 | 307.45 | 324.2 | 332.97 | (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= | 605.37 | 586.05 | 532.59 | 442.53 | 339.89 | 225.9 | 151.29 | 158.09 | 245.86 | 374.26 | 496.17 | 598.46 | (97) |
| Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m | | | | | | | | | | | | | |
| (98)m= | 193.95 | 146.61 | 107.39 | 41.56 | 10.1 | 0 | 0 | 0 | 0 | 49.71 | 123.82 | 197.53 | (98) |

# DER WorkSheet: New dwelling design stage

| | | | |
|---|---|---|---|
| | Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = | 870.67 | (98) |
| Space heating requirement in kWh/m²/year | | 17.2 | (99) |

## 9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

| | | | |
|---|---|---|---|
| Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none | | 0 | (301) |
| Fraction of space heat from community system 1 – (301) = | | 1 | (302) |

*The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.*

| | | | |
|---|---|---|---|
| Fraction of heat from Community boilers | | 1 | (303a) |
| Fraction of total space heat from Community boilers | (302) x (303a) = | 1 | (304a) |
| Factor for control and charging method (Table 4c(3)) for community heating system | | 1 | (305) |
| Distribution loss factor (Table 12c) for community heating system | | 1.05 | (306) |
| **Space heating** | | **kWh/year** | |
| Annual space heating requirement | | 870.67 | |
| Space heat from Community boilers | (98) x (304a) x (305) x (306) = | 914.2 | (307a) |
| Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) | | 0 | (308 |
| Space heating requirement from secondary/supplementary system | (98) x (301) x 100 ÷ (308) = | 0 | (309) |
| **Water heating** | | | |
| Annual water heating requirement | | 1827.32 | |
| If DHW from community scheme: Water heat from Community boilers | (64) x (303a) x (305) x (306) = | 1918.69 | (310a) |
| Electricity used for heat distribution | 0.01 × [(307a)…(307e) + (310a)…(310e)] = | 28.33 | (313) |
| Cooling System Energy Efficiency Ratio | | 0 | (314) |
| Space cooling (if there is a fixed cooling system, if not enter 0) | = (107) ÷ (314) = | 0 | (315) |
| Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside | | 107.68 | (330a) |
| warm air heating system fans | | 0 | (330b) |
| pump for solar water heating | | 0 | (330g) |
| Total electricity for the above, kWh/year | =(330a) + (330b) + (330g) = | 107.68 | (331) |
| Energy for lighting (calculated in Appendix L) | | 239.96 | (332) |
| Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) = | | 3180.53 | (338) |

## 12b. $CO_2$ Emissions – Community heating scheme

| | | Energy kWh/year | Emission factor kg CO2/kWh | | Emissions kg CO2/year | |
|---|---|---|---|---|---|---|
| CO2 from other sources of space and water heating (not CHP) | | | | | | |
| Efficiency of heat source 1 (%) | If there is CHP using two fuels repeat (363) to (366) for the second fuel | | | | 96 | (367a) |
| CO2 associated with heat source 1 | [(307b)+(310b)] x 100 ÷ (367b) x | | 0.22 | = | 637.4 | (367) |
| Electrical energy for heat distribution | [(313) x | | 0.52 | = | 14.7 | (372) |

# DER WorkSheet: New dwelling design stage

| | | | | | |
|---|---|---|---|---|---|
| Total CO2 associated with community systems | (363)…(366) + (368)...(372) | | = | 652.1 | (373) |
| CO2 associated with space heating (secondary) | (309) x | 0 | = | 0 | (374) |
| CO2 associated with water from immersion heater or instantaneous heater | (312) x | 0.22 | = | 0 | (375) |
| Total CO2 associated with space and water heating | (373) + (374) + (375) = | | | 652.1 | (376) |
| CO2 associated with electricity for pumps and fans within dwelling | (331)) x | 0.52 | = | 55.89 | (378) |
| CO2 associated with electricity for lighting | (332))) x | 0.52 | = | 124.54 | (379) |
| **Total CO2, kg/year** | sum of (376)…(382) = | | | 832.53 | (383) |
| **Dwelling CO2 Emission Rate** | (383) ÷ (4) = | | | 16.45 | (384) |
| **EI rating (section 14)** | | | | 88.33 | (385) |

# Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.50
*Printed on 06 December 2021 at 10:54:02*

## Project Information:

**Assessed By:** Neil Ingham (STRO010943) **Building Type:** Flat

## Dwelling Details:

**NEW DWELLING DESIGN STAGE** Total Floor Area: 63.92m²

**Site Reference :** Highgate Road - GREEN **Plot Reference:** 03 - H

**Address :**

## Client Details:

**Name:**

**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 (c) | | |
| Fuel factor: 1.00 (mains gas (c)) | | |
| Target Carbon Dioxide Emission Rate (TER) | 17.67 kg/m² | |
| Dwelling Carbon Dioxide Emission Rate (DER) | 15.46 kg/m² | OK |

## 1b TFEE and DFEE

| | | |
|---|---|---|
| Target Fabric Energy Efficiency (TFEE) | 45.6 kWh/m² | |
| Dwelling Fabric Energy Efficiency (DFEE) | 38.8 kWh/m² | |
| | | OK |

## 2 Fabric U-values

| Element | Average | Highest | |
|---|---|---|---|
| External wall | 0.18 (max. 0.30) | 0.18 (max. 0.70) | OK |
| Party wall | 0.00 (max. 0.20) | - | OK |
| Floor | (no floor) | | |
| Roof | (no roof) | | |
| Openings | 1.40 (max. 2.00) | 1.40 (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 | 3.00 (design value) | |
| Maximum | 10.0 | OK |

## 4 Heating efficiency

| | |
|---|---|
| Main Heating system: | Community heating schemes - mains gas |
| Secondary heating system: | None |

## 5 Cylinder insulation

| | |
|---|---|
| Hot water Storage: | No cylinder |

## 6 Controls

| | | |
|---|---|---|
| Space heating controls | Charging system linked to use of community heating, programmer and at least two room thermostats | OK |
| Hot water controls: | No cylinder thermostat<br>No cylinder | |

# Regulations Compliance Report

| 7 Low energy lights | | |
|---|---|---|
| Percentage of fixed lights with low-energy fittings | 100.0% | |
| Minimum | 75.0% | **OK** |
| **8 Mechanical ventilation** | | |
| Continuous supply and extract system | | |
| Specific fan power: | 0.47 | |
| Maximum | 1.5 | **OK** |
| MVHR efficiency: | 89% | |
| Minimum | 70% | **OK** |
| **9 Summertime temperature** | | |
| Overheating risk (Thames valley): | Slight | **OK** |
| Based on: | | |
| Overshading: | Average or unknown | |
| Windows facing: North East | 9.56m² | |
| Windows facing: South East | 8.76m² | |
| Ventilation rate: | 6.00 | |
| **10 Key features** | | |
| Air permeablility | 3.0 m³/m²h | |
| Party Walls U-value | 0 W/m²K | |
| Community heating, heat from boilers – mains gas | | |

# DER WorkSheet: New dwelling design stage

User Details:

| | | | |
|---|---|---|---|
| **Assessor Name:** | Neil Ingham | **Stroma Number:** | STRO010943 |
| **Software Name:** | Stroma FSAP 2012 | **Software Version:** | Version: 1.0.5.50 |

Property Address: 03 - H

**Address :**

## 1. Overall dwelling dimensions:

| | Area(m²) | | Av. Height(m) | | Volume(m³) | |
|---|---|---|---|---|---|---|
| Ground floor | 63.92 | (1a) x | 2.65 | (2a) = | 169.39 | (3a) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n) | 63.92 | (4) | | | | |
| Dwelling volume | | | | (3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) = | 169.39 | (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 | | | | | | | 0 | x 10 = | 0 | (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) = | 0 | ÷ (5) = | 0 | (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 | | 3 | (17) |
| If based on air permeability value, then | (18) = [(17) ÷ 20]+(8), otherwise (18) = (16) | 0.15 | (18) |

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

| | | | |
|---|---|---|---|
| Number of sides sheltered | | 0 | (19) |
| Shelter factor | (20) = 1 - [0.075 x (19)] = | 1 | (20) |
| Infiltration rate incorporating shelter factor | (21) = (18) x (20) = | 0.15 | (21) |

Infiltration rate modified for monthly wind speed

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

# DER WorkSheet: New dwelling design stage

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

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.19 | 0.19 | 0.18 | 0.16 | 0.16 | 0.14 | 0.14 | 0.14 | 0.15 | 0.16 | 0.17 | 0.18 |

*Calculate effective air change rate for the applicable case*

| | | |
|---|---|---|
| If mechanical ventilation: | 0.5 | (23a) |
| If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) | 0.5 | (23b) |
| If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = | 75.65 | (23c) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24a)m= | 0.31 | 0.31 | 0.31 | 0.29 | 0.28 | 0.26 | 0.26 | 0.26 | 0.27 | 0.28 | 0.29 | 0.3 | (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 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24d) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (25)m= | 0.31 | 0.31 | 0.31 | 0.29 | 0.28 | 0.26 | 0.26 | 0.26 | 0.27 | 0.28 | 0.29 | 0.3 | (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 | |
|---|---|---|---|---|---|---|---|---|---|---|
| Windows Type 1 | | | 9.56 | x1/[1/( 1.4 )+ 0.04] | | = | 12.67 | | | (27) |
| Windows Type 2 | | | 8.76 | x1/[1/( 1.4 )+ 0.04] | | = | 11.61 | | | (27) |
| Walls Type1 | 61.09 | 18.32 | 42.77 | x | 0.18 | = | 7.7 | 60 | 2566.2 | (29) |
| Walls Type2 | 3.86 | 0 | 3.86 | x | 0.17 | = | 0.65 | 60 | 231.6 | (29) |
| Total area of elements, m² | | | 64.95 | | | | | | | (31) |
| Party wall | | | 37.5 | x | 0 | = | 0 | 45 | 1687.5 | (32) |
| Party floor | | | 63.92 | | | | | 40 | 2556.8 | (32a) |
| Party ceiling | | | 63.92 | | | | | 30 | 1917.6 | (32b) |
| Internal wall ** | | | 113.47 | | | | | 9 | 1021.23 | (32c) |

** 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) = | 32.63 | (33) |
| Heat capacity Cm = S(A x k ) | ((28)…(30) + (32) + (32a)…(32e) = | 9980.93 | (34) |
| Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K | = (34) ÷ (4) = | 156.15 | (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 | | 7.91 | (36) |

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

| | | | |
|---|---|---|---|
| Total fabric heat loss | (33) + (36) = | 40.54 | (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= | 17.5 | 17.29 | 17.08 | 16.03 | 15.82 | 14.77 | 14.77 | 14.56 | 15.19 | 15.82 | 16.24 | 16.66 | (38) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (39)m= | 58.04 | 57.83 | 57.62 | 56.57 | 56.36 | 55.32 | 55.32 | 55.11 | 55.73 | 56.36 | 56.78 | 57.2 | |

Average = Sum(39)$_{1…12}$ /12= 56.52 (39)

# DER WorkSheet: New dwelling design stage

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

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (40)m= | 0.91 | 0.9 | 0.9 | 0.89 | 0.88 | 0.87 | 0.87 | 0.86 | 0.87 | 0.88 | 0.89 | 0.89 |

Average = Sum(40)$_{1...12}$ /12= 0.88 (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 2.09 (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 83.84 (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= | 92.22 | 88.87 | 85.51 | 82.16 | 78.81 | 75.45 | 75.45 | 78.81 | 82.16 | 85.51 | 88.87 | 92.22 |

Total = Sum(44)$_{1...12}$ = 1006.06 (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= | 136.76 | 119.61 | 123.43 | 107.61 | 103.25 | 89.1 | 82.56 | 94.74 | 95.88 | 111.73 | 121.97 | 132.45 |

Total = Sum(45)$_{1...12}$ = 1319.1 (45)

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (46)m= | 20.51 | 17.94 | 18.51 | 16.14 | 15.49 | 13.37 | 12.38 | 14.21 | 14.38 | 16.76 | 18.29 | 19.87 | (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) = 110 (50)

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

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (56)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (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= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (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= | 23.26 | 21.01 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | (59) |

# DER WorkSheet: New dwelling design stage

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 | (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= | 192.04 | 169.54 | 178.71 | 161.1 | 158.53 | 142.59 | 137.84 | 150.02 | 149.37 | 167.01 | 175.46 | 187.72 | (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= | 192.04 | 169.54 | 178.71 | 161.1 | 158.53 | 142.59 | 137.84 | 150.02 | 149.37 | 167.01 | 175.46 | 187.72 | |

Output from water heater (annual)$_{1\ldots12}$ 1969.94 (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= | 89.69 | 79.71 | 85.26 | 78.58 | 78.55 | 72.42 | 71.67 | 75.72 | 74.67 | 81.37 | 83.35 | 88.26 | (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= | 104.5 | 104.5 | 104.5 | 104.5 | 104.5 | 104.5 | 104.5 | 104.5 | 104.5 | 104.5 | 104.5 | 104.5 | (66) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (67)m= | 16.29 | 14.47 | 11.77 | 8.91 | 6.66 | 5.62 | 6.07 | 7.9 | 10.6 | 13.46 | 15.7 | 16.74 | (67) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (68)m= | 182.71 | 184.61 | 179.83 | 169.66 | 156.82 | 144.75 | 136.69 | 134.8 | 139.57 | 149.75 | 162.58 | 174.65 | (68) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (69)m= | 33.45 | 33.45 | 33.45 | 33.45 | 33.45 | 33.45 | 33.45 | 33.45 | 33.45 | 33.45 | 33.45 | 33.45 | (69) |

Pumps and fans gains (Table 5a)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (70)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (70) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (71)m= | -83.6 | -83.6 | -83.6 | -83.6 | -83.6 | -83.6 | -83.6 | -83.6 | -83.6 | -83.6 | -83.6 | -83.6 | (71) |

Water heating gains (Table 5)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (72)m= | 120.56 | 118.62 | 114.6 | 109.13 | 105.58 | 100.58 | 96.34 | 101.78 | 103.71 | 109.37 | 115.76 | 118.63 | (72) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (73)m= | 373.91 | 372.05 | 360.55 | 342.05 | 323.41 | 305.31 | 293.45 | 298.82 | 308.23 | 326.92 | 348.4 | 364.37 | (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 | 9.56 | x | 11.28 | x | 0.63 | x | 0.7 | = | 32.96 | (75) |
| Northeast 0.9x | 0.77 | x | 9.56 | x | 22.97 | x | 0.63 | x | 0.7 | = | 67.1 | (75) |
| Northeast 0.9x | 0.77 | x | 9.56 | x | 41.38 | x | 0.63 | x | 0.7 | = | 120.89 | (75) |
| Northeast 0.9x | 0.77 | x | 9.56 | x | 67.96 | x | 0.63 | x | 0.7 | = | 198.54 | (75) |
| Northeast 0.9x | 0.77 | x | 9.56 | x | 91.35 | x | 0.63 | x | 0.7 | = | 266.88 | (75) |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Northeast 0.9x | 0.77 | x | 9.56 | x | 97.38 | x | 0.63 | x | 0.7 | = | 284.52 | (75) |
| Northeast 0.9x | 0.77 | x | 9.56 | x | 91.1 | x | 0.63 | x | 0.7 | = | 266.17 | (75) |
| Northeast 0.9x | 0.77 | x | 9.56 | x | 72.63 | x | 0.63 | x | 0.7 | = | 212.19 | (75) |
| Northeast 0.9x | 0.77 | x | 9.56 | x | 50.42 | x | 0.63 | x | 0.7 | = | 147.31 | (75) |
| Northeast 0.9x | 0.77 | x | 9.56 | x | 28.07 | x | 0.63 | x | 0.7 | = | 82 | (75) |
| Northeast 0.9x | 0.77 | x | 9.56 | x | 14.2 | x | 0.63 | x | 0.7 | = | 41.48 | (75) |
| Northeast 0.9x | 0.77 | x | 9.56 | x | 9.21 | x | 0.63 | x | 0.7 | = | 26.92 | (75) |
| Southeast 0.9x | 0.77 | x | 8.76 | x | 36.79 | x | 0.63 | x | 0.7 | = | 98.5 | (77) |
| Southeast 0.9x | 0.77 | x | 8.76 | x | 62.67 | x | 0.63 | x | 0.7 | = | 167.79 | (77) |
| Southeast 0.9x | 0.77 | x | 8.76 | x | 85.75 | x | 0.63 | x | 0.7 | = | 229.57 | (77) |
| Southeast 0.9x | 0.77 | x | 8.76 | x | 106.25 | x | 0.63 | x | 0.7 | = | 284.45 | (77) |
| Southeast 0.9x | 0.77 | x | 8.76 | x | 119.01 | x | 0.63 | x | 0.7 | = | 318.61 | (77) |
| Southeast 0.9x | 0.77 | x | 8.76 | x | 118.15 | x | 0.63 | x | 0.7 | = | 316.31 | (77) |
| Southeast 0.9x | 0.77 | x | 8.76 | x | 113.91 | x | 0.63 | x | 0.7 | = | 304.95 | (77) |
| Southeast 0.9x | 0.77 | x | 8.76 | x | 104.39 | x | 0.63 | x | 0.7 | = | 279.47 | (77) |
| Southeast 0.9x | 0.77 | x | 8.76 | x | 92.85 | x | 0.63 | x | 0.7 | = | 248.58 | (77) |
| Southeast 0.9x | 0.77 | x | 8.76 | x | 69.27 | x | 0.63 | x | 0.7 | = | 185.44 | (77) |
| Southeast 0.9x | 0.77 | x | 8.76 | x | 44.07 | x | 0.63 | x | 0.7 | = | 117.98 | (77) |
| Southeast 0.9x | 0.77 | x | 8.76 | x | 31.49 | x | 0.63 | x | 0.7 | = | 84.3 | (77) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (83)m= | 131.47 | 234.89 | 350.47 | 483 | 585.49 | 600.83 | 571.12 | 491.66 | 395.89 | 267.44 | 159.46 | 111.22 | (83) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (84)m= | 505.38 | 606.94 | 711.02 | 825.05 | 908.91 | 906.14 | 864.57 | 790.48 | 704.13 | 594.37 | 507.86 | 475.59 | (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= | 0.97 | 0.94 | 0.87 | 0.73 | 0.55 | 0.39 | 0.28 | 0.32 | 0.53 | 0.8 | 0.94 | 0.97 | (86) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (87)m= | 19.93 | 20.19 | 20.51 | 20.81 | 20.95 | 20.99 | 21 | 21 | 20.97 | 20.76 | 20.3 | 19.89 | (87) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (88)m= | 20.16 | 20.16 | 20.17 | 20.18 | 20.18 | 20.2 | 20.2 | 20.2 | 20.19 | 20.18 | 20.18 | 20.17 | (88) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (89)m= | 0.96 | 0.92 | 0.85 | 0.69 | 0.51 | 0.34 | 0.23 | 0.26 | 0.47 | 0.77 | 0.93 | 0.97 | (89) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (90)m= | 18.74 | 19.11 | 19.56 | 19.97 | 20.13 | 20.19 | 20.2 | 20.2 | 20.17 | 19.91 | 19.29 | 18.69 | (90) |

fLA = Living area ÷ (4) = | 0.38 | (91)

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (92)m= | 19.19 | 19.52 | 19.92 | 20.29 | 20.44 | 20.5 | 20.5 | 20.5 | 20.47 | 20.23 | 19.67 | 19.14 | (92) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (93)m= | 19.19 | 19.52 | 19.92 | 20.29 | 20.44 | 20.5 | 20.5 | 20.5 | 20.47 | 20.23 | 19.67 | 19.14 | (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= | 0.95 | 0.91 | 0.84 | 0.7 | 0.52 | 0.36 | 0.25 | 0.29 | 0.49 | 0.77 | 0.92 | 0.96 | (94) |
| Useful gains, hmGm , W = (94)m x (84)m | | | | | | | | | | | | | |
| (95)m= | 481.7 | 555.07 | 597.49 | 576.76 | 475.72 | 323.61 | 215.39 | 225.34 | 345.69 | 458.98 | 466.53 | 457.07 | (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= | 864.4 | 845.57 | 773.35 | 644.22 | 492.83 | 326.09 | 215.79 | 226.04 | 355.11 | 542.96 | 713.83 | 854.77 | (97) |
| Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m | | | | | | | | | | | | | |
| (98)m= | 284.73 | 195.21 | 130.84 | 48.57 | 12.73 | 0 | 0 | 0 | 0 | 62.48 | 178.05 | 295.89 | |

| | | |
|---|---|---|
| Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = | 1208.5 | (98) |
| Space heating requirement in kWh/m²/year | 18.91 | (99) |

## 9b. Energy requirements – Community heating scheme

| | | | |
|---|---|---|---|
| This part is used for space heating, space cooling or water heating provided by a community scheme.<br>Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none | | 0 | (301) |
| Fraction of space heat from community system 1 – (301) = | | 1 | (302) |

*The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.*

| | | | |
|---|---|---|---|
| Fraction of heat from Community boilers | | 1 | (303a) |
| Fraction of total space heat from Community boilers | (302) x (303a) = | 1 | (304a) |
| Factor for control and charging method (Table 4c(3)) for community heating system | | 1 | (305) |
| Distribution loss factor (Table 12c) for community heating system | | 1.05 | (306) |
| **Space heating** | | **kWh/year** | |
| Annual space heating requirement | | 1208.5 | |
| Space heat from Community boilers | (98) x (304a) x (305) x (306) = | 1268.93 | (307a) |
| Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) | | 0 | (308 |
| Space heating requirement from secondary/supplementary system | (98) x (301) x 100 ÷ (308) = | 0 | (309) |
| **Water heating** | | | |
| Annual water heating requirement | | 1969.94 | |
| If DHW from community scheme:<br>Water heat from Community boilers | (64) x (303a) x (305) x (306) = | 2068.44 | (310a) |
| Electricity used for heat distribution | 0.01 × [(307a)…(307e) + (310a)…(310e)] = | 33.37 | (313) |
| Cooling System Energy Efficiency Ratio | | 0 | (314) |
| Space cooling (if there is a fixed cooling system, if not enter 0) | = (107) ÷ (314) = | 0 | (315) |
| Electricity for pumps and fans within dwelling (Table 4f):<br>mechanical ventilation - balanced, extract or positive input from outside | | 135.98 | (330a) |

# DER WorkSheet: New dwelling design stage

| | | | | | |
|---|---|---|---|---|---|
| warm air heating system fans | | | | 0 | (330b) |
| pump for solar water heating | | | | 0 | (330g) |
| Total electricity for the above, kWh/year | =(330a) + (330b) + (330g) = | | | 135.98 | (331) |
| Energy for lighting (calculated in Appendix L) | | | | 287.67 | (332) |
| Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) = | | | | 3761.01 | (338) |

## 12b. CO2 Emissions – Community heating scheme

| | | Energy kWh/year | Emission factor kg CO2/kWh | | Emissions kg CO2/year | |
|---|---|---|---|---|---|---|
| CO2 from other sources of space and water heating (not CHP) | | | | | | |
| Efficiency of heat source 1 (%) | If there is CHP using two fuels repeat (363) to (366) for the second fuel | | | | 96 | (367a) |
| CO2 associated with heat source 1 | [(307b)+(310b)] x 100 ÷ (367b) x | | 0.22 | = | 750.91 | (367) |
| Electrical energy for heat distribution | [(313) x | | 0.52 | = | 17.32 | (372) |
| Total CO2 associated with community systems | (363)…(366) + (368)...(372) | | | = | 768.23 | (373) |
| CO2 associated with space heating (secondary) | (309) x | | 0 | = | 0 | (374) |
| CO2 associated with water from immersion heater or instantaneous heater | (312) x | | 0.22 | = | 0 | (375) |
| Total CO2 associated with space and water heating | (373) + (374) + (375) = | | | | 768.23 | (376) |
| CO2 associated with electricity for pumps and fans within dwelling | (331)) x | | 0.52 | = | 70.57 | (378) |
| CO2 associated with electricity for lighting | (332))) x | | 0.52 | = | 149.3 | (379) |
| **Total CO2, kg/year** | sum of (376)…(382) = | | | | 988.1 | (383) |
| **Dwelling CO2 Emission Rate** | (383) ÷ (4) = | | | | 15.46 | (384) |
| **EI rating (section 14)** | | | | | 87.84 | (385) |

# Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.50
*Printed on 06 December 2021 at 10:53:58*

## Project Information:

**Assessed By:** Neil Ingham (STRO010943) **Building Type:** Flat

## Dwelling Details:

**NEW DWELLING DESIGN STAGE** Total Floor Area: 60.34m²
**Site Reference :** Highgate Road - GREEN **Plot Reference:** 03 - I
**Address :**

## Client Details:

**Name:**
**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 (c) | | |
| Fuel factor: 1.00 (mains gas (c)) | | |
| Target Carbon Dioxide Emission Rate (TER) | 18.05 kg/m² | |
| Dwelling Carbon Dioxide Emission Rate (DER) | 15.55 kg/m² | **OK** |

## 1b TFEE and DFEE

| | | |
|---|---|---|
| Target Fabric Energy Efficiency (TFEE) | 45.6 kWh/m² | |
| Dwelling Fabric Energy Efficiency (DFEE) | 37.8 kWh/m² | |
| | | **OK** |

## 2 Fabric U-values

| Element | Average | Highest | |
|---|---|---|---|
| External wall | 0.18 (max. 0.30) | 0.18 (max. 0.70) | **OK** |
| Party wall | 0.00 (max. 0.20) | - | **OK** |
| Floor | (no floor) | | |
| Roof | (no roof) | | |
| Openings | 1.40 (max. 2.00) | 1.40 (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 | 3.00 (design value) | |
| Maximum | 10.0 | **OK** |

## 4 Heating efficiency

| | |
|---|---|
| Main Heating system: | Community heating schemes - mains gas |
| Secondary heating system: | None |

## 5 Cylinder insulation

| | |
|---|---|
| Hot water Storage: | No cylinder |

## 6 Controls

| | | |
|---|---|---|
| Space heating controls | Charging system linked to use of community heating, programmer and at least two room thermostats | **OK** |
| Hot water controls: | No cylinder thermostat<br>No cylinder | |

# Regulations Compliance Report

| 7 Low energy lights | | |
|---|---|---|
| Percentage of fixed lights with low-energy fittings | 100.0% | |
| Minimum | 75.0% | **OK** |
| **8 Mechanical ventilation** | | |
| Continuous supply and extract system | | |
| Specific fan power: | 0.47 | |
| Maximum | 1.5 | **OK** |
| MVHR efficiency: | 89% | |
| Minimum | 70% | **OK** |
| **9 Summertime temperature** | | |
| Overheating risk (Thames valley): | Slight | **OK** |
| Based on: | | |
| Overshading: | Average or unknown | |
| Windows facing: South West | 4.7m² | |
| Windows facing: South East | 6.09m² | |
| Windows facing: North West | 2.92m² | |
| Ventilation rate: | 6.00 | |
| **10 Key features** | | |
| Air permeablility | 3.0 m³/m²h | |
| Party Walls U-value | 0 W/m²K | |
| Community heating, heat from boilers – mains gas | | |

# DER WorkSheet: New dwelling design stage

User Details:

| | | | |
|---|---|---|---|
| **Assessor Name:** | Neil Ingham | **Stroma Number:** | STRO010943 |
| **Software Name:** | Stroma FSAP 2012 | **Software Version:** | Version: 1.0.5.50 |

Property Address: 03 - I

**Address :**

## 1. Overall dwelling dimensions:

| | Area(m²) | | Av. Height(m) | | Volume(m³) | |
|---|---|---|---|---|---|---|
| Ground floor | 60.34 | (1a) x | 2.65 | (2a) = | 159.9 | (3a) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n) | 60.34 | (4) | | | | |
| Dwelling volume | | | (3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) = | | 159.9 | (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 | | | | | | | 0 | x 10 = | 0 | (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) = | 0 | ÷ (5) = | 0 | (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 | | 3 | (17) |
| If based on air permeability value, then | (18) = [(17) ÷ 20]+(8), otherwise (18) = (16) | 0.15 | (18) |
| *Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used* | | | |
| Number of sides sheltered | | 0 | (19) |
| Shelter factor | (20) = 1 - [0.075 x (19)] = | 1 | (20) |
| Infiltration rate incorporating shelter factor | (21) = (18) x (20) = | 0.15 | (21) |

Infiltration rate modified for monthly wind speed

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

# DER WorkSheet: New dwelling design stage

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

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.19 | 0.19 | 0.18 | 0.16 | 0.16 | 0.14 | 0.14 | 0.14 | 0.15 | 0.16 | 0.17 | 0.18 |

*Calculate effective air change rate for the applicable case*

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 75.65 (23c)

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24a)m= | 0.31 | 0.31 | 0.31 | 0.29 | 0.28 | 0.26 | 0.26 | 0.26 | 0.27 | 0.28 | 0.29 | 0.3 | (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 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24d) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (25)m= | 0.31 | 0.31 | 0.31 | 0.29 | 0.28 | 0.26 | 0.26 | 0.26 | 0.27 | 0.28 | 0.29 | 0.3 | (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 | |
|---|---|---|---|---|---|---|---|---|---|
| Windows Type 1 | | | 4.7 | x1/[1/( 1.4 )+ 0.04] | = | 6.23 | | | (27) |
| Windows Type 2 | | | 6.09 | x1/[1/( 1.4 )+ 0.04] | = | 8.07 | | | (27) |
| Windows Type 3 | | | 2.92 | x1/[1/( 1.4 )+ 0.04] | = | 3.87 | | | (27) |
| Walls Type1 | 52.8 | 13.71 | 39.09 | x 0.18 | = | 7.04 | 60 | 2345.4 | (29) |
| Walls Type2 | 27.31 | 0 | 27.31 | x 0.17 | = | 4.59 | 60 | 1638.6 | (29) |
| Total area of elements, m² | | | 80.11 | | | | | | (31) |
| Party wall | | | 16.88 | x 0 | = | 0 | 45 | 759.6 | (32) |
| Party floor | | | 60.34 | | | | 40 | 2413.6 | (32a) |
| Party ceiling | | | 60.34 | | | | 30 | 1810.2 | (32b) |
| Internal wall ** | | | 107.91 | | | | 9 | 971.1901 | (32c) |

** 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) = 29.8 (33)

Heat capacity Cm = S(A x k ) ((28)…(30) + (32) + (32a)…(32e) = 9938.59 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 164.71 (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 7.62 (36)

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

Total fabric heat loss (33) + (36) = 37.42 (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 |
|---|---|---|---|---|---|---|---|---|---|---|---|

# DER WorkSheet: New dwelling design stage

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (38)m= | 16.52 | 16.32 | 16.12 | 15.13 | 14.93 | 13.94 | 13.94 | 13.75 | 14.34 | 14.93 | 15.33 | 15.72 | (38) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (39)m= | 53.93 | 53.74 | 53.54 | 52.55 | 52.35 | 51.36 | 51.36 | 51.16 | 51.76 | 52.35 | 52.75 | 53.14 | |

Average = Sum(39)$_{1…12}$ /12= 52.5 (39)

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

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (40)m= | 0.89 | 0.89 | 0.89 | 0.87 | 0.87 | 0.85 | 0.85 | 0.85 | 0.86 | 0.87 | 0.87 | 0.88 |

Average = Sum(40)$_{1…12}$ /12= 0.87 (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 1.99 (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 81.49 (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= | 89.64 | 86.38 | 83.12 | 79.86 | 76.6 | 73.34 | 73.34 | 76.6 | 79.86 | 83.12 | 86.38 | 89.64 |

Total = Sum(44)$_{1…12}$ = 977.9 (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= | 132.93 | 116.27 | 119.98 | 104.6 | 100.36 | 86.61 | 80.25 | 92.09 | 93.19 | 108.61 | 118.55 | 128.74 |

Total = Sum(45)$_{1…12}$ = 1282.18 (45)

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (46)m= | 19.94 | 17.44 | 18 | 15.69 | 15.05 | 12.99 | 12.04 | 13.81 | 13.98 | 16.29 | 17.78 | 19.31 | (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) = 110 (50)

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

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (56)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (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= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (57) |

# DER WorkSheet: New dwelling design stage

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= | 23.26 | 21.01 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | (59) |

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 | (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= | 188.21 | 166.19 | 175.25 | 158.09 | 155.64 | 140.1 | 135.53 | 147.37 | 146.69 | 163.88 | 172.05 | 184.02 | (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= | 188.21 | 166.19 | 175.25 | 158.09 | 155.64 | 140.1 | 135.53 | 147.37 | 146.69 | 163.88 | 172.05 | 184.02 |

Output from water heater (annual)$_{1...12}$ | 1933.02 | (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= | 88.42 | 78.6 | 84.11 | 77.57 | 77.59 | 71.59 | 70.91 | 74.84 | 73.78 | 80.33 | 82.21 | 87.03 | (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= | 99.56 | 99.56 | 99.56 | 99.56 | 99.56 | 99.56 | 99.56 | 99.56 | 99.56 | 99.56 | 99.56 | 99.56 | (66) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (67)m= | 15.49 | 13.76 | 11.19 | 8.47 | 6.33 | 5.35 | 5.78 | 7.51 | 10.08 | 12.8 | 14.94 | 15.93 | (67) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (68)m= | 173.8 | 175.61 | 171.06 | 161.39 | 149.17 | 137.69 | 130.03 | 128.22 | 132.77 | 142.44 | 154.66 | 166.13 | (68) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (69)m= | 32.96 | 32.96 | 32.96 | 32.96 | 32.96 | 32.96 | 32.96 | 32.96 | 32.96 | 32.96 | 32.96 | 32.96 | (69) |

Pumps and fans gains (Table 5a)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (70)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (70) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (71)m= | -79.65 | -79.65 | -79.65 | -79.65 | -79.65 | -79.65 | -79.65 | -79.65 | -79.65 | -79.65 | -79.65 | -79.65 | (71) |

Water heating gains (Table 5)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (72)m= | 118.85 | 116.96 | 113.06 | 107.74 | 104.29 | 99.43 | 95.3 | 100.59 | 102.47 | 107.97 | 114.19 | 116.97 | (72) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (73)m= | 361.01 | 359.2 | 348.18 | 330.47 | 312.67 | 295.34 | 283.98 | 289.2 | 298.19 | 316.08 | 336.65 | 351.9 | (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) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Southeast | 0.9x | 0.77 | x | 6.09 | x | 36.79 | x | 0.63 | x | 0.7 | = | 68.48 | (77) |
| Southeast | 0.9x | 0.77 | x | 6.09 | x | 62.67 | x | 0.63 | x | 0.7 | = | 116.65 | (77) |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Southeast | 0.9x | 0.77 | x | 6.09 | x | 85.75 | x | 0.63 | x | 0.7 | = | 159.6 | (77) |
| Southeast | 0.9x | 0.77 | x | 6.09 | x | 106.25 | x | 0.63 | x | 0.7 | = | 197.75 | (77) |
| Southeast | 0.9x | 0.77 | x | 6.09 | x | 119.01 | x | 0.63 | x | 0.7 | = | 221.5 | (77) |
| Southeast | 0.9x | 0.77 | x | 6.09 | x | 118.15 | x | 0.63 | x | 0.7 | = | 219.9 | (77) |
| Southeast | 0.9x | 0.77 | x | 6.09 | x | 113.91 | x | 0.63 | x | 0.7 | = | 212.01 | (77) |
| Southeast | 0.9x | 0.77 | x | 6.09 | x | 104.39 | x | 0.63 | x | 0.7 | = | 194.29 | (77) |
| Southeast | 0.9x | 0.77 | x | 6.09 | x | 92.85 | x | 0.63 | x | 0.7 | = | 172.81 | (77) |
| Southeast | 0.9x | 0.77 | x | 6.09 | x | 69.27 | x | 0.63 | x | 0.7 | = | 128.92 | (77) |
| Southeast | 0.9x | 0.77 | x | 6.09 | x | 44.07 | x | 0.63 | x | 0.7 | = | 82.02 | (77) |
| Southeast | 0.9x | 0.77 | x | 6.09 | x | 31.49 | x | 0.63 | x | 0.7 | = | 58.6 | (77) |
| Southwest | 0.9x | 0.77 | x | 4.7 | x | 36.79 | | 0.63 | x | 0.7 | = | 52.85 | (79) |
| Southwest | 0.9x | 0.77 | x | 4.7 | x | 62.67 | | 0.63 | x | 0.7 | = | 90.02 | (79) |
| Southwest | 0.9x | 0.77 | x | 4.7 | x | 85.75 | | 0.63 | x | 0.7 | = | 123.17 | (79) |
| Southwest | 0.9x | 0.77 | x | 4.7 | x | 106.25 | | 0.63 | x | 0.7 | = | 152.62 | (79) |
| Southwest | 0.9x | 0.77 | x | 4.7 | x | 119.01 | | 0.63 | x | 0.7 | = | 170.94 | (79) |
| Southwest | 0.9x | 0.77 | x | 4.7 | x | 118.15 | | 0.63 | x | 0.7 | = | 169.71 | (79) |
| Southwest | 0.9x | 0.77 | x | 4.7 | x | 113.91 | | 0.63 | x | 0.7 | = | 163.62 | (79) |
| Southwest | 0.9x | 0.77 | x | 4.7 | x | 104.39 | | 0.63 | x | 0.7 | = | 149.94 | (79) |
| Southwest | 0.9x | 0.77 | x | 4.7 | x | 92.85 | | 0.63 | x | 0.7 | = | 133.37 | (79) |
| Southwest | 0.9x | 0.77 | x | 4.7 | x | 69.27 | | 0.63 | x | 0.7 | = | 99.49 | (79) |
| Southwest | 0.9x | 0.77 | x | 4.7 | x | 44.07 | | 0.63 | x | 0.7 | = | 63.3 | (79) |
| Southwest | 0.9x | 0.77 | x | 4.7 | x | 31.49 | | 0.63 | x | 0.7 | = | 45.23 | (79) |
| Northwest | 0.9x | 0.77 | x | 2.92 | x | 11.28 | x | 0.63 | x | 0.7 | = | 10.07 | (81) |
| Northwest | 0.9x | 0.77 | x | 2.92 | x | 22.97 | x | 0.63 | x | 0.7 | = | 20.5 | (81) |
| Northwest | 0.9x | 0.77 | x | 2.92 | x | 41.38 | x | 0.63 | x | 0.7 | = | 36.93 | (81) |
| Northwest | 0.9x | 0.77 | x | 2.92 | x | 67.96 | x | 0.63 | x | 0.7 | = | 60.64 | (81) |
| Northwest | 0.9x | 0.77 | x | 2.92 | x | 91.35 | x | 0.63 | x | 0.7 | = | 81.52 | (81) |
| Northwest | 0.9x | 0.77 | x | 2.92 | x | 97.38 | x | 0.63 | x | 0.7 | = | 86.9 | (81) |
| Northwest | 0.9x | 0.77 | x | 2.92 | x | 91.1 | x | 0.63 | x | 0.7 | = | 81.3 | (81) |
| Northwest | 0.9x | 0.77 | x | 2.92 | x | 72.63 | x | 0.63 | x | 0.7 | = | 64.81 | (81) |
| Northwest | 0.9x | 0.77 | x | 2.92 | x | 50.42 | x | 0.63 | x | 0.7 | = | 44.99 | (81) |
| Northwest | 0.9x | 0.77 | x | 2.92 | x | 28.07 | x | 0.63 | x | 0.7 | = | 25.05 | (81) |
| Northwest | 0.9x | 0.77 | x | 2.92 | x | 14.2 | x | 0.63 | x | 0.7 | = | 12.67 | (81) |
| Northwest | 0.9x | 0.77 | x | 2.92 | x | 9.21 | x | 0.63 | x | 0.7 | = | 8.22 | (81) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (83)m= | 131.4 | 227.17 | 319.7 | 411.01 | 473.96 | 476.51 | 456.92 | 409.05 | 351.18 | 253.46 | 157.99 | 112.06 | (83) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (84)m= | 492.41 | 586.37 | 667.88 | 741.48 | 786.63 | 771.86 | 740.9 | 698.24 | 649.37 | 569.55 | 494.64 | 463.96 | (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 |
|---|---|---|---|---|---|---|---|---|---|---|---|

# DER WorkSheet: New dwelling design stage

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (86)m= | 0.97 | 0.93 | 0.87 | 0.75 | 0.59 | 0.42 | 0.3 | 0.34 | 0.53 | 0.8 | 0.94 | 0.97 | | (86) |
| Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c) | | | | | | | | | | | | | | |
| (87)m= | 20.03 | 20.28 | 20.56 | 20.82 | 20.95 | 20.99 | 21 | 21 | 20.97 | 20.8 | 20.38 | 19.99 | | (87) |
| Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C) | | | | | | | | | | | | | | |
| (88)m= | 20.17 | 20.18 | 20.18 | 20.19 | 20.2 | 20.21 | 20.21 | 20.21 | 20.2 | 20.2 | 20.19 | 20.18 | | (88) |
| Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a) | | | | | | | | | | | | | | |
| (89)m= | 0.96 | 0.92 | 0.85 | 0.72 | 0.55 | 0.37 | 0.25 | 0.28 | 0.48 | 0.76 | 0.92 | 0.97 | | (89) |
| Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c) | | | | | | | | | | | | | | |
| (90)m= | 18.9 | 19.24 | 19.63 | 19.99 | 20.14 | 20.2 | 20.21 | 20.21 | 20.18 | 19.97 | 19.41 | 18.84 | | (90) |
| | | | | | | | | | | fLA = Living area ÷ (4) = | | | 0.44 | (91) |
| Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2 | | | | | | | | | | | | | | |
| (92)m= | 19.4 | 19.7 | 20.04 | 20.35 | 20.5 | 20.55 | 20.56 | 20.56 | 20.53 | 20.34 | 19.84 | 19.35 | | (92) |
| Apply adjustment to the mean internal temperature from Table 4e, where appropriate | | | | | | | | | | | | | | |
| (93)m= | 19.4 | 19.7 | 20.04 | 20.35 | 20.5 | 20.55 | 20.56 | 20.56 | 20.53 | 20.34 | 19.84 | 19.35 | | (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= | 0.95 | 0.92 | 0.85 | 0.72 | 0.56 | 0.39 | 0.27 | 0.3 | 0.5 | 0.77 | 0.92 | 0.96 | | (94) |
| Useful gains, hmGm , W = (94)m x (84)m | | | | | | | | | | | | | | |
| (95)m= | 469.79 | 536.92 | 566.33 | 537.01 | 442.7 | 303.05 | 202.92 | 212.18 | 325.06 | 438.84 | 454.12 | 446.31 | | (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= | 814.42 | 795.35 | 725.02 | 601.93 | 460.68 | 305.71 | 203.32 | 212.81 | 333 | 509.67 | 672 | 805.28 | | (97) |
| Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m | | | | | | | | | | | | | | |
| (98)m= | 256.41 | 173.67 | 118.07 | 46.74 | 13.38 | 0 | 0 | 0 | 0 | 52.7 | 156.87 | 267.08 | | |
| | | | | | | | | | Total per year (kWh/year) = Sum(98)1...5,9...12 = | | | | 1084.92 | (98) |
| Space heating requirement in kWh/m²/year | | | | | | | | | | | | | 17.98 | (99) |

## 9b. Energy requirements – Community heating scheme

| | | | |
|---|---|---|---|
| This part is used for space heating, space cooling or water heating provided by a community scheme. Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none | | 0 | (301) |
| Fraction of space heat from community system 1 – (301) = | | 1 | (302) |

*The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.*

| | | | |
|---|---|---|---|
| Fraction of heat from Community boilers | | 1 | (303a) |
| Fraction of total space heat from Community boilers | (302) x (303a) = | 1 | (304a) |
| Factor for control and charging method (Table 4c(3)) for community heating system | | 1 | (305) |
| Distribution loss factor (Table 12c) for community heating system | | 1.05 | (306) |
| **Space heating** | | **kWh/year** | |
| Annual space heating requirement | | 1084.92 | |

# DER WorkSheet: New dwelling design stage

| | | | |
|---|---|---|---|
| Space heat from Community boilers | (98) x (304a) x (305) x (306) = | 1139.16 | (307a) |
| Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) | | 0 | (308 |
| Space heating requirement from secondary/supplementary system | (98) x (301) x 100 ÷ (308) = | 0 | (309) |

**Water heating**

| | | | |
|---|---|---|---|
| Annual water heating requirement | | 1933.02 | |
| If DHW from community scheme:<br>Water heat from Community boilers | (64) x (303a) x (305) x (306) = | 2029.67 | (310a) |
| Electricity used for heat distribution | 0.01 × [(307a)…(307e) + (310a)…(310e)] = | 31.69 | (313) |
| Cooling System Energy Efficiency Ratio | | 0 | (314) |
| Space cooling (if there is a fixed cooling system, if not enter 0) | = (107) ÷ (314) = | 0 | (315) |
| Electricity for pumps and fans within dwelling (Table 4f):<br>mechanical ventilation - balanced, extract or positive input from outside | | 128.36 | (330a) |
| warm air heating system fans | | 0 | (330b) |
| pump for solar water heating | | 0 | (330g) |
| Total electricity for the above, kWh/year | =(330a) + (330b) + (330g) = | 128.36 | (331) |
| Energy for lighting (calculated in Appendix L) | | 273.64 | (332) |
| Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) = | | 3570.84 | (338) |

## 12b. CO2 Emissions – Community heating scheme

| | | Energy kWh/year | Emission factor kg CO2/kWh | | Emissions kg CO2/year | |
|---|---|---|---|---|---|---|
| CO2 from other sources of space and water heating (not CHP)<br>Efficiency of heat source 1 (%) | If there is CHP using two fuels repeat (363) to (366) for the second fuel | | | | 96 | (367a) |
| CO2 associated with heat source 1 | [(307b)+(310b)] x 100 ÷ (367b) x | | 0.22 | = | 712.99 | (367) |
| Electrical energy for heat distribution | [(313) x | | 0.52 | = | 16.45 | (372) |
| Total CO2 associated with community systems | (363)…(366) + (368)...(372) | | | = | 729.43 | (373) |
| CO2 associated with space heating (secondary) | (309) x | | 0 | = | 0 | (374) |
| CO2 associated with water from immersion heater or instantaneous heater | (312) x | | 0.22 | = | 0 | (375) |
| Total CO2 associated with space and water heating | (373) + (374) + (375) = | | | | 729.43 | (376) |
| CO2 associated with electricity for pumps and fans within dwelling | (331)) x | | 0.52 | = | 66.62 | (378) |
| CO2 associated with electricity for lighting | (332))) x | | 0.52 | = | 142.02 | (379) |
| **Total CO2, kg/year** | sum of (376)…(382) = | | | | 938.07 | (383) |
| **Dwelling CO2 Emission Rate** | (383) ÷ (4) = | | | | 15.55 | (384) |
| **EI rating (section 14)** | | | | | 88.07 | (385) |

# Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.50
*Printed on 06 December 2021 at 10:53:54*

## Project Information:

| | | | |
|---|---|---|---|
| **Assessed By:** | Neil Ingham (STRO010943) | **Building Type:** | Flat |

## Dwelling Details:

| | | | |
|---|---|---|---|
| **NEW DWELLING DESIGN STAGE** | | Total Floor Area: 103.81m² | |
| **Site Reference :** | Highgate Road - GREEN | **Plot Reference:** | 04 - A |
| **Address :** | | | |

## Client Details:

**Name:**
**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 (c) | | |
| Fuel factor: 1.00 (mains gas (c)) | | |
| Target Carbon Dioxide Emission Rate (TER) | 15.34 kg/m² | |
| Dwelling Carbon Dioxide Emission Rate (DER) | 13.08 kg/m² | OK |

## 1b TFEE and DFEE

| | | |
|---|---|---|
| Target Fabric Energy Efficiency (TFEE) | 45.8 kWh/m² | |
| Dwelling Fabric Energy Efficiency (DFEE) | 37.3 kWh/m² | |
| | | OK |

## 2 Fabric U-values

| Element | Average | Highest | |
|---|---|---|---|
| External wall | 0.18 (max. 0.30) | 0.18 (max. 0.70) | OK |
| Party wall | 0.00 (max. 0.20) | - | OK |
| Floor | (no floor) | | |
| Roof | (no roof) | | |
| Openings | 1.40 (max. 2.00) | 1.40 (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 | 3.00 (design value) | |
| Maximum | 10.0 | OK |

## 4 Heating efficiency

| | |
|---|---|
| Main Heating system: | Community heating schemes - mains gas |
| Secondary heating system: | None |

## 5 Cylinder insulation

| | |
|---|---|
| Hot water Storage: | No cylinder |

## 6 Controls

| | | |
|---|---|---|
| Space heating controls | Charging system linked to use of community heating, programmer and at least two room thermostats | OK |
| Hot water controls: | No cylinder thermostat<br>No cylinder | |

# Regulations Compliance Report

## 7 Low energy lights

| | | |
|---|---|---|
| Percentage of fixed lights with low-energy fittings | 100.0% | |
| Minimum | 75.0% | **OK** |

## 8 Mechanical ventilation

| | | |
|---|---|---|
| Continuous supply and extract system | | |
| Specific fan power: | 0.54 | |
| Maximum | 1.5 | **OK** |
| MVHR efficiency: | 88% | |
| Minimum | 70% | **OK** |

## 9 Summertime temperature

| | | |
|---|---|---|
| Overheating risk (Thames valley): | Slight | **OK** |
| Based on: | | |
| Overshading: | Average or unknown | |
| Windows facing: South West | 13.21m² | |
| Windows facing: South East | 5.5m² | |
| Windows facing: North West | 4.61m² | |
| Ventilation rate: | 6.00 | |

## 10 Key features

| | |
|---|---|
| Air permeablility | 3.0 m³/m²h |
| Party  Walls U-value | 0 W/m²K |
| Community heating, heat from boilers – mains gas | |

# DER WorkSheet: New dwelling design stage

## User Details:

| | | | |
|---|---|---|---|
| **Assessor Name:** | Neil Ingham | **Stroma Number:** | STRO010943 |
| **Software Name:** | Stroma FSAP 2012 | **Software Version:** | Version: 1.0.5.50 |

Property Address: 04 - A

**Address :**

## 1. Overall dwelling dimensions:

| | Area(m²) | | Av. Height(m) | | Volume(m³) | |
|---|---|---|---|---|---|---|
| Ground floor | 103.81 | (1a) x | 2.65 | (2a) = | 275.1 | (3a) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n) | 103.81 | (4) | | | | |
| Dwelling volume | | | | (3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) = | 275.1 | (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 | | | | | | | 0 | x 10 = | 0 | (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) = | 0 | ÷ (5) = | 0 | (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 | | 3 | (17) |
| If based on air permeability value, then | (18) = [(17) ÷ 20]+(8), otherwise (18) = (16) | 0.15 | (18) |
| *Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used* | | | |
| Number of sides sheltered | | 0 | (19) |
| Shelter factor | (20) = 1 - [0.075 x (19)] = | 1 | (20) |
| Infiltration rate incorporating shelter factor | (21) = (18) x (20) = | 0.15 | (21) |

Infiltration rate modified for monthly wind speed

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

# DER WorkSheet: New dwelling design stage

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

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.19 | 0.19 | 0.18 | 0.16 | 0.16 | 0.14 | 0.14 | 0.14 | 0.15 | 0.16 | 0.17 | 0.18 |

*Calculate effective air change rate for the applicable case*

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 74.8 (23c)

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24a)m= | 0.32 | 0.31 | 0.31 | 0.29 | 0.29 | 0.27 | 0.27 | 0.26 | 0.28 | 0.29 | 0.29 | 0.3 | (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 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24d) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (25)m= | 0.32 | 0.31 | 0.31 | 0.29 | 0.29 | 0.27 | 0.27 | 0.26 | 0.28 | 0.29 | 0.29 | 0.3 | (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 | |
|---|---|---|---|---|---|---|---|---|
| Windows Type 1 | | | 13.21 | x1/[1/( 1.4 )+ 0.04] = | 17.51 | | | (27) |
| Windows Type 2 | | | 5.5 | x1/[1/( 1.4 )+ 0.04] = | 7.29 | | | (27) |
| Windows Type 3 | | | 4.61 | x1/[1/( 1.4 )+ 0.04] = | 6.11 | | | (27) |
| Walls Type1 | 76.16 | 23.32 | 52.84 | x 0.18 = | 9.51 | 60 | 3170.4 | (29) |
| Walls Type2 | 49.77 | 0 | 49.77 | x 0.17 = | 8.36 | 60 | 2986.2 | (29) |
| Total area of elements, m² | | | 125.93 | | | | | (31) |
| Party wall | | | 12.14 | x 0 = | 0 | 45 | 546.3 | (32) |
| Party floor | | | 103.81 | | | 40 | 4152.4 | (32a) |
| Party ceiling | | | 103.81 | | | 30 | 3114.3 | (32b) |
| Internal wall ** | | | 193.17 | | | 9 | 1738.53 | (32c) |

* *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) = 48.78 (33)

Heat capacity Cm = S(A x k ) ((28)…(30) + (32) + (32a)…(32e) = 15708.13 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 151.32 (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 9.77 (36)

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

Total fabric heat loss (33) + (36) = 58.55 (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 |
|---|---|---|---|---|---|---|---|---|---|---|---|

# DER WorkSheet: New dwelling design stage

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (38)m= | 28.8 | 28.46 | 28.12 | 26.42 | 26.08 | 24.37 | 24.37 | 24.03 | 25.06 | 26.08 | 26.76 | 27.44 | (38) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (39)m= | 87.35 | 87.01 | 86.67 | 84.97 | 84.63 | 82.93 | 82.93 | 82.59 | 83.61 | 84.63 | 85.31 | 85.99 | |

Average = Sum(39)$_{1…12}$ /12= 84.89 (39)

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (40)m= | 0.84 | 0.84 | 0.83 | 0.82 | 0.82 | 0.8 | 0.8 | 0.8 | 0.81 | 0.82 | 0.82 | 0.83 | |

Average = Sum(40)$_{1…12}$ /12= 0.82 (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 2.77 (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) + 36 100.04 (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= | 110.04 | 106.04 | 102.04 | 98.04 | 94.04 | 90.03 | 90.03 | 94.04 | 98.04 | 102.04 | 106.04 | 110.04 | |

Total = Sum(44)$_{1…12}$ = 1200.45 (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= | 163.19 | 142.73 | 147.28 | 128.4 | 123.2 | 106.32 | 98.52 | 113.05 | 114.4 | 133.32 | 145.53 | 158.04 | |

Total = Sum(45)$_{1…12}$ = 1573.98 (45)

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (46)m= | 24.48 | 21.41 | 22.09 | 19.26 | 18.48 | 15.95 | 14.78 | 16.96 | 17.16 | 20 | 21.83 | 23.71 | (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) = 110 (50)

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

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (56)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (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= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (57) |

# DER WorkSheet: New dwelling design stage

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= | 23.26 | 21.01 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | (59) |

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 | (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= | 218.46 | 192.65 | 202.56 | 181.9 | 178.48 | 159.81 | 153.79 | 168.33 | 167.89 | 188.6 | 199.03 | 213.32 | (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= | 218.46 | 192.65 | 202.56 | 181.9 | 178.48 | 159.81 | 153.79 | 168.33 | 167.89 | 188.6 | 199.03 | 213.32 |

Output from water heater (annual)1…12 | 2224.82 | (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= | 98.48 | 87.4 | 93.19 | 85.49 | 85.19 | 78.15 | 76.98 | 81.81 | 80.83 | 88.55 | 91.18 | 96.77 | (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= | 138.61 | 138.61 | 138.61 | 138.61 | 138.61 | 138.61 | 138.61 | 138.61 | 138.61 | 138.61 | 138.61 | 138.61 | (66) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (67)m= | 23.39 | 20.77 | 16.89 | 12.79 | 9.56 | 8.07 | 8.72 | 11.34 | 15.21 | 19.32 | 22.55 | 24.04 | (67) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (68)m= | 262.34 | 265.07 | 258.21 | 243.6 | 225.17 | 207.84 | 196.26 | 193.54 | 200.4 | 215.01 | 233.44 | 250.77 | (68) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (69)m= | 36.86 | 36.86 | 36.86 | 36.86 | 36.86 | 36.86 | 36.86 | 36.86 | 36.86 | 36.86 | 36.86 | 36.86 | (69) |

Pumps and fans gains (Table 5a)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (70)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (70) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (71)m= | -110.88 | -110.88 | -110.88 | -110.88 | -110.88 | -110.88 | -110.88 | -110.88 | -110.88 | -110.88 | -110.88 | -110.88 | (71) |

Water heating gains (Table 5)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (72)m= | 132.37 | 130.06 | 125.26 | 118.73 | 114.5 | 108.53 | 103.47 | 109.96 | 112.27 | 119.02 | 126.65 | 130.07 | (72) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (73)m= | 482.68 | 480.48 | 464.94 | 439.71 | 413.81 | 389.03 | 373.03 | 379.42 | 392.47 | 417.93 | 447.22 | 469.45 | (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) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Southeast | 0.9x | 0.77 | x | 5.5 | x | 36.79 | x | 0.63 | x | 0.7 | = | 61.85 | (77) |
| Southeast | 0.9x | 0.77 | x | 5.5 | x | 62.67 | x | 0.63 | x | 0.7 | = | 105.35 | (77) |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Southeast | 0.9x | 0.77 | x | 5.5 | x | 85.75 | x | 0.63 | x | 0.7 | = | 144.14 | (77) |
| Southeast | 0.9x | 0.77 | x | 5.5 | x | 106.25 | x | 0.63 | x | 0.7 | = | 178.6 | (77) |
| Southeast | 0.9x | 0.77 | x | 5.5 | x | 119.01 | x | 0.63 | x | 0.7 | = | 200.04 | (77) |
| Southeast | 0.9x | 0.77 | x | 5.5 | x | 118.15 | x | 0.63 | x | 0.7 | = | 198.6 | (77) |
| Southeast | 0.9x | 0.77 | x | 5.5 | x | 113.91 | x | 0.63 | x | 0.7 | = | 191.47 | (77) |
| Southeast | 0.9x | 0.77 | x | 5.5 | x | 104.39 | x | 0.63 | x | 0.7 | = | 175.47 | (77) |
| Southeast | 0.9x | 0.77 | x | 5.5 | x | 92.85 | x | 0.63 | x | 0.7 | = | 156.07 | (77) |
| Southeast | 0.9x | 0.77 | x | 5.5 | x | 69.27 | x | 0.63 | x | 0.7 | = | 116.43 | (77) |
| Southeast | 0.9x | 0.77 | x | 5.5 | x | 44.07 | x | 0.63 | x | 0.7 | = | 74.08 | (77) |
| Southeast | 0.9x | 0.77 | x | 5.5 | x | 31.49 | x | 0.63 | x | 0.7 | = | 52.93 | (77) |
| Southwest | 0.9x | 0.77 | x | 13.21 | x | 36.79 | | 0.63 | x | 0.7 | = | 148.54 | (79) |
| Southwest | 0.9x | 0.77 | x | 13.21 | x | 62.67 | | 0.63 | x | 0.7 | = | 253.02 | (79) |
| Southwest | 0.9x | 0.77 | x | 13.21 | x | 85.75 | | 0.63 | x | 0.7 | = | 346.2 | (79) |
| Southwest | 0.9x | 0.77 | x | 13.21 | x | 106.25 | | 0.63 | x | 0.7 | = | 428.95 | (79) |
| Southwest | 0.9x | 0.77 | x | 13.21 | x | 119.01 | | 0.63 | x | 0.7 | = | 480.46 | (79) |
| Southwest | 0.9x | 0.77 | x | 13.21 | x | 118.15 | | 0.63 | x | 0.7 | = | 476.99 | (79) |
| Southwest | 0.9x | 0.77 | x | 13.21 | x | 113.91 | | 0.63 | x | 0.7 | = | 459.87 | (79) |
| Southwest | 0.9x | 0.77 | x | 13.21 | x | 104.39 | | 0.63 | x | 0.7 | = | 421.44 | (79) |
| Southwest | 0.9x | 0.77 | x | 13.21 | x | 92.85 | | 0.63 | x | 0.7 | = | 374.86 | (79) |
| Southwest | 0.9x | 0.77 | x | 13.21 | x | 69.27 | | 0.63 | x | 0.7 | = | 279.64 | (79) |
| Southwest | 0.9x | 0.77 | x | 13.21 | x | 44.07 | | 0.63 | x | 0.7 | = | 177.92 | (79) |
| Southwest | 0.9x | 0.77 | x | 13.21 | x | 31.49 | | 0.63 | x | 0.7 | = | 127.12 | (79) |
| Northwest | 0.9x | 0.77 | x | 4.61 | x | 11.28 | x | 0.63 | x | 0.7 | = | 15.9 | (81) |
| Northwest | 0.9x | 0.77 | x | 4.61 | x | 22.97 | x | 0.63 | x | 0.7 | = | 32.36 | (81) |
| Northwest | 0.9x | 0.77 | x | 4.61 | x | 41.38 | x | 0.63 | x | 0.7 | = | 58.3 | (81) |
| Northwest | 0.9x | 0.77 | x | 4.61 | x | 67.96 | x | 0.63 | x | 0.7 | = | 95.74 | (81) |
| Northwest | 0.9x | 0.77 | x | 4.61 | x | 91.35 | x | 0.63 | x | 0.7 | = | 128.7 | (81) |
| Northwest | 0.9x | 0.77 | x | 4.61 | x | 97.38 | x | 0.63 | x | 0.7 | = | 137.2 | (81) |
| Northwest | 0.9x | 0.77 | x | 4.61 | x | 91.1 | x | 0.63 | x | 0.7 | = | 128.35 | (81) |
| Northwest | 0.9x | 0.77 | x | 4.61 | x | 72.63 | x | 0.63 | x | 0.7 | = | 102.32 | (81) |
| Northwest | 0.9x | 0.77 | x | 4.61 | x | 50.42 | x | 0.63 | x | 0.7 | = | 71.04 | (81) |
| Northwest | 0.9x | 0.77 | x | 4.61 | x | 28.07 | x | 0.63 | x | 0.7 | = | 39.54 | (81) |
| Northwest | 0.9x | 0.77 | x | 4.61 | x | 14.2 | x | 0.63 | x | 0.7 | = | 20 | (81) |
| Northwest | 0.9x | 0.77 | x | 4.61 | x | 9.21 | x | 0.63 | x | 0.7 | = | 12.98 | (81) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (83)m= | 226.28 | 390.73 | 548.63 | 703.29 | 809.2 | 812.79 | 779.69 | 699.23 | 601.97 | 435.62 | 272 | 193.03 | (83) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (84)m= | 708.96 | 871.2 | 1013.57 | 1143 | 1223.01 | 1201.81 | 1152.72 | 1078.65 | 994.43 | 853.54 | 719.21 | 662.48 | (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 |
|---|---|---|---|---|---|---|---|---|---|---|---|

# DER WorkSheet: New dwelling design stage

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (86)m= | 0.98 | 0.95 | 0.89 | 0.77 | 0.61 | 0.44 | 0.32 | 0.35 | 0.56 | 0.83 | 0.95 | 0.98 | (86) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (87)m= | 19.9 | 20.18 | 20.49 | 20.79 | 20.94 | 20.99 | 21 | 21 | 20.97 | 20.75 | 20.28 | 19.86 | (87) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (88)m= | 20.22 | 20.22 | 20.22 | 20.24 | 20.24 | 20.25 | 20.25 | 20.26 | 20.25 | 20.24 | 20.23 | 20.23 | (88) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (89)m= | 0.97 | 0.94 | 0.87 | 0.74 | 0.57 | 0.39 | 0.26 | 0.29 | 0.5 | 0.8 | 0.94 | 0.98 | (89) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (90)m= | 18.75 | 19.14 | 19.58 | 19.99 | 20.18 | 20.25 | 20.25 | 20.26 | 20.22 | 19.95 | 19.3 | 18.69 | (90) |

fLA = Living area ÷ (4) = 0.38 (91)

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (92)m= | 19.19 | 19.54 | 19.93 | 20.3 | 20.47 | 20.53 | 20.54 | 20.54 | 20.51 | 20.26 | 19.68 | 19.14 | (92) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (93)m= | 19.19 | 19.54 | 19.93 | 20.3 | 20.47 | 20.53 | 20.54 | 20.54 | 20.51 | 20.26 | 19.68 | 19.14 | (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= | 0.97 | 0.93 | 0.86 | 0.74 | 0.58 | 0.4 | 0.28 | 0.32 | 0.52 | 0.8 | 0.94 | 0.97 | (94) |
| Useful gains, hmGm , W = (94)m x (84)m | | | | | | | | | | | | | |
| (95)m= | 684.71 | 810.29 | 876.63 | 848.5 | 708.01 | 486.63 | 325.87 | 340.61 | 519.7 | 681.17 | 673.32 | 644.36 | (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= | 1300.79 | 1273.63 | 1164.02 | 968.27 | 742.05 | 491.85 | 326.66 | 341.91 | 535.72 | 817.5 | 1073.07 | 1284.7 | (97) |
| Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m | | | | | | | | | | | | | |
| (98)m= | 458.37 | 311.36 | 213.82 | 86.23 | 25.32 | 0 | 0 | 0 | 0 | 101.43 | 287.82 | 476.41 | |

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1960.76 (98)

Space heating requirement in kWh/m²/year 18.89 (99)

## 9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

| | | |
|---|---|---|
| Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none | 0 | (301) |
| Fraction of space heat from community system 1 – (301) = | 1 | (302) |

*The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.*

| | | | |
|---|---|---|---|
| Fraction of heat from Community boilers | | 1 | (303a) |
| Fraction of total space heat from Community boilers | (302) x (303a) = | 1 | (304a) |
| Factor for control and charging method (Table 4c(3)) for community heating system | | 1 | (305) |
| Distribution loss factor (Table 12c) for community heating system | | 1.05 | (306) |

| **Space heating** | **kWh/year** |
|---|---|
| Annual space heating requirement | 1960.76 |

# DER WorkSheet: New dwelling design stage

| | | | |
|---|---|---|---|
| Space heat from Community boilers | (98) x (304a) x (305) x (306) = | 2058.8 | (307a) |
| Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) | | 0 | (308 |
| Space heating requirement from secondary/supplementary system | (98) x (301) x 100 ÷ (308) = | 0 | (309) |
| **Water heating** | | | |
| Annual water heating requirement | | 2224.82 | |
| If DHW from community scheme:<br>Water heat from Community boilers | (64) x (303a) x (305) x (306) = | 2336.06 | (310a) |
| Electricity used for heat distribution | 0.01 × [(307a)…(307e) + (310a)…(310e)] = | 43.95 | (313) |
| Cooling System Energy Efficiency Ratio | | 0 | (314) |
| Space cooling (if there is a fixed cooling system, if not enter 0) | = (107) ÷ (314) = | 0 | (315) |
| Electricity for pumps and fans within dwelling (Table 4f):<br>mechanical ventilation - balanced, extract or positive input from outside | | 253.73 | (330a) |
| warm air heating system fans | | 0 | (330b) |
| pump for solar water heating | | 0 | (330g) |
| Total electricity for the above, kWh/year | =(330a) + (330b) + (330g) = | 253.73 | (331) |
| Energy for lighting (calculated in Appendix L) | | 412.99 | (332) |
| Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) = | | 5061.57 | (338) |

## 12b. CO2 Emissions – Community heating scheme

| | | Energy kWh/year | Emission factor kg CO2/kWh | | Emissions kg CO2/year | |
|---|---|---|---|---|---|---|
| CO2 from other sources of space and water heating (not CHP)<br>Efficiency of heat source 1 (%) | If there is CHP using two fuels repeat (363) to (366) for the second fuel | | | | 96 | (367a) |
| CO2 associated with heat source 1 | [(307b)+(310b)] x 100 ÷ (367b) x | | 0.22 | = | 988.84 | (367) |
| Electrical energy for heat distribution | [(313) x | | 0.52 | = | 22.81 | (372) |
| Total CO2 associated with community systems | (363)…(366) + (368)...(372) | | | = | 1011.65 | (373) |
| CO2 associated with space heating (secondary) | (309) x | | 0 | = | 0 | (374) |
| CO2 associated with water from immersion heater or instantaneous heater | (312) x | | 0.22 | = | 0 | (375) |
| Total CO2 associated with space and water heating | (373) + (374) + (375) = | | | | 1011.65 | (376) |
| CO2 associated with electricity for pumps and fans within dwelling | (331)) x | | 0.52 | = | 131.68 | (378) |
| CO2 associated with electricity for lighting | (332))) x | | 0.52 | = | 214.34 | (379) |
| **Total CO2, kg/year** | sum of (376)…(382) = | | | | 1357.68 | (383) |
| **Dwelling CO2 Emission Rate** | (383) ÷ (4) = | | | | 13.08 | (384) |
| **EI rating (section 14)** | | | | | 87.77 | (385) |

# Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.50
*Printed on 06 December 2021 at 10:53:51*

## Project Information:

**Assessed By:** Neil Ingham (STRO010943) **Building Type:** Flat

## Dwelling Details:

**NEW DWELLING DESIGN STAGE** Total Floor Area: 62.56m²

**Site Reference :** Highgate Road - GREEN **Plot Reference:** 04 - B

**Address :**

## Client Details:

**Name:**

**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 (c) | | |
| Fuel factor: 1.00 (mains gas (c)) | | |
| Target Carbon Dioxide Emission Rate (TER) | 18.61 kg/m² | |
| Dwelling Carbon Dioxide Emission Rate (DER) | 16.22 kg/m² | **OK** |

## 1b TFEE and DFEE

| | | |
|---|---|---|
| Target Fabric Energy Efficiency (TFEE) | 49.8 kWh/m² | |
| Dwelling Fabric Energy Efficiency (DFEE) | 41.0 kWh/m² | |
| | | **OK** |

## 2 Fabric U-values

| Element | Average | Highest | |
|---|---|---|---|
| External wall | 0.18 (max. 0.30) | 0.18 (max. 0.70) | **OK** |
| Party wall | 0.00 (max. 0.20) | - | **OK** |
| Floor | (no floor) | | |
| Roof | (no roof) | | |
| Openings | 1.40 (max. 2.00) | 1.40 (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 | 3.00 (design value) | |
| Maximum | 10.0 | **OK** |

## 4 Heating efficiency

| | |
|---|---|
| Main Heating system: | Community heating schemes - mains gas |
| Secondary heating system: | None |

## 5 Cylinder insulation

| | |
|---|---|
| Hot water Storage: | No cylinder |

## 6 Controls

| | | |
|---|---|---|
| Space heating controls | Charging system linked to use of community heating, programmer and at least two room thermostats | **OK** |
| Hot water controls: | No cylinder thermostat<br>No cylinder | |

# Regulations Compliance Report

## 7 Low energy lights

| | | |
|---|---|---|
| Percentage of fixed lights with low-energy fittings | 100.0% | |
| Minimum | 75.0% | **OK** |

## 8 Mechanical ventilation

| | | |
|---|---|---|
| Continuous supply and extract system | | |
| Specific fan power: | 0.54 | |
| Maximum | 1.5 | **OK** |
| MVHR efficiency: | 88% | |
| Minimum | 70% | **OK** |

## 9 Summertime temperature

| | | |
|---|---|---|
| Overheating risk (Thames valley): | Slight | **OK** |
| Based on: | | |
| Overshading: | Average or unknown | |
| Windows facing: North East | 12.71m² | |
| Windows facing: North West | 3.46m² | |
| Ventilation rate: | 6.00 | |

## 10 Key features

| | |
|---|---|
| Air permeablility | 3.0 m³/m²h |
| Party Walls U-value | 0 W/m²K |
| Community heating, heat from boilers – mains gas | |

# DER WorkSheet: New dwelling design stage

User Details:

| | | | |
|---|---|---|---|
| **Assessor Name:** | Neil Ingham | **Stroma Number:** | STRO010943 |
| **Software Name:** | Stroma FSAP 2012 | **Software Version:** | Version: 1.0.5.50 |

Property Address: 04 - B

**Address :**

## 1. Overall dwelling dimensions:

| | Area(m²) | | Av. Height(m) | | Volume(m³) | |
|---|---|---|---|---|---|---|
| Ground floor | 62.56 | (1a) x | 2.65 | (2a) = | 165.78 | (3a) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n) | 62.56 | (4) | | | | |
| Dwelling volume | | | (3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) = | | 165.78 | (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 | | | | | | | 0 | x 10 = | 0 | (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) = | 0 | ÷ (5) = | 0 | (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 | | 3 | (17) |
| If based on air permeability value, then | (18) = [(17) ÷ 20]+(8), otherwise (18) = (16) | 0.15 | (18) |

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

| | | | |
|---|---|---|---|
| Number of sides sheltered | | 0 | (19) |
| Shelter factor | (20) = 1 - [0.075 x (19)] = | 1 | (20) |
| Infiltration rate incorporating shelter factor | (21) = (18) x (20) = | 0.15 | (21) |

Infiltration rate modified for monthly wind speed

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|

Monthly average wind speed from Table 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 |

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 |

# DER WorkSheet: New dwelling design stage

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

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.19 | 0.19 | 0.18 | 0.16 | 0.16 | 0.14 | 0.14 | 0.14 | 0.15 | 0.16 | 0.17 | 0.18 |

*Calculate effective air change rate for the applicable case*

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 74.8 (23c)

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24a)m= | 0.32 | 0.31 | 0.31 | 0.29 | 0.29 | 0.27 | 0.27 | 0.26 | 0.28 | 0.29 | 0.29 | 0.3 | (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 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24d) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (25)m= | 0.32 | 0.31 | 0.31 | 0.29 | 0.29 | 0.27 | 0.27 | 0.26 | 0.28 | 0.29 | 0.29 | 0.3 | (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 | |
|---|---|---|---|---|---|---|---|---|---|---|
| Windows Type 1 | | | 12.71 | x1/[1/( 1.4 )+ 0.04] | | = | 16.85 | | | (27) |
| Windows Type 2 | | | 3.46 | x1/[1/( 1.4 )+ 0.04] | | = | 4.59 | | | (27) |
| Walls Type1 | 46.72 | 16.17 | 30.55 | x | 0.18 | = | 5.5 | 60 | 1833 | (29) |
| Walls Type2 | 13.75 | 0 | 13.75 | x | 0.17 | = | 2.31 | 60 | 825 | (29) |
| Total area of elements, m² | | | 60.47 | | | | | | | (31) |
| Party wall | | | 30.32 | x | 0 | = | 0 | 45 | 1364.4 | (32) |
| Party floor | | | 62.56 | | | | | 40 | 2502.4 | (32a) |
| Party ceiling | | | 62.56 | | | | | 30 | 1876.8 | (32b) |
| Internal wall ** | | | 100.8 | | | | | 9 | 907.2 | (32c) |

** 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) = 29.25 (33)

Heat capacity Cm = S(A x k ) ((28)…(30) + (32) + (32a)…(32e) = 9308.8 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 148.8 (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 7.08 (36)

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

Total fabric heat loss (33) + (36) = 36.33 (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= | 17.36 | 17.15 | 16.95 | 15.92 | 15.72 | 14.69 | 14.69 | 14.48 | 15.1 | 15.72 | 16.13 | 16.54 | (38) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (39)m= | 53.68 | 53.48 | 53.27 | 52.25 | 52.04 | 51.01 | 51.01 | 50.81 | 51.42 | 52.04 | 52.45 | 52.86 | |

Average = Sum(39)$_{1…12}$ /12= 52.19 (39)

# DER WorkSheet: New dwelling design stage

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

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (40)m= | 0.86 | 0.85 | 0.85 | 0.84 | 0.83 | 0.82 | 0.82 | 0.81 | 0.82 | 0.83 | 0.84 | 0.84 |

Average = Sum(40)$_{1...12}$ /12= 0.83 (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 2.05 (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 82.96 (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= | 91.25 | 87.94 | 84.62 | 81.3 | 77.98 | 74.66 | 74.66 | 77.98 | 81.3 | 84.62 | 87.94 | 91.25 | |
| | | | | | | | | | | Total = Sum(44)$_{1...12}$ = | | 995.51 | (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= | 135.33 | 118.36 | 122.14 | 106.48 | 102.17 | 88.17 | 81.7 | 93.75 | 94.87 | 110.56 | 120.69 | 131.06 | |
| | | | | | | | | | | Total = Sum(45)$_{1...12}$ = | | 1305.27 | (45) |
| *If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)* | | | | | | | | | | | | | |
| (46)m= | 20.3 | 17.75 | 18.32 | 15.97 | 15.33 | 13.22 | 12.25 | 14.06 | 14.23 | 16.58 | 18.1 | 19.66 | (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) = 110 (50)

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

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (56)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (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= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (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= | 23.26 | 21.01 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | (59) |

# DER WorkSheet: New dwelling design stage

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 | (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= | 190.61 | 168.29 | 177.41 | 159.97 | 157.45 | 141.66 | 136.98 | 149.03 | 148.36 | 165.84 | 174.18 | 186.34 | (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= | 190.61 | 168.29 | 177.41 | 159.97 | 157.45 | 141.66 | 136.98 | 149.03 | 148.36 | 165.84 | 174.18 | 186.34 | |

Output from water heater (annual)$_{1...12}$ 1956.11 (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= | 89.22 | 79.3 | 84.83 | 78.2 | 78.19 | 72.11 | 71.39 | 75.39 | 74.34 | 80.98 | 82.92 | 87.8 | (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= | 102.65 | 102.65 | 102.65 | 102.65 | 102.65 | 102.65 | 102.65 | 102.65 | 102.65 | 102.65 | 102.65 | 102.65 | (66) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (67)m= | 15.99 | 14.2 | 11.55 | 8.74 | 6.54 | 5.52 | 5.96 | 7.75 | 10.4 | 13.21 | 15.42 | 16.43 | (67) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (68)m= | 179.35 | 181.22 | 176.53 | 166.54 | 153.94 | 142.09 | 134.18 | 132.32 | 137.01 | 146.99 | 159.59 | 171.44 | (68) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (69)m= | 33.27 | 33.27 | 33.27 | 33.27 | 33.27 | 33.27 | 33.27 | 33.27 | 33.27 | 33.27 | 33.27 | 33.27 | (69) |

Pumps and fans gains (Table 5a)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (70)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (70) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (71)m= | -82.12 | -82.12 | -82.12 | -82.12 | -82.12 | -82.12 | -82.12 | -82.12 | -82.12 | -82.12 | -82.12 | -82.12 | (71) |

Water heating gains (Table 5)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (72)m= | 119.92 | 118 | 114.02 | 108.61 | 105.1 | 100.15 | 95.95 | 101.34 | 103.25 | 108.85 | 115.17 | 118.01 | (72) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (73)m= | 369.06 | 367.21 | 355.89 | 337.69 | 319.37 | 301.56 | 289.88 | 295.2 | 304.45 | 322.84 | 343.98 | 359.68 | (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 | 12.71 | x | 11.28 | x | 0.63 | x | 0.7 | = | 43.83 | (75) |
| Northeast 0.9x | 0.77 | x | 12.71 | x | 22.97 | x | 0.63 | x | 0.7 | = | 89.21 | (75) |
| Northeast 0.9x | 0.77 | x | 12.71 | x | 41.38 | x | 0.63 | x | 0.7 | = | 160.73 | (75) |
| Northeast 0.9x | 0.77 | x | 12.71 | x | 67.96 | x | 0.63 | x | 0.7 | = | 263.96 | (75) |
| Northeast 0.9x | 0.77 | x | 12.71 | x | 91.35 | x | 0.63 | x | 0.7 | = | 354.82 | (75) |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Northeast | 0.9x | 0.77 | x | 12.71 | x | 97.38 | x | 0.63 | x | 0.7 | = | 378.27 | (75) |
| Northeast | 0.9x | 0.77 | x | 12.71 | x | 91.1 | x | 0.63 | x | 0.7 | = | 353.87 | (75) |
| Northeast | 0.9x | 0.77 | x | 12.71 | x | 72.63 | x | 0.63 | x | 0.7 | = | 282.11 | (75) |
| Northeast | 0.9x | 0.77 | x | 12.71 | x | 50.42 | x | 0.63 | x | 0.7 | = | 195.85 | (75) |
| Northeast | 0.9x | 0.77 | x | 12.71 | x | 28.07 | x | 0.63 | x | 0.7 | = | 109.02 | (75) |
| Northeast | 0.9x | 0.77 | x | 12.71 | x | 14.2 | x | 0.63 | x | 0.7 | = | 55.15 | (75) |
| Northeast | 0.9x | 0.77 | x | 12.71 | x | 9.21 | x | 0.63 | x | 0.7 | = | 35.79 | (75) |
| Northwest | 0.9x | 0.77 | x | 3.46 | x | 11.28 | x | 0.63 | x | 0.7 | = | 11.93 | (81) |
| Northwest | 0.9x | 0.77 | x | 3.46 | x | 22.97 | x | 0.63 | x | 0.7 | = | 24.29 | (81) |
| Northwest | 0.9x | 0.77 | x | 3.46 | x | 41.38 | x | 0.63 | x | 0.7 | = | 43.75 | (81) |
| Northwest | 0.9x | 0.77 | x | 3.46 | x | 67.96 | x | 0.63 | x | 0.7 | = | 71.86 | (81) |
| Northwest | 0.9x | 0.77 | x | 3.46 | x | 91.35 | x | 0.63 | x | 0.7 | = | 96.59 | (81) |
| Northwest | 0.9x | 0.77 | x | 3.46 | x | 97.38 | x | 0.63 | x | 0.7 | = | 102.98 | (81) |
| Northwest | 0.9x | 0.77 | x | 3.46 | x | 91.1 | x | 0.63 | x | 0.7 | = | 96.33 | (81) |
| Northwest | 0.9x | 0.77 | x | 3.46 | x | 72.63 | x | 0.63 | x | 0.7 | = | 76.8 | (81) |
| Northwest | 0.9x | 0.77 | x | 3.46 | x | 50.42 | x | 0.63 | x | 0.7 | = | 53.32 | (81) |
| Northwest | 0.9x | 0.77 | x | 3.46 | x | 28.07 | x | 0.63 | x | 0.7 | = | 29.68 | (81) |
| Northwest | 0.9x | 0.77 | x | 3.46 | x | 14.2 | x | 0.63 | x | 0.7 | = | 15.01 | (81) |
| Northwest | 0.9x | 0.77 | x | 3.46 | x | 9.21 | x | 0.63 | x | 0.7 | = | 9.74 | (81) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (83)m= | 55.76 | 113.5 | 204.48 | 335.82 | 451.41 | 481.25 | 450.2 | 358.9 | 249.17 | 138.7 | 70.16 | 45.53 | (83) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (84)m= | 424.81 | 480.71 | 560.38 | 673.51 | 770.78 | 782.81 | 740.09 | 654.1 | 553.62 | 461.54 | 414.13 | 405.21 | (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= | 0.98 | 0.96 | 0.91 | 0.78 | 0.59 | 0.41 | 0.3 | 0.35 | 0.6 | 0.87 | 0.96 | 0.98 | (86) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (87)m= | 19.85 | 20.04 | 20.37 | 20.75 | 20.94 | 20.99 | 21 | 21 | 20.95 | 20.66 | 20.2 | 19.82 | (87) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (88)m= | 20.2 | 20.21 | 20.21 | 20.22 | 20.23 | 20.24 | 20.24 | 20.24 | 20.23 | 20.23 | 20.22 | 20.21 | (88) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (89)m= | 0.97 | 0.95 | 0.9 | 0.76 | 0.55 | 0.36 | 0.25 | 0.3 | 0.55 | 0.84 | 0.95 | 0.98 | (89) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (90)m= | 18.66 | 18.94 | 19.41 | 19.93 | 20.16 | 20.23 | 20.24 | 20.24 | 20.19 | 19.83 | 19.18 | 18.63 | (90) |

fLA = Living area ÷ (4) = 0.43 (91)

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (92)m= | 19.17 | 19.42 | 19.83 | 20.28 | 20.49 | 20.56 | 20.57 | 20.57 | 20.52 | 20.19 | 19.62 | 19.14 | (92) |

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

# DER WorkSheet: New dwelling design stage

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (93)m= | 19.17 | 19.42 | 19.83 | 20.28 | 20.49 | 20.56 | 20.57 | 20.57 | 20.52 | 20.19 | 19.62 | 19.14 | (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= | 0.97 | 0.95 | 0.89 | 0.76 | 0.57 | 0.38 | 0.27 | 0.32 | 0.57 | 0.84 | 0.94 | 0.97 | (94) |
| Useful gains, hmGm , W = (94)m x (84)m | | | | | | | | | | | | | |
| (95)m= | 410.32 | 454.37 | 499.35 | 510.31 | 436.71 | 300.96 | 201.78 | 210.63 | 315.05 | 388.63 | 390.91 | 393.37 | (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= | 798.2 | 776.21 | 709.91 | 594.7 | 457.66 | 303.93 | 202.28 | 211.64 | 330.02 | 499.01 | 656.71 | 789.76 | (97) |
| Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m | | | | | | | | | | | | | |
| (98)m= | 288.59 | 216.28 | 156.66 | 60.76 | 15.58 | 0 | 0 | 0 | 0 | 82.12 | 191.38 | 294.91 | |

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1306.29 (98)

Space heating requirement in kWh/m²/year 20.88 (99)

## 9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

| | | | |
|---|---|---|---|
| Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none | | 0 | (301) |
| Fraction of space heat from community system 1 – (301) = | | 1 | (302) |

*The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.*

| | | | |
|---|---|---|---|
| Fraction of heat from Community boilers | | 1 | (303a) |
| Fraction of total space heat from Community boilers | (302) x (303a) = | 1 | (304a) |
| Factor for control and charging method (Table 4c(3)) for community heating system | | 1 | (305) |
| Distribution loss factor (Table 12c) for community heating system | | 1.05 | (306) |
| **Space heating** | | **kWh/year** | |
| Annual space heating requirement | | 1306.29 | |
| Space heat from Community boilers | (98) x (304a) x (305) x (306) = | 1371.61 | (307a) |
| Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) | | 0 | (308 |
| Space heating requirement from secondary/supplementary system | (98) x (301) x 100 ÷ (308) = | 0 | (309) |
| **Water heating** | | | |
| Annual water heating requirement | | 1956.11 | |
| If DHW from community scheme:<br>Water heat from Community boilers | (64) x (303a) x (305) x (306) = | 2053.91 | (310a) |
| Electricity used for heat distribution | 0.01 × [(307a)…(307e) + (310a)…(310e)] = | 34.26 | (313) |
| Cooling System Energy Efficiency Ratio | | 0 | (314) |
| Space cooling (if there is a fixed cooling system, if not enter 0) | = (107) ÷ (314) = | 0 | (315) |
| Electricity for pumps and fans within dwelling (Table 4f):<br>mechanical ventilation - balanced, extract or positive input from outside | | 152.91 | (330a) |

| | | | |
|---|---|---|---|
| warm air heating system fans | | 0 | (330b) |
| pump for solar water heating | | 0 | (330g) |
| Total electricity for the above, kWh/year | =(330a) + (330b) + (330g) = | 152.91 | (331) |
| Energy for lighting (calculated in Appendix L) | | 282.38 | (332) |
| Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) = | | 3860.81 | (338) |

## 12b. CO2 Emissions – Community heating scheme

| | | Energy kWh/year | Emission factor kg CO2/kWh | | Emissions kg CO2/year | |
|---|---|---|---|---|---|---|
| CO2 from other sources of space and water heating (not CHP) | | | | | | |
| Efficiency of heat source 1 (%) | If there is CHP using two fuels repeat (363) to (366) for the second fuel | | | | 96 | (367a) |
| CO2 associated with heat source 1 | [(307b)+(310b)] x 100 ÷ (367b) x | | 0.22 | = | 770.74 | (367) |
| Electrical energy for heat distribution | [(313) x | | 0.52 | = | 17.78 | (372) |
| Total CO2 associated with community systems | (363)…(366) + (368)...(372) | | | = | 788.52 | (373) |
| CO2 associated with space heating (secondary) | (309) x | | 0 | = | 0 | (374) |
| CO2 associated with water from immersion heater or instantaneous heater | (312) x | | 0.22 | = | 0 | (375) |
| Total CO2 associated with space and water heating | (373) + (374) + (375) = | | | | 788.52 | (376) |
| CO2 associated with electricity for pumps and fans within dwelling | (331)) x | | 0.52 | = | 79.36 | (378) |
| CO2 associated with electricity for lighting | (332))) x | | 0.52 | = | 146.56 | (379) |
| **Total CO2, kg/year** | sum of (376)…(382) = | | | | 1014.43 | (383) |
| **Dwelling CO2 Emission Rate** | (383) ÷ (4) = | | | | 16.22 | (384) |
| **EI rating (section 14)** | | | | | 87.36 | (385) |

# Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.50
*Printed on 06 December 2021 at 10:53:48*

## Project Information:

**Assessed By:** Neil Ingham (STRO010943) **Building Type:** Flat

## Dwelling Details:

**NEW DWELLING DESIGN STAGE** Total Floor Area: 72.62m²

**Site Reference :** Highgate Road - GREEN **Plot Reference:** 04 - C

**Address :**

## Client Details:

**Name:**

**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 (c) | | |
| Fuel factor: 1.00 (mains gas (c)) | | |
| Target Carbon Dioxide Emission Rate (TER) | 18.46 kg/m² | |
| Dwelling Carbon Dioxide Emission Rate (DER) | 15.74 kg/m² | OK |

## 1b TFEE and DFEE

| | | |
|---|---|---|
| Target Fabric Energy Efficiency (TFEE) | 52.6 kWh/m² | |
| Dwelling Fabric Energy Efficiency (DFEE) | 42.5 kWh/m² | |
| | | OK |

## 2 Fabric U-values

| Element | Average | Highest | |
|---|---|---|---|
| External wall | 0.18 (max. 0.30) | 0.18 (max. 0.70) | OK |
| Party wall | 0.00 (max. 0.20) | - | OK |
| Floor | (no floor) | | |
| Roof | (no roof) | | |
| Openings | 1.40 (max. 2.00) | 1.40 (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 | 3.00 (design value) | |
| Maximum | 10.0 | OK |

## 4 Heating efficiency

| | |
|---|---|
| Main Heating system: | Community heating schemes - mains gas |
| Secondary heating system: | None |

## 5 Cylinder insulation

Hot water Storage: No cylinder

## 6 Controls

| | | |
|---|---|---|
| Space heating controls | Charging system linked to use of community heating, programmer and at least two room thermostats | OK |
| Hot water controls: | No cylinder thermostat<br>No cylinder | |

# Regulations Compliance Report

## 7 Low energy lights

| | | |
|---|---|---|
| Percentage of fixed lights with low-energy fittings | 100.0% | |
| Minimum | 75.0% | **OK** |

## 8 Mechanical ventilation

| | | |
|---|---|---|
| Continuous supply and extract system | | |
| Specific fan power: | 0.54 | |
| Maximum | 1.5 | **OK** |
| MVHR efficiency: | 88% | |
| Minimum | 70% | **OK** |

## 9 Summertime temperature

| | | |
|---|---|---|
| Overheating risk (Thames valley): | Slight | **OK** |

Based on:

| | |
|---|---|
| Overshading: | Average or unknown |
| Windows facing: North East | 12.71m² |
| Windows facing: North West | 3.46m² |
| Ventilation rate: | 6.00 |

## 10 Key features

| | |
|---|---|
| Air permeablility | 3.0 m³/m²h |
| Party Walls U-value | 0 W/m²K |
| Community heating, heat from boilers – mains gas | |

# DER WorkSheet: New dwelling design stage

User Details:

| | | | |
|---|---|---|---|
| **Assessor Name:** | Neil Ingham | **Stroma Number:** | STRO010943 |
| **Software Name:** | Stroma FSAP 2012 | **Software Version:** | Version: 1.0.5.50 |

Property Address: 04 - C

**Address :**

## 1. Overall dwelling dimensions:

| | Area(m²) | | Av. Height(m) | | Volume(m³) | |
|---|---|---|---|---|---|---|
| Ground floor | 72.62 | (1a) x | 2.65 | (2a) = | 192.44 | (3a) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n) | 72.62 | (4) | | | | |
| Dwelling volume | | | | (3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) = | 192.44 | (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 | | | | | | | 0 | x 10 = | 0 | (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) = | 0 | ÷ (5) = | 0 | (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 | | 3 | (17) |
| If based on air permeability value, then | (18) = [(17) ÷ 20]+(8), otherwise (18) = (16) | 0.15 | (18) |

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

| | | | |
|---|---|---|---|
| Number of sides sheltered | | 0 | (19) |
| Shelter factor | (20) = 1 - [0.075 x (19)] = | 1 | (20) |
| Infiltration rate incorporating shelter factor | (21) = (18) x (20) = | 0.15 | (21) |

Infiltration rate modified for monthly wind speed

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

# DER WorkSheet: New dwelling design stage

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

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.19 | 0.19 | 0.18 | 0.16 | 0.16 | 0.14 | 0.14 | 0.14 | 0.15 | 0.16 | 0.17 | 0.18 |

*Calculate effective air change rate for the applicable case*

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 74.8 (23c)

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24a)m= | 0.32 | 0.31 | 0.31 | 0.29 | 0.29 | 0.27 | 0.27 | 0.26 | 0.28 | 0.29 | 0.29 | 0.3 | (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 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24d) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (25)m= | 0.32 | 0.31 | 0.31 | 0.29 | 0.29 | 0.27 | 0.27 | 0.26 | 0.28 | 0.29 | 0.29 | 0.3 | (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 | |
|---|---|---|---|---|---|---|---|---|---|
| Windows Type 1 | | | 12.71 | x1/[1/( 1.4 )+ 0.04] | = | 16.85 | | | (27) |
| Windows Type 2 | | | 3.46 | x1/[1/( 1.4 )+ 0.04] | = | 4.59 | | | (27) |
| Walls Type1 | 72.62 | 16.17 | 56.45 | x 0.18 | = | 10.16 | 60 | 3387 | (29) |
| Walls Type2 | 17.78 | 0 | 17.78 | x 0.17 | = | 2.99 | 60 | 1066.8 | (29) |
| Total area of elements, m² | | | 90.4 | | | | | | (31) |
| Party wall | | | 30.32 | x 0 | = | 0 | 45 | 1364.4 | (32) |
| Party floor | | | 72.62 | | | | 40 | 2904.8 | (32a) |
| Party ceiling | | | 72.62 | | | | 30 | 2178.6 | (32b) |
| Internal wall ** | | | 146.17 | | | | 9 | 1315.53 | (32c) |

** 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) = 34.58 (33)

Heat capacity Cm = S(A x k ) ((28)…(30) + (32) + (32a)…(32e) = 12217.13 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 168.23 (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 7.11 (36)

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

Total fabric heat loss (33) + (36) = 41.69 (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= | 20.15 | 19.91 | 19.67 | 18.48 | 18.24 | 17.05 | 17.05 | 16.81 | 17.53 | 18.24 | 18.72 | 19.19 | (38) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (39)m= | 61.84 | 61.6 | 61.36 | 60.17 | 59.93 | 58.74 | 58.74 | 58.51 | 59.22 | 59.93 | 60.41 | 60.89 | |

Average = Sum(39)$_{1…12}$ /12= 60.11 (39)

# DER WorkSheet: New dwelling design stage

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

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (40)m= | 0.85 | 0.85 | 0.84 | 0.83 | 0.83 | 0.81 | 0.81 | 0.81 | 0.82 | 0.83 | 0.83 | 0.84 |

Average = $Sum(40)_{1...12}$ /12= 0.83 (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 2.31 (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 89.02 (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= | 97.92 | 94.36 | 90.8 | 87.24 | 83.67 | 80.11 | 80.11 | 83.67 | 87.24 | 90.8 | 94.36 | 97.92 |

Total = $Sum(44)_{1...12}$ = 1068.18 (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= | 145.21 | 127 | 131.05 | 114.25 | 109.63 | 94.6 | 87.66 | 100.59 | 101.8 | 118.63 | 129.5 | 140.63 |

Total = $Sum(45)_{1...12}$ = 1400.56 (45)

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (46)m= | 21.78 | 19.05 | 19.66 | 17.14 | 16.44 | 14.19 | 13.15 | 15.09 | 15.27 | 17.8 | 19.42 | 21.09 | (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) = 110 (50)

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

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (56)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (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= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (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= | 23.26 | 21.01 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | (59) |

# DER WorkSheet: New dwelling design stage

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 | (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= | 200.48 | 176.93 | 186.33 | 167.75 | 164.91 | 148.1 | 142.94 | 155.87 | 155.29 | 173.91 | 182.99 | 195.9 | (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= | 200.48 | 176.93 | 186.33 | 167.75 | 164.91 | 148.1 | 142.94 | 155.87 | 155.29 | 173.91 | 182.99 | 195.9 | |

Output from water heater (annual)$_{1...12}$ 2051.4 (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= | 92.5 | 82.17 | 87.8 | 80.78 | 80.67 | 74.25 | 73.37 | 77.67 | 76.64 | 83.67 | 85.85 | 90.98 | (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= | 115.4 | 115.4 | 115.4 | 115.4 | 115.4 | 115.4 | 115.4 | 115.4 | 115.4 | 115.4 | 115.4 | 115.4 | (66) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (67)m= | 18.13 | 16.1 | 13.09 | 9.91 | 7.41 | 6.26 | 6.76 | 8.79 | 11.79 | 14.97 | 17.48 | 18.63 | (67) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (68)m= | 203.33 | 205.44 | 200.13 | 188.81 | 174.52 | 161.09 | 152.12 | 150.01 | 155.32 | 166.64 | 180.93 | 194.36 | (68) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (69)m= | 34.54 | 34.54 | 34.54 | 34.54 | 34.54 | 34.54 | 34.54 | 34.54 | 34.54 | 34.54 | 34.54 | 34.54 | (69) |

Pumps and fans gains (Table 5a)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (70)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (70) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (71)m= | -92.32 | -92.32 | -92.32 | -92.32 | -92.32 | -92.32 | -92.32 | -92.32 | -92.32 | -92.32 | -92.32 | -92.32 | (71) |

Water heating gains (Table 5)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (72)m= | 124.33 | 122.28 | 118.01 | 112.2 | 108.43 | 103.13 | 98.61 | 104.39 | 106.45 | 112.46 | 119.24 | 122.28 | (72) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (73)m= | 403.41 | 401.44 | 388.85 | 368.54 | 347.98 | 328.09 | 315.11 | 320.81 | 331.19 | 351.69 | 375.27 | 392.9 | (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 | 12.71 | x | 11.28 | x | 0.63 | x | 0.7 | = | 43.83 | (75) |
| Northeast | 0.9x | 0.77 | x | 12.71 | x | 22.97 | x | 0.63 | x | 0.7 | = | 89.21 | (75) |
| Northeast | 0.9x | 0.77 | x | 12.71 | x | 41.38 | x | 0.63 | x | 0.7 | = | 160.73 | (75) |
| Northeast | 0.9x | 0.77 | x | 12.71 | x | 67.96 | x | 0.63 | x | 0.7 | = | 263.96 | (75) |
| Northeast | 0.9x | 0.77 | x | 12.71 | x | 91.35 | x | 0.63 | x | 0.7 | = | 354.82 | (75) |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Northeast 0.9x | 0.77 | x | 12.71 | x | 97.38 | x | 0.63 | x | 0.7 | = | 378.27 | (75) |
| Northeast 0.9x | 0.77 | x | 12.71 | x | 91.1 | x | 0.63 | x | 0.7 | = | 353.87 | (75) |
| Northeast 0.9x | 0.77 | x | 12.71 | x | 72.63 | x | 0.63 | x | 0.7 | = | 282.11 | (75) |
| Northeast 0.9x | 0.77 | x | 12.71 | x | 50.42 | x | 0.63 | x | 0.7 | = | 195.85 | (75) |
| Northeast 0.9x | 0.77 | x | 12.71 | x | 28.07 | x | 0.63 | x | 0.7 | = | 109.02 | (75) |
| Northeast 0.9x | 0.77 | x | 12.71 | x | 14.2 | x | 0.63 | x | 0.7 | = | 55.15 | (75) |
| Northeast 0.9x | 0.77 | x | 12.71 | x | 9.21 | x | 0.63 | x | 0.7 | = | 35.79 | (75) |
| Northwest 0.9x | 0.77 | x | 3.46 | x | 11.28 | x | 0.63 | x | 0.7 | = | 11.93 | (81) |
| Northwest 0.9x | 0.77 | x | 3.46 | x | 22.97 | x | 0.63 | x | 0.7 | = | 24.29 | (81) |
| Northwest 0.9x | 0.77 | x | 3.46 | x | 41.38 | x | 0.63 | x | 0.7 | = | 43.75 | (81) |
| Northwest 0.9x | 0.77 | x | 3.46 | x | 67.96 | x | 0.63 | x | 0.7 | = | 71.86 | (81) |
| Northwest 0.9x | 0.77 | x | 3.46 | x | 91.35 | x | 0.63 | x | 0.7 | = | 96.59 | (81) |
| Northwest 0.9x | 0.77 | x | 3.46 | x | 97.38 | x | 0.63 | x | 0.7 | = | 102.98 | (81) |
| Northwest 0.9x | 0.77 | x | 3.46 | x | 91.1 | x | 0.63 | x | 0.7 | = | 96.33 | (81) |
| Northwest 0.9x | 0.77 | x | 3.46 | x | 72.63 | x | 0.63 | x | 0.7 | = | 76.8 | (81) |
| Northwest 0.9x | 0.77 | x | 3.46 | x | 50.42 | x | 0.63 | x | 0.7 | = | 53.32 | (81) |
| Northwest 0.9x | 0.77 | x | 3.46 | x | 28.07 | x | 0.63 | x | 0.7 | = | 29.68 | (81) |
| Northwest 0.9x | 0.77 | x | 3.46 | x | 14.2 | x | 0.63 | x | 0.7 | = | 15.01 | (81) |
| Northwest 0.9x | 0.77 | x | 3.46 | x | 9.21 | x | 0.63 | x | 0.7 | = | 9.74 | (81) |

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

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (83)m= | 55.76 | 113.5 | 204.48 | 335.82 | 451.41 | 481.25 | 450.2 | 358.9 | 249.17 | 138.7 | 70.16 | 45.53 | (83) |

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

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (84)m= | 459.17 | 514.94 | 593.33 | 704.36 | 799.39 | 809.34 | 765.31 | 679.71 | 580.35 | 490.4 | 445.43 | 438.43 | (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= | 0.99 | 0.98 | 0.94 | 0.84 | 0.65 | 0.46 | 0.34 | 0.39 | 0.66 | 0.91 | 0.98 | 0.99 | (86) |

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

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (87)m= | 19.91 | 20.08 | 20.38 | 20.74 | 20.93 | 20.99 | 21 | 21 | 20.95 | 20.66 | 20.23 | 19.89 | (87) |

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

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (88)m= | 20.21 | 20.21 | 20.21 | 20.23 | 20.23 | 20.25 | 20.25 | 20.25 | 20.24 | 20.23 | 20.23 | 20.22 | (88) |

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

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (89)m= | 0.98 | 0.97 | 0.93 | 0.81 | 0.61 | 0.41 | 0.28 | 0.33 | 0.6 | 0.89 | 0.97 | 0.99 | (89) |

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

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (90)m= | 18.74 | 18.99 | 19.42 | 19.93 | 20.17 | 20.24 | 20.24 | 20.25 | 20.2 | 19.84 | 19.23 | 18.72 | (90) |

fLA = Living area ÷ (4) = 0.38 (91)

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

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (92)m= | 19.19 | 19.41 | 19.79 | 20.24 | 20.46 | 20.53 | 20.53 | 20.54 | 20.49 | 20.15 | 19.61 | 19.17 | (92) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (93)m= | 19.19 | 19.41 | 19.79 | 20.24 | 20.46 | 20.53 | 20.53 | 20.54 | 20.49 | 20.15 | 19.61 | 19.17 | (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= | 0.98 | 0.97 | 0.93 | 0.81 | 0.62 | 0.43 | 0.3 | 0.35 | 0.62 | 0.88 | 0.96 | 0.98 | (94) |
| Useful gains, hmGm , W = (94)m x (84)m | | | | | | | | | | | | | |
| (95)m= | 449.99 | 497.58 | 549.78 | 572.64 | 498.55 | 344.88 | 230.65 | 240.9 | 360.02 | 433.61 | 429.81 | 431.1 | (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= | 920.89 | 893.8 | 815.46 | 682.31 | 525.12 | 348.22 | 231.14 | 241.92 | 378.27 | 572.65 | 755.98 | 911.39 | (97) |
| Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m | | | | | | | | | | | | | |
| (98)m= | 350.35 | 266.26 | 197.66 | 78.97 | 19.77 | 0 | 0 | 0 | 0 | 103.45 | 234.84 | 357.33 | |

| | | |
|---|---|---|
| Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = | 1608.62 | (98) |
| Space heating requirement in kWh/m²/year | 22.15 | (99) |

## 9b. Energy requirements – Community heating scheme

| | | | |
|---|---|---|---|
| This part is used for space heating, space cooling or water heating provided by a community scheme.<br>Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none | | 0 | (301) |
| Fraction of space heat from community system 1 – (301) = | | 1 | (302) |

*The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.*

| | | | |
|---|---|---|---|
| Fraction of heat from Community boilers | | 1 | (303a) |
| Fraction of total space heat from Community boilers | (302) x (303a) = | 1 | (304a) |
| Factor for control and charging method (Table 4c(3)) for community heating system | | 1 | (305) |
| Distribution loss factor (Table 12c) for community heating system | | 1.05 | (306) |
| **Space heating** | | **kWh/year** | |
| Annual space heating requirement | | 1608.62 | |
| Space heat from Community boilers | (98) x (304a) x (305) x (306) = | 1689.05 | (307a) |
| Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) | | 0 | (308 |
| Space heating requirement from secondary/supplementary system | (98) x (301) x 100 ÷ (308) = | 0 | (309) |
| **Water heating** | | | |
| Annual water heating requirement | | 2051.4 | |
| If DHW from community scheme:<br>Water heat from Community boilers | (64) x (303a) x (305) x (306) = | 2153.97 | (310a) |
| Electricity used for heat distribution | 0.01 × [(307a)…(307e) + (310a)…(310e)] = | 38.43 | (313) |
| Cooling System Energy Efficiency Ratio | | 0 | (314) |
| Space cooling (if there is a fixed cooling system, if not enter 0) | = (107) ÷ (314) = | 0 | (315) |
| Electricity for pumps and fans within dwelling (Table 4f):<br>mechanical ventilation - balanced, extract or positive input from outside | | 177.49 | (330a) |

# DER WorkSheet: New dwelling design stage

| | | | |
|---|---|---|---|
| warm air heating system fans | | 0 | (330b) |
| pump for solar water heating | | 0 | (330g) |
| Total electricity for the above, kWh/year | =(330a) + (330b) + (330g) = | 177.49 | (331) |
| Energy for lighting (calculated in Appendix L) | | 320.14 | (332) |
| Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) = | | 4340.66 | (338) |

## 12b. CO2 Emissions – Community heating scheme

| | | Energy kWh/year | Emission factor kg CO2/kWh | | Emissions kg CO2/year | |
|---|---|---|---|---|---|---|
| CO2 from other sources of space and water heating (not CHP) | | | | | | |
| Efficiency of heat source 1 (%) | If there is CHP using two fuels repeat (363) to (366) for the second fuel | | | | 96 | (367a) |
| CO2 associated with heat source 1 | [(307b)+(310b)] x 100 ÷ (367b) x | | 0.22 | = | 864.68 | (367) |
| Electrical energy for heat distribution | [(313) x | | 0.52 | = | 19.95 | (372) |
| Total CO2 associated with community systems | (363)…(366) + (368)...(372) | | | = | 884.62 | (373) |
| CO2 associated with space heating (secondary) | (309) x | | 0 | = | 0 | (374) |
| CO2 associated with water from immersion heater or instantaneous heater | (312) x | | 0.22 | = | 0 | (375) |
| Total CO2 associated with space and water heating | (373) + (374) + (375) = | | | | 884.62 | (376) |
| CO2 associated with electricity for pumps and fans within dwelling | (331)) x | | 0.52 | = | 92.12 | (378) |
| CO2 associated with electricity for lighting | (332))) x | | 0.52 | = | 166.15 | (379) |
| **Total CO2, kg/year** | sum of (376)…(382) = | | | | 1142.9 | (383) |
| **Dwelling CO2 Emission Rate** | (383) ÷ (4) = | | | | 15.74 | (384) |
| **EI rating (section 14)** | | | | | 86.98 | (385) |

# Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.50
*Printed on 06 December 2021 at 10:53:45*

## Project Information:

**Assessed By:** Neil Ingham (STRO010943) **Building Type:** Flat

## Dwelling Details:

**NEW DWELLING DESIGN STAGE** Total Floor Area: 53.96m²

**Site Reference :** Highgate Road - GREEN **Plot Reference:** 04 - D

**Address :**

## Client Details:

**Name:**

**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 (c)
Fuel factor: 1.00 (mains gas (c))

| | | |
|---|---|---|
| Target Carbon Dioxide Emission Rate (TER) | 19.25 kg/m² | |
| Dwelling Carbon Dioxide Emission Rate (DER) | 16.23 kg/m² | **OK** |

## 1b TFEE and DFEE

| | | |
|---|---|---|
| Target Fabric Energy Efficiency (TFEE) | 48.6 kWh/m² | |
| Dwelling Fabric Energy Efficiency (DFEE) | 39.2 kWh/m² | |
| | | **OK** |

## 2 Fabric U-values

| Element | Average | Highest | |
|---|---|---|---|
| External wall | 0.17 (max. 0.30) | 0.18 (max. 0.70) | **OK** |
| Party wall | 0.00 (max. 0.20) | - | **OK** |
| Floor | (no floor) | | |
| Roof | (no roof) | | |
| Openings | 1.40 (max. 2.00) | 1.40 (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 | 3.00 (design value) | |
| Maximum | 10.0 | **OK** |

## 4 Heating efficiency

| | |
|---|---|
| Main Heating system: | Community heating schemes - mains gas |
| Secondary heating system: | None |

## 5 Cylinder insulation

| | |
|---|---|
| Hot water Storage: | No cylinder |

## 6 Controls

| | | |
|---|---|---|
| Space heating controls | Charging system linked to use of community heating, programmer and at least two room thermostats | **OK** |
| Hot water controls: | No cylinder thermostat<br>No cylinder | |

# Regulations Compliance Report

## 7 Low energy lights

| | | |
|---|---|---|
| Percentage of fixed lights with low-energy fittings | 100.0% | |
| Minimum | 75.0% | **OK** |

## 8 Mechanical ventilation

| | | |
|---|---|---|
| Continuous supply and extract system | | |
| Specific fan power: | 0.47 | |
| Maximum | 1.5 | **OK** |
| MVHR efficiency: | 89% | |
| Minimum | 70% | **OK** |

## 9 Summertime temperature

| | | |
|---|---|---|
| Overheating risk (Thames valley): | Medium | **OK** |
| Based on: | | |
| Overshading: | Average or unknown | |
| Windows facing: North East | 12.07m² | |
| Ventilation rate: | 4.00 | |

## 10 Key features

| | |
|---|---|
| Air permeablility | 3.0 m³/m²h |
| Party  Walls U-value | 0 W/m²K |
| Community heating, heat from boilers – mains gas | |

# DER WorkSheet: New dwelling design stage

User Details:

| | | | |
|---|---|---|---|
| **Assessor Name:** | Neil Ingham | **Stroma Number:** | STRO010943 |
| **Software Name:** | Stroma FSAP 2012 | **Software Version:** | Version: 1.0.5.50 |

Property Address: 04 - D

**Address :**

## 1. Overall dwelling dimensions:

| | Area(m²) | | Av. Height(m) | | Volume(m³) | |
|---|---|---|---|---|---|---|
| Ground floor | 53.96 | (1a) x | 2.65 | (2a) = | 142.99 | (3a) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n) | 53.96 | (4) | | | | |
| Dwelling volume | | | | (3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) = | 142.99 | (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 | | | | | | | 0 | x 10 = | 0 | (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) = | 0 | ÷ (5) = | 0 | (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 | | 3 | (17) |
| If based on air permeability value, then | (18) = [(17) ÷ 20]+(8), otherwise (18) = (16) | 0.15 | (18) |

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

| | | | |
|---|---|---|---|
| Number of sides sheltered | | 0 | (19) |
| Shelter factor | (20) = 1 - [0.075 x (19)] = | 1 | (20) |
| Infiltration rate incorporating shelter factor | (21) = (18) x (20) = | 0.15 | (21) |

Infiltration rate modified for monthly wind speed

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|

Monthly average wind speed from Table 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 |

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 |

# DER WorkSheet: New dwelling design stage

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

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.19 | 0.19 | 0.18 | 0.16 | 0.16 | 0.14 | 0.14 | 0.14 | 0.15 | 0.16 | 0.17 | 0.18 |

*Calculate effective air change rate for the applicable case*

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 75.65 (23c)

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24a)m= | 0.31 | 0.31 | 0.31 | 0.29 | 0.28 | 0.26 | 0.26 | 0.26 | 0.27 | 0.28 | 0.29 | 0.3 | (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 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24d) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (25)m= | 0.31 | 0.31 | 0.31 | 0.29 | 0.28 | 0.26 | 0.26 | 0.26 | 0.27 | 0.28 | 0.29 | 0.3 | (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 | |
|---|---|---|---|---|---|---|---|---|---|---|
| Windows | | | 12.07 | x1/[1/( 1.4 )+ 0.04] | | = | 16 | | | (27) |
| Walls Type1 | 27.66 | 12.07 | 15.59 | x | 0.18 | = | 2.81 | 60 | 935.4 | (29) |
| Walls Type2 | 24.24 | 0 | 24.24 | x | 0.17 | = | 4.07 | 60 | 1454.4 | (29) |
| Total area of elements, m² | | | 51.9 | | | | | | | (31) |
| Party wall | | | 31.67 | x | 0 | = | 0 | 45 | 1425.15 | (32) |
| Party floor | | | 53.96 | | | | | 40 | 2158.4 | (32a) |
| Party ceiling | | | 53.96 | | | | | 30 | 1618.8 | (32b) |
| Internal wall ** | | | 95.03 | | | | | 9 | 855.27 | (32c) |

** 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) = 22.88 (33)

Heat capacity Cm = S(A x k ) ((28)…(30) + (32) + (32a)…(32e) = 8447.42 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 156.55 (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 6.04 (36)

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

Total fabric heat loss (33) + (36) = 28.91 (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= | 14.77 | 14.59 | 14.42 | 13.53 | 13.35 | 12.47 | 12.47 | 12.29 | 12.82 | 13.35 | 13.71 | 14.06 | (38) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (39)m= | 43.68 | 43.51 | 43.33 | 42.45 | 42.27 | 41.38 | 41.38 | 41.21 | 41.74 | 42.27 | 42.62 | 42.98 | |

Average = $Sum(39)_{1…12}$ /12= 42.4 (39)

# DER WorkSheet: New dwelling design stage

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

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (40)m= | 0.81 | 0.81 | 0.8 | 0.79 | 0.78 | 0.77 | 0.77 | 0.76 | 0.77 | 0.78 | 0.79 | 0.8 |

Average = Sum(40)$_{1…12}$ /12= 0.79 (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 1.81 (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 77.11 (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)*

*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)*

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

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (44)m= | 84.82 | 81.74 | 78.65 | 75.57 | 72.49 | 69.4 | 69.4 | 72.49 | 75.57 | 78.65 | 81.74 | 84.82 | |
| (45)m= | 125.79 | 110.02 | 113.53 | 98.98 | 94.97 | 81.95 | 75.94 | 87.14 | 88.18 | 102.77 | 112.18 | 121.82 | |
| (46)m= | 18.87 | 16.5 | 17.03 | 14.85 | 14.25 | 12.29 | 11.39 | 13.07 | 13.23 | 15.42 | 16.83 | 18.27 | (46) |

Total = Sum(44)$_{1…12}$ = 925.35 (44)

Total = Sum(45)$_{1…12}$ = 1213.27 (45)

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) = 110 (50)

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

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (56)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (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= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (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= | 23.26 | 21.01 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | (59) |

# DER WorkSheet: New dwelling design stage

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 | (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= | 181.07 | 159.94 | 168.8 | 152.47 | 150.25 | 135.45 | 131.22 | 142.42 | 141.68 | 158.05 | 165.67 | 177.1 | (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= | 181.07 | 159.94 | 168.8 | 152.47 | 150.25 | 135.45 | 131.22 | 142.42 | 141.68 | 158.05 | 165.67 | 177.1 | |

Output from water heater (annual)$_{1...12}$ 1864.11 (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= | 86.05 | 76.52 | 81.97 | 75.7 | 75.8 | 70.04 | 69.47 | 73.2 | 72.12 | 78.39 | 80.1 | 84.73 | (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= | 90.34 | 90.34 | 90.34 | 90.34 | 90.34 | 90.34 | 90.34 | 90.34 | 90.34 | 90.34 | 90.34 | 90.34 | (66) |

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (67)m= | 14.04 | 12.47 | 10.14 | 7.68 | 5.74 | 4.85 | 5.24 | 6.81 | 9.13 | 11.6 | 13.54 | 14.43 | (67) |

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (68)m= | 157.5 | 159.14 | 155.02 | 146.25 | 135.18 | 124.78 | 117.83 | 116.2 | 120.31 | 129.08 | 140.15 | 150.55 | (68) |

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (69)m= | 32.03 | 32.03 | 32.03 | 32.03 | 32.03 | 32.03 | 32.03 | 32.03 | 32.03 | 32.03 | 32.03 | 32.03 | (69) |

Pumps and fans gains (Table 5a)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (70)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (70) |

Losses e.g. evaporation (negative values) (Table 5)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (71)m= | -72.27 | -72.27 | -72.27 | -72.27 | -72.27 | -72.27 | -72.27 | -72.27 | -72.27 | -72.27 | -72.27 | -72.27 | (71) |

Water heating gains (Table 5)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (72)m= | 115.65 | 113.87 | 110.17 | 105.15 | 101.88 | 97.28 | 93.38 | 98.38 | 100.16 | 105.37 | 111.24 | 113.88 | (72) |

**Total internal gains =** (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (73)m= | 337.3 | 335.58 | 325.44 | 309.18 | 292.9 | 277.01 | 266.54 | 271.49 | 279.71 | 296.15 | 315.03 | 328.97 | (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 | 12.07 | x | 11.28 | x | 0.63 | x | 0.7 | = | 41.62 | (75) |
| Northeast 0.9x | 0.77 | x | 12.07 | x | 22.97 | x | 0.63 | x | 0.7 | = | 84.72 | (75) |
| Northeast 0.9x | 0.77 | x | 12.07 | x | 41.38 | x | 0.63 | x | 0.7 | = | 152.64 | (75) |
| Northeast 0.9x | 0.77 | x | 12.07 | x | 67.96 | x | 0.63 | x | 0.7 | = | 250.67 | (75) |
| Northeast 0.9x | 0.77 | x | 12.07 | x | 91.35 | x | 0.63 | x | 0.7 | = | 336.95 | (75) |

# DER WorkSheet: New dwelling design stage

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Northeast | 0.9x | 0.77 | x | 12.07 | x | 97.38 | x | 0.63 | x | 0.7 | = | 359.23 | (75) |
| Northeast | 0.9x | 0.77 | x | 12.07 | x | 91.1 | x | 0.63 | x | 0.7 | = | 336.05 | (75) |
| Northeast | 0.9x | 0.77 | x | 12.07 | x | 72.63 | x | 0.63 | x | 0.7 | = | 267.9 | (75) |
| Northeast | 0.9x | 0.77 | x | 12.07 | x | 50.42 | x | 0.63 | x | 0.7 | = | 185.99 | (75) |
| Northeast | 0.9x | 0.77 | x | 12.07 | x | 28.07 | x | 0.63 | x | 0.7 | = | 103.53 | (75) |
| Northeast | 0.9x | 0.77 | x | 12.07 | x | 14.2 | x | 0.63 | x | 0.7 | = | 52.37 | (75) |
| Northeast | 0.9x | 0.77 | x | 12.07 | x | 9.21 | x | 0.63 | x | 0.7 | = | 33.99 | (75) |

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (83)m= | 41.62 | 84.72 | 152.64 | 250.67 | 336.95 | 359.23 | 336.05 | 267.9 | 185.99 | 103.53 | 52.37 | 33.99 | (83) |

Total gains – internal and solar (84)m = (73)m + (83)m , watts

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (84)m= | 378.92 | 420.3 | 478.07 | 559.85 | 629.86 | 636.24 | 602.59 | 539.39 | 465.7 | 399.68 | 367.4 | 362.95 | (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= | 0.98 | 0.96 | 0.91 | 0.79 | 0.6 | 0.41 | 0.3 | 0.35 | 0.59 | 0.86 | 0.96 | 0.98 | (86) |

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (87)m= | 20.03 | 20.19 | 20.48 | 20.8 | 20.95 | 20.99 | 21 | 21 | 20.97 | 20.74 | 20.34 | 20 | (87) |

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (88)m= | 20.25 | 20.25 | 20.25 | 20.26 | 20.27 | 20.28 | 20.28 | 20.28 | 20.28 | 20.27 | 20.26 | 20.26 | (88) |

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (89)m= | 0.97 | 0.95 | 0.9 | 0.76 | 0.56 | 0.37 | 0.25 | 0.3 | 0.54 | 0.83 | 0.95 | 0.98 | (89) |

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (90)m= | 18.94 | 19.19 | 19.59 | 20.03 | 20.22 | 20.28 | 20.28 | 20.28 | 20.25 | 19.97 | 19.41 | 18.92 | (90) |

fLA = Living area ÷ (4) = 0.47 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (92)m= | 19.45 | 19.66 | 20.01 | 20.4 | 20.57 | 20.62 | 20.62 | 20.62 | 20.59 | 20.33 | 19.85 | 19.43 | (92) |

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (93)m= | 19.45 | 19.66 | 20.01 | 20.4 | 20.57 | 20.62 | 20.62 | 20.62 | 20.59 | 20.33 | 19.85 | 19.43 | (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= | 0.97 | 0.95 | 0.89 | 0.76 | 0.57 | 0.39 | 0.28 | 0.32 | 0.56 | 0.84 | 0.94 | 0.97 | (94) |
| Useful gains, hmGm , W = (94)m x (84)m | | | | | | | | | | | | | |
| (95)m= | 365.75 | 397.48 | 427.33 | 427.25 | 360.81 | 247.22 | 166.11 | 173.41 | 261.73 | 334.22 | 345.95 | 352.08 | (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= | 661.94 | 642.24 | 585.42 | 487.92 | 374.76 | 248.93 | 166.37 | 173.92 | 270.77 | 411.33 | 543.52 | 654.55 | (97) |
| Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m | | | | | | | | | | | | | |
| (98)m= | 220.37 | 164.48 | 117.62 | 43.69 | 10.37 | 0 | 0 | 0 | 0 | 57.37 | 142.25 | 225.03 | (98) |

# DER WorkSheet: New dwelling design stage

| | | | |
|---|---|---|---|
| | Total per year (kWh/year) = $Sum(98)_{1...5,9...12}$ = | 981.18 | (98) |
| Space heating requirement in kWh/m²/year | | 18.18 | (99) |

## 9b. Energy requirements – Community heating scheme

| | | | |
|---|---|---|---|
| This part is used for space heating, space cooling or water heating provided by a community scheme. Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none | | 0 | (301) |
| Fraction of space heat from community system 1 – (301) = | | 1 | (302) |

*The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.*

| | | | |
|---|---|---|---|
| Fraction of heat from Community boilers | | 1 | (303a) |
| Fraction of total space heat from Community boilers | (302) x (303a) = | 1 | (304a) |
| Factor for control and charging method (Table 4c(3)) for community heating system | | 1 | (305) |
| Distribution loss factor (Table 12c) for community heating system | | 1.05 | (306) |
| **Space heating** | | **kWh/year** | |
| Annual space heating requirement | | 981.18 | |
| Space heat from Community boilers | (98) x (304a) x (305) x (306) = | 1030.24 | (307a) |
| Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) | | 0 | (308 |
| Space heating requirement from secondary/supplementary system | (98) x (301) x 100 ÷ (308) = | 0 | (309) |
| **Water heating** | | | |
| Annual water heating requirement | | 1864.11 | |
| If DHW from community scheme: Water heat from Community boilers | (64) x (303a) x (305) x (306) = | 1957.32 | (310a) |
| Electricity used for heat distribution | 0.01 × [(307a)…(307e) + (310a)…(310e)] = | 29.88 | (313) |
| Cooling System Energy Efficiency Ratio | | 0 | (314) |
| Space cooling (if there is a fixed cooling system, if not enter 0) | = (107) ÷ (314) = | 0 | (315) |
| Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside | | 114.79 | (330a) |
| warm air heating system fans | | 0 | (330b) |
| pump for solar water heating | | 0 | (330g) |
| Total electricity for the above, kWh/year | =(330a) + (330b) + (330g) = | 114.79 | (331) |
| Energy for lighting (calculated in Appendix L) | | 247.96 | (332) |
| Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) = | | 3350.31 | (338) |

## 12b. CO2 Emissions – Community heating scheme

| | | Energy kWh/year | Emission factor kg CO2/kWh | | Emissions kg CO2/year | |
|---|---|---|---|---|---|---|
| CO2 from other sources of space and water heating (not CHP) Efficiency of heat source 1 (%) | If there is CHP using two fuels repeat (363) to (366) for the second fuel | | | | 96 | (367a) |
| CO2 associated with heat source 1 | [(307b)+(310b)] x 100 ÷ (367b) x | | 0.22 | = | 672.2 | (367) |
| Electrical energy for heat distribution | [(313) x | | 0.52 | = | 15.51 | (372) |

# DER WorkSheet: New dwelling design stage

| | | | | | |
|---|---|---|---|---|---|
| Total CO2 associated with community systems | (363)…(366) + (368)...(372) | | = | 687.71 | (373) |
| CO2 associated with space heating (secondary) | (309) x | 0 | = | 0 | (374) |
| CO2 associated with water from immersion heater or instantaneous heater | (312) x | 0.22 | = | 0 | (375) |
| Total CO2 associated with space and water heating | (373) + (374) + (375) = | | | 687.71 | (376) |
| CO2 associated with electricity for pumps and fans within dwelling | (331)) x | 0.52 | = | 59.58 | (378) |
| CO2 associated with electricity for lighting | (332))) x | 0.52 | = | 128.69 | (379) |
| **Total CO2, kg/year** | sum of (376)…(382) = | | | 875.97 | (383) |
| **Dwelling CO2 Emission Rate** | (383) ÷ (4) = | | | 16.23 | (384) |
| **EI rating (section 14)** | | | | 88.14 | (385) |

# Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.50
*Printed on 06 December 2021 at 10:53:42*

## Project Information:

**Assessed By:** Neil Ingham (STRO010943) **Building Type:** Flat

## Dwelling Details:

**NEW DWELLING DESIGN STAGE** Total Floor Area: 69.61m²

**Site Reference :** Highgate Road - GREEN **Plot Reference:** 04 - E

**Address :**

## Client Details:

**Name:**

**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 (c) | | |
| Fuel factor: 1.00 (mains gas (c)) | | |
| Target Carbon Dioxide Emission Rate (TER) | 18.52 kg/m² | |
| Dwelling Carbon Dioxide Emission Rate (DER) | 16.10 kg/m² | OK |

## 1b TFEE and DFEE

| | | |
|---|---|---|
| Target Fabric Energy Efficiency (TFEE) | 50.9 kWh/m² | |
| Dwelling Fabric Energy Efficiency (DFEE) | 41.2 kWh/m² | |
| | | OK |

## 2 Fabric U-values

| Element | Average | Highest | |
|---|---|---|---|
| External wall | 0.18 (max. 0.30) | 0.18 (max. 0.70) | OK |
| Party wall | 0.00 (max. 0.20) | - | OK |
| Floor | (no floor) | | |
| Roof | 0.13 (max. 0.20) | 0.13 (max. 0.35) | OK |
| Openings | 1.40 (max. 2.00) | 1.40 (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 | 3.00 (design value) | |
| Maximum | 10.0 | OK |

## 4 Heating efficiency

| | |
|---|---|
| Main Heating system: | Community heating schemes - mains gas |
| Secondary heating system: | None |

## 5 Cylinder insulation

| | |
|---|---|
| Hot water Storage: | No cylinder |

## 6 Controls

| | | |
|---|---|---|
| Space heating controls | Charging system linked to use of community heating, programmer and at least two room thermostats | OK |
| Hot water controls: | No cylinder thermostat<br>No cylinder | |

# Regulations Compliance Report

| 7 Low energy lights | | |
|---|---|---|
| Percentage of fixed lights with low-energy fittings | 100.0% | |
| Minimum | 75.0% | **OK** |

| 8 Mechanical ventilation | | |
|---|---|---|
| Continuous supply and extract system | | |
| Specific fan power: | 0.54 | |
| Maximum | 1.5 | **OK** |
| MVHR efficiency: | 88% | |
| Minimum | 70% | **OK** |

| 9 Summertime temperature | | |
|---|---|---|
| Overheating risk (Thames valley): | Slight | **OK** |
| Based on: | | |
| Overshading: | Average or unknown | |
| Windows facing: North East | 8.97m² | |
| Windows facing: South West | 2.92m² | |
| Ventilation rate: | 6.00 | |

| 10 Key features | |
|---|---|
| Air permeablility | 3.0 m³/m²h |
| Party Walls U-value | 0 W/m²K |
| Community heating, heat from boilers – mains gas | |

# DER WorkSheet: New dwelling design stage

## User Details:

| | | | |
|---|---|---|---|
| **Assessor Name:** | Neil Ingham | **Stroma Number:** | STRO010943 |
| **Software Name:** | Stroma FSAP 2012 | **Software Version:** | Version: 1.0.5.50 |

Property Address: 04 - E

**Address :**

## 1. Overall dwelling dimensions:

| | Area(m²) | | | Av. Height(m) | | | Volume(m³) | |
|---|---|---|---|---|---|---|---|---|
| Ground floor | 69.61 | (1a) | x | 2.65 | (2a) | = | 184.47 | (3a) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n) | 69.61 | (4) | | | | | | |
| Dwelling volume | | | | (3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) = | | | 184.47 | (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 | | | | | | | 0 | x 10 = | 0 | (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) = | 0 | ÷ (5) = | 0 | (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 | | 3 | (17) |
| If based on air permeability value, then | (18) = [(17) ÷ 20]+(8), otherwise (18) = (16) | 0.15 | (18) |
| *Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used* | | | |
| Number of sides sheltered | | 0 | (19) |
| Shelter factor | (20) = 1 - [0.075 x (19)] = | 1 | (20) |
| Infiltration rate incorporating shelter factor | (21) = (18) x (20) = | 0.15 | (21) |

Infiltration rate modified for monthly wind speed

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Monthly average wind speed from Table 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 |
| 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 |

# DER WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.19 | 0.19 | 0.18 | 0.16 | 0.16 | 0.14 | 0.14 | 0.14 | 0.15 | 0.16 | 0.17 | 0.18 |

*Calculate effective air change rate for the applicable case*

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 74.8 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24a)m= | 0.32 | 0.31 | 0.31 | 0.29 | 0.29 | 0.27 | 0.27 | 0.26 | 0.28 | 0.29 | 0.29 | 0.3 | (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 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24d) |

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (25)m= | 0.32 | 0.31 | 0.31 | 0.29 | 0.29 | 0.27 | 0.27 | 0.26 | 0.28 | 0.29 | 0.29 | 0.3 | (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 | |
|---|---|---|---|---|---|---|---|---|---|---|
| Windows Type 1 | | | 8.97 | x1/[1/( 1.4 )+ 0.04] | | = | 11.89 | | | (27) |
| Windows Type 2 | | | 2.92 | x1/[1/( 1.4 )+ 0.04] | | = | 3.87 | | | (27) |
| Walls Type1 | 41.59 | 11.89 | 29.7 | x | 0.18 | = | 5.35 | 60 | 1782 | (29) |
| Walls Type2 | 18.41 | 0 | 18.41 | x | 0.17 | = | 3.09 | 60 | 1104.6 | (29) |
| Roof | 69.61 | 0 | 69.61 | x | 0.13 | = | 9.05 | 9 | 626.49 | (30) |
| Total area of elements, m² | | | 129.61 | | | | | | | (31) |
| Party wall | | | 38.68 | x | 0 | = | 0 | 45 | 1740.6 | (32) |
| Party floor | | | 69.61 | | | | | 40 | 2784.4 | (32a) |
| Internal wall ** | | | 136.21 | | | | | 9 | 1225.89 | (32c) |

** 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) = 33.25 (33)

Heat capacity Cm = S(A x k ) ((28)…(30) + (32) + (32a)…(32e) = 9263.98 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 133.08 (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 7.36 (36)

*if details of thermal bridging are not known (36) = 0.05 x (31)*

Total fabric heat loss (33) + (36) = 40.61 (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= | 19.31 | 19.08 | 18.86 | 17.71 | 17.49 | 16.34 | 16.34 | 16.12 | 16.8 | 17.49 | 17.94 | 18.4 | (38) |

Heat transfer coefficient, W/K (39)m = (37) + (38)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (39)m= | 59.93 | 59.7 | 59.47 | 58.33 | 58.1 | 56.96 | 56.96 | 56.73 | 57.42 | 58.1 | 58.56 | 59.01 | |

Average = Sum(39)$_{1…12}$ /12= 58.27 (39)

# DER WorkSheet: New dwelling design stage

Heat loss parameter (HLP), W/m²K — (40)m = (39)m ÷ (4)

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (40)m= | 0.86 | 0.86 | 0.85 | 0.84 | 0.83 | 0.82 | 0.82 | 0.81 | 0.82 | 0.83 | 0.84 | 0.85 |

Average = Sum(40)$_{1…12}$ /12= 0.84 (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 — 2.24 (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 — 87.32 (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)*

*Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)*

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (44)m= | 96.05 | 92.56 | 89.07 | 85.57 | 82.08 | 78.59 | 78.59 | 82.08 | 85.57 | 89.07 | 92.56 | 96.05 |

Total = Sum(44)$_{1…12}$ = 1047.84 (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= | 142.44 | 124.58 | 128.56 | 112.08 | 107.54 | 92.8 | 85.99 | 98.68 | 99.86 | 116.37 | 127.03 | 137.95 |

Total = Sum(45)$_{1…12}$ = 1373.88 (45)

*If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)*

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (46)m= | 21.37 | 18.69 | 19.28 | 16.81 | 16.13 | 13.92 | 12.9 | 14.8 | 14.98 | 17.46 | 19.05 | 20.69 | (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) = — 110 (50)

b) If manufacturer’s declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) — 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a — 1.03 (52)

Temperature factor from Table 2b — 0.6 (53)

Energy lost from water storage, kWh/year — (47) x (51) x (52) x (53) = — 1.03 (54)

Enter (50) or (54) in (55) — 1.03 (55)

Water storage loss calculated for each month — ((56)m = (55) × (41)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (56)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (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= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (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= | 23.26 | 21.01 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | (59) |

# DER WorkSheet: New dwelling design stage

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 | (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= | 197.72 | 174.51 | 183.83 | 165.57 | 162.82 | 146.29 | 141.27 | 153.96 | 153.35 | 171.65 | 180.52 | 193.22 | (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= | 197.72 | 174.51 | 183.83 | 165.57 | 162.82 | 146.29 | 141.27 | 153.96 | 153.35 | 171.65 | 180.52 | 193.22 | |

Output from water heater (annual)$_{1...12}$ 2024.72 (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= | 91.58 | 81.36 | 86.97 | 80.06 | 79.98 | 73.65 | 72.81 | 77.03 | 76 | 82.92 | 85.03 | 90.09 | (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= | 111.83 | 111.83 | 111.83 | 111.83 | 111.83 | 111.83 | 111.83 | 111.83 | 111.83 | 111.83 | 111.83 | 111.83 | (66) |

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (67)m= | 18.04 | 16.02 | 13.03 | 9.87 | 7.37 | 6.23 | 6.73 | 8.74 | 11.74 | 14.9 | 17.39 | 18.54 | (67) |

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (68)m= | 196.39 | 198.42 | 193.29 | 182.36 | 168.55 | 155.58 | 146.92 | 144.88 | 150.02 | 160.95 | 174.75 | 187.72 | (68) |

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (69)m= | 34.18 | 34.18 | 34.18 | 34.18 | 34.18 | 34.18 | 34.18 | 34.18 | 34.18 | 34.18 | 34.18 | 34.18 | (69) |

Pumps and fans gains (Table 5a)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (70)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (70) |

Losses e.g. evaporation (negative values) (Table 5)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (71)m= | -89.46 | -89.46 | -89.46 | -89.46 | -89.46 | -89.46 | -89.46 | -89.46 | -89.46 | -89.46 | -89.46 | -89.46 | (71) |

Water heating gains (Table 5)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (72)m= | 123.1 | 121.08 | 116.89 | 111.2 | 107.5 | 102.29 | 97.87 | 103.54 | 105.55 | 111.45 | 118.1 | 121.09 | (72) |

**Total internal gains =** (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (73)m= | 394.07 | 392.08 | 379.76 | 359.97 | 339.98 | 320.65 | 308.06 | 313.71 | 323.86 | 343.85 | 366.79 | 383.9 | (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 | 8.97 | x | 11.28 | x | 0.63 | x | 0.7 | = | 30.93 | (75) |
| Northeast 0.9x | 0.77 | x | 8.97 | x | 22.97 | x | 0.63 | x | 0.7 | = | 62.96 | (75) |
| Northeast 0.9x | 0.77 | x | 8.97 | x | 41.38 | x | 0.63 | x | 0.7 | = | 113.43 | (75) |
| Northeast 0.9x | 0.77 | x | 8.97 | x | 67.96 | x | 0.63 | x | 0.7 | = | 186.29 | (75) |
| Northeast 0.9x | 0.77 | x | 8.97 | x | 91.35 | x | 0.63 | x | 0.7 | = | 250.41 | (75) |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Northeast | 0.9x | 0.77 | x | 8.97 | x | 97.38 | x | 0.63 | x | 0.7 | = | 266.96 | (75) |
| Northeast | 0.9x | 0.77 | x | 8.97 | x | 91.1 | x | 0.63 | x | 0.7 | = | 249.74 | (75) |
| Northeast | 0.9x | 0.77 | x | 8.97 | x | 72.63 | x | 0.63 | x | 0.7 | = | 199.1 | (75) |
| Northeast | 0.9x | 0.77 | x | 8.97 | x | 50.42 | x | 0.63 | x | 0.7 | = | 138.22 | (75) |
| Northeast | 0.9x | 0.77 | x | 8.97 | x | 28.07 | x | 0.63 | x | 0.7 | = | 76.94 | (75) |
| Northeast | 0.9x | 0.77 | x | 8.97 | x | 14.2 | x | 0.63 | x | 0.7 | = | 38.92 | (75) |
| Northeast | 0.9x | 0.77 | x | 8.97 | x | 9.21 | x | 0.63 | x | 0.7 | = | 25.26 | (75) |
| Southwest | 0.9x | 0.77 | x | 2.92 | x | 36.79 | | 0.63 | x | 0.7 | = | 32.83 | (79) |
| Southwest | 0.9x | 0.77 | x | 2.92 | x | 62.67 | | 0.63 | x | 0.7 | = | 55.93 | (79) |
| Southwest | 0.9x | 0.77 | x | 2.92 | x | 85.75 | | 0.63 | x | 0.7 | = | 76.52 | (79) |
| Southwest | 0.9x | 0.77 | x | 2.92 | x | 106.25 | | 0.63 | x | 0.7 | = | 94.82 | (79) |
| Southwest | 0.9x | 0.77 | x | 2.92 | x | 119.01 | | 0.63 | x | 0.7 | = | 106.2 | (79) |
| Southwest | 0.9x | 0.77 | x | 2.92 | x | 118.15 | | 0.63 | x | 0.7 | = | 105.44 | (79) |
| Southwest | 0.9x | 0.77 | x | 2.92 | x | 113.91 | | 0.63 | x | 0.7 | = | 101.65 | (79) |
| Southwest | 0.9x | 0.77 | x | 2.92 | x | 104.39 | | 0.63 | x | 0.7 | = | 93.16 | (79) |
| Southwest | 0.9x | 0.77 | x | 2.92 | x | 92.85 | | 0.63 | x | 0.7 | = | 82.86 | (79) |
| Southwest | 0.9x | 0.77 | x | 2.92 | x | 69.27 | | 0.63 | x | 0.7 | = | 61.81 | (79) |
| Southwest | 0.9x | 0.77 | x | 2.92 | x | 44.07 | | 0.63 | x | 0.7 | = | 39.33 | (79) |
| Southwest | 0.9x | 0.77 | x | 2.92 | x | 31.49 | | 0.63 | x | 0.7 | = | 28.1 | (79) |

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (83)m= | 63.76 | 118.89 | 189.96 | 281.11 | 356.62 | 372.4 | 351.39 | 292.25 | 221.08 | 138.76 | 78.25 | 53.36 | (83) |

Total gains – internal and solar (84)m = (73)m + (83)m , watts

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (84)m= | 457.84 | 510.96 | 569.72 | 641.07 | 696.59 | 693.05 | 659.46 | 605.97 | 544.94 | 482.6 | 445.04 | 437.26 | (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= | 0.97 | 0.96 | 0.92 | 0.83 | 0.69 | 0.51 | 0.38 | 0.42 | 0.66 | 0.88 | 0.96 | 0.98 | (86) |

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (87)m= | 19.7 | 19.9 | 20.21 | 20.6 | 20.85 | 20.97 | 20.99 | 20.99 | 20.91 | 20.57 | 20.09 | 19.68 | (87) |

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (88)m= | 20.2 | 20.2 | 20.21 | 20.22 | 20.22 | 20.24 | 20.24 | 20.24 | 20.23 | 20.22 | 20.22 | 20.21 | (88) |

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (89)m= | 0.97 | 0.95 | 0.91 | 0.81 | 0.65 | 0.45 | 0.31 | 0.36 | 0.6 | 0.85 | 0.95 | 0.97 | (89) |

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (90)m= | 18.46 | 18.74 | 19.19 | 19.73 | 20.07 | 20.21 | 20.23 | 20.23 | 20.15 | 19.71 | 19.02 | 18.43 | (90) |

fLA = Living area ÷ (4) = 0.38 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (92)m= | 18.93 | 19.18 | 19.58 | 20.06 | 20.37 | 20.5 | 20.52 | 20.52 | 20.44 | 20.04 | 19.43 | 18.9 | (92) |

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (93)m= | 18.93 | 19.18 | 19.58 | 20.06 | 20.37 | 20.5 | 20.52 | 20.52 | 20.44 | 20.04 | 19.43 | 18.9 | (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= | 0.96 | 0.94 | 0.9 | 0.8 | 0.65 | 0.47 | 0.34 | 0.38 | 0.62 | 0.85 | 0.94 | 0.96 | (94) |
| Useful gains, hmGm , W = (94)m x (84)m | | | | | | | | | | | | | |
| (95)m= | 439.27 | 480.25 | 511.52 | 515.27 | 455.14 | 326.24 | 221.49 | 230.62 | 336.01 | 408.15 | 416.96 | 421.82 | (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= | 876.88 | 852.5 | 777.76 | 651.09 | 503.53 | 335.98 | 223.41 | 233.76 | 363.88 | 548.54 | 721.97 | 867.71 | (97) |
| Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m | | | | | | | | | | | | | |
| (98)m= | 325.58 | 250.15 | 198.08 | 97.79 | 36 | 0 | 0 | 0 | 0 | 104.45 | 219.61 | 331.75 | |

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1563.42 (98)

Space heating requirement in kWh/m²/year 22.46 (99)

## 9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

| | | | |
|---|---|---|---|
| Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none | | 0 | (301) |
| Fraction of space heat from community system 1 – (301) = | | 1 | (302) |

*The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.*

| | | | |
|---|---|---|---|
| Fraction of heat from Community boilers | | 1 | (303a) |
| Fraction of total space heat from Community boilers | (302) x (303a) = | 1 | (304a) |
| Factor for control and charging method (Table 4c(3)) for community heating system | | 1 | (305) |
| Distribution loss factor (Table 12c) for community heating system | | 1.05 | (306) |
| **Space heating** | | **kWh/year** | |
| Annual space heating requirement | | 1563.42 | |
| Space heat from Community boilers | (98) x (304a) x (305) x (306) = | 1641.6 | (307a) |
| Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) | | 0 | (308 |
| Space heating requirement from secondary/supplementary system | (98) x (301) x 100 ÷ (308) = | 0 | (309) |
| **Water heating** | | | |
| Annual water heating requirement | | 2024.72 | |
| If DHW from community scheme: Water heat from Community boilers | (64) x (303a) x (305) x (306) = | 2125.95 | (310a) |
| Electricity used for heat distribution | 0.01 × [(307a)…(307e) + (310a)…(310e)] = | 37.68 | (313) |
| Cooling System Energy Efficiency Ratio | | 0 | (314) |
| Space cooling (if there is a fixed cooling system, if not enter 0) | = (107) ÷ (314) = | 0 | (315) |
| Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside | | 170.14 | (330a) |

| | | | | |
|---|---|---|---|---|
| warm air heating system fans | | | 0 | (330b) |
| pump for solar water heating | | | 0 | (330g) |
| Total electricity for the above, kWh/year | =(330a) + (330b) + (330g) = | | 170.14 | (331) |
| Energy for lighting (calculated in Appendix L) | | | 318.62 | (332) |
| Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) = | | | 4256.31 | (338) |

## 12b. CO2 Emissions – Community heating scheme

| | | Energy kWh/year | Emission factor kg CO2/kWh | | Emissions kg CO2/year | |
|---|---|---|---|---|---|---|
| CO2 from other sources of space and water heating (not CHP) | | | | | | |
| Efficiency of heat source 1 (%) | If there is CHP using two fuels repeat (363) to (366) for the second fuel | | | | 96 | (367a) |
| CO2 associated with heat source 1 | [(307b)+(310b)] x 100 ÷ (367b) x | | 0.22 | = | 847.7 | (367) |
| Electrical energy for heat distribution | [(313) x | | 0.52 | = | 19.55 | (372) |
| Total CO2 associated with community systems | (363)…(366) + (368)...(372) | | | = | 867.25 | (373) |
| CO2 associated with space heating (secondary) | (309) x | | 0 | = | 0 | (374) |
| CO2 associated with water from immersion heater or instantaneous heater | (312) x | | 0.22 | = | 0 | (375) |
| Total CO2 associated with space and water heating | (373) + (374) + (375) = | | | | 867.25 | (376) |
| CO2 associated with electricity for pumps and fans within dwelling | (331)) x | | 0.52 | = | 88.3 | (378) |
| CO2 associated with electricity for lighting | (332))) x | | 0.52 | = | 165.36 | (379) |
| **Total CO2, kg/year** | sum of (376)…(382) = | | | | 1120.92 | (383) |
| **Dwelling CO2 Emission Rate** | (383) ÷ (4) = | | | | 16.1 | (384) |
| **EI rating (section 14)** | | | | | 86.89 | (385) |

# Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.50
*Printed on 06 December 2021 at 10:53:40*

## Project Information:

**Assessed By:** Neil Ingham (STRO010943) **Building Type:** Flat

## Dwelling Details:

**NEW DWELLING DESIGN STAGE** Total Floor Area: 50.62m²

**Site Reference :** Highgate Road - GREEN **Plot Reference:** 04 - F

**Address :**

## Client Details:

**Name:**

**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 (c)
Fuel factor: 1.00 (mains gas (c))

| | | |
|---|---|---|
| Target Carbon Dioxide Emission Rate (TER) | 21.42 kg/m² | |
| Dwelling Carbon Dioxide Emission Rate (DER) | 18.26 kg/m² | OK |

## 1b TFEE and DFEE

| | | |
|---|---|---|
| Target Fabric Energy Efficiency (TFEE) | 57.2 kWh/m² | |
| Dwelling Fabric Energy Efficiency (DFEE) | 46.0 kWh/m² | |
| | | OK |

## 2 Fabric U-values

| Element | Average | Highest | |
|---|---|---|---|
| External wall | 0.17 (max. 0.30) | 0.18 (max. 0.70) | OK |
| Party wall | 0.00 (max. 0.20) | - | OK |
| Floor | (no floor) | | |
| Roof | 0.13 (max. 0.20) | 0.13 (max. 0.35) | OK |
| Openings | 1.40 (max. 2.00) | 1.40 (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 | 3.00 (design value) | |
| Maximum | 10.0 | OK |

## 4 Heating efficiency

Main Heating system: Community heating schemes - mains gas

Secondary heating system: None

## 5 Cylinder insulation

Hot water Storage: No cylinder

## 6 Controls

| | | |
|---|---|---|
| Space heating controls | Charging system linked to use of community heating, programmer and at least two room thermostats | OK |
| Hot water controls: | No cylinder thermostat<br>No cylinder | |

# Regulations Compliance Report

## 7 Low energy lights

| | | |
|---|---|---|
| Percentage of fixed lights with low-energy fittings | 100.0% | |
| Minimum | 75.0% | **OK** |

## 8 Mechanical ventilation

| | | |
|---|---|---|
| Continuous supply and extract system | | |
| Specific fan power: | 0.47 | |
| Maximum | 1.5 | **OK** |
| MVHR efficiency: | 89% | |
| Minimum | 70% | **OK** |

## 9 Summertime temperature

| | | |
|---|---|---|
| Overheating risk (Thames valley): | Medium | **OK** |
| Based on: | | |
| Overshading: | Average or unknown | |
| Windows facing: North East | 8.97m² | |
| Ventilation rate: | 4.00 | |

## 10 Key features

| | |
|---|---|
| Air permeablility | 3.0 m³/m²h |
| Party Walls U-value | 0 W/m²K |
| Community heating, heat from boilers – mains gas | |

# DER WorkSheet: New dwelling design stage

## User Details:

| | | | |
|---|---|---|---|
| **Assessor Name:** | Neil Ingham | **Stroma Number:** | STRO010943 |
| **Software Name:** | Stroma FSAP 2012 | **Software Version:** | Version: 1.0.5.50 |

## Property Address: 04 - F

**Address :**

## 1. Overall dwelling dimensions:

| | Area(m²) | | Av. Height(m) | | Volume(m³) | |
|---|---|---|---|---|---|---|
| Ground floor | 50.62 | (1a) x | 2.65 | (2a) = | 134.14 | (3a) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n) | 50.62 | (4) | | | | |
| Dwelling volume | | | | (3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) = | 134.14 | (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 | | | | | | | 0 | x 10 = | 0 | (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) = | 0 | ÷ (5) = | 0 | (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 | | 3 | (17) |
| If based on air permeability value, then | (18) = [(17) ÷ 20]+(8), otherwise (18) = (16) | 0.15 | (18) |

*Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used*

| | | | |
|---|---|---|---|
| Number of sides sheltered | | 0 | (19) |
| Shelter factor | (20) = 1 - [0.075 x (19)] = | 1 | (20) |
| Infiltration rate incorporating shelter factor | (21) = (18) x (20) = | 0.15 | (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 |

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 |

# DER WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.19 | 0.19 | 0.18 | 0.16 | 0.16 | 0.14 | 0.14 | 0.14 | 0.15 | 0.16 | 0.17 | 0.18 |

*Calculate effective air change rate for the applicable case*

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 75.65 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24a)m= | 0.31 | 0.31 | 0.31 | 0.29 | 0.28 | 0.26 | 0.26 | 0.26 | 0.27 | 0.28 | 0.29 | 0.3 | (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 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24d) |

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (25)m= | 0.31 | 0.31 | 0.31 | 0.29 | 0.28 | 0.26 | 0.26 | 0.26 | 0.27 | 0.28 | 0.29 | 0.3 | (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 | |
|---|---|---|---|---|---|---|---|---|---|---|
| Windows | | | 8.97 | x1/[1/( 1.4 )+ 0.04] | | = | 11.89 | | | (27) |
| Walls Type1 | 31.4 | 8.97 | 22.43 | x | 0.18 | = | 4.04 | 60 | 1345.8 | (29) |
| Walls Type2 | 22.92 | 0 | 22.92 | x | 0.17 | = | 3.85 | 60 | 1375.2 | (29) |
| Roof | 50.62 | 0 | 50.62 | x | 0.13 | = | 6.58 | 9 | 455.58 | (30) |
| Total area of elements, m² | | | 104.94 | | | | | | | (31) |
| Party wall | | | 30.08 | x | 0 | = | 0 | 45 | 1353.6 | (32) |
| Party floor | | | 50.62 | | | | | 40 | 2024.8 | (32a) |
| Internal wall ** | | | 83.2 | | | | | 9 | 748.8 | (32c) |

** 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) = 26.36 (33)

Heat capacity Cm = S(A x k ) ((28)…(30) + (32) + (32a)…(32e) = 7303.78 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 144.29 (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 6.24 (36)

*if details of thermal bridging are not known (36) = 0.05 x (31)*

Total fabric heat loss (33) + (36) = 32.6 (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= | 13.86 | 13.69 | 13.52 | 12.69 | 12.53 | 11.7 | 11.7 | 11.53 | 12.03 | 12.53 | 12.86 | 13.19 | (38) |

Heat transfer coefficient, W/K (39)m = (37) + (38)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (39)m= | 46.45 | 46.29 | 46.12 | 45.29 | 45.12 | 44.29 | 44.29 | 44.13 | 44.63 | 45.12 | 45.46 | 45.79 | |

Average = Sum(39)$_{1…12}$ /12= 45.25 (39)

# DER WorkSheet: New dwelling design stage

Heat loss parameter (HLP), W/m²K — (40)m = (39)m ÷ (4)

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (40)m= | 0.92 | 0.91 | 0.91 | 0.89 | 0.89 | 0.88 | 0.88 | 0.87 | 0.88 | 0.89 | 0.9 | 0.9 |

Average = Sum(40)$_{1...12}$ /12= 0.89 (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 — 1.71 (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 — 74.77 (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)*

*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)*

*If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)*

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (44)m= | 82.25 | 79.26 | 76.27 | 73.28 | 70.29 | 67.3 | 67.3 | 70.29 | 73.28 | 76.27 | 79.26 | 82.25 | |
| (45)m= | 121.98 | 106.68 | 110.09 | 95.97 | 92.09 | 79.47 | 73.64 | 84.5 | 85.51 | 99.65 | 108.78 | 118.13 | |
| (46)m= | 18.3 | 16 | 16.51 | 14.4 | 13.81 | 11.92 | 11.05 | 12.68 | 12.83 | 14.95 | 16.32 | 17.72 | (46) |

Total = Sum(44)$_{1...12}$ = 897.28 (44)

Total = Sum(45)$_{1...12}$ = 1176.48 (45)

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) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) — 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a — 1.03 (52)

Temperature factor from Table 2b — 0.6 (53)

Energy lost from water storage, kWh/year — (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) — 1.03 (55)

Water storage loss calculated for each month — ((56)m = (55) × (41)m

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

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)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (56)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (56) |
| (57)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (57) |
| (59)m= | 23.26 | 21.01 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | (59) |

# DER WorkSheet: New dwelling design stage

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 | (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= | 177.25 | 156.61 | 165.36 | 149.47 | 147.37 | 132.96 | 128.91 | 139.78 | 139 | 154.93 | 162.27 | 173.4 | (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= | 177.25 | 156.61 | 165.36 | 149.47 | 147.37 | 132.96 | 128.91 | 139.78 | 139 | 154.93 | 162.27 | 173.4 | |

Output from water heater (annual)$_{1...12}$ 1827.32 (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= | 84.78 | 75.41 | 80.82 | 74.71 | 74.84 | 69.22 | 68.71 | 72.32 | 71.23 | 77.36 | 78.96 | 83.5 | (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= | 85.42 | 85.42 | 85.42 | 85.42 | 85.42 | 85.42 | 85.42 | 85.42 | 85.42 | 85.42 | 85.42 | 85.42 | (66) |

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (67)m= | 13.59 | 12.07 | 9.81 | 7.43 | 5.55 | 4.69 | 5.07 | 6.59 | 8.84 | 11.22 | 13.1 | 13.97 | (67) |

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (68)m= | 148.84 | 150.39 | 146.5 | 138.21 | 127.75 | 117.92 | 111.35 | 109.81 | 113.7 | 121.99 | 132.45 | 142.28 | (68) |

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (69)m= | 31.54 | 31.54 | 31.54 | 31.54 | 31.54 | 31.54 | 31.54 | 31.54 | 31.54 | 31.54 | 31.54 | 31.54 | (69) |

Pumps and fans gains (Table 5a)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (70)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (70) |

Losses e.g. evaporation (negative values) (Table 5)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (71)m= | -68.33 | -68.33 | -68.33 | -68.33 | -68.33 | -68.33 | -68.33 | -68.33 | -68.33 | -68.33 | -68.33 | -68.33 | (71) |

Water heating gains (Table 5)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (72)m= | 113.95 | 112.22 | 108.64 | 103.76 | 100.59 | 96.14 | 92.35 | 97.2 | 98.93 | 103.97 | 109.67 | 112.23 | (72) |

**Total internal gains =** (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (73)m= | 325.01 | 323.3 | 313.57 | 298.03 | 282.52 | 267.37 | 257.39 | 262.22 | 270.09 | 285.81 | 303.84 | 317.1 | (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 | 8.97 | x | 11.28 | x | 0.63 | x | 0.7 | = | 30.93 | (75) |
| Northeast 0.9x | 0.77 | x | 8.97 | x | 22.97 | x | 0.63 | x | 0.7 | = | 62.96 | (75) |
| Northeast 0.9x | 0.77 | x | 8.97 | x | 41.38 | x | 0.63 | x | 0.7 | = | 113.43 | (75) |
| Northeast 0.9x | 0.77 | x | 8.97 | x | 67.96 | x | 0.63 | x | 0.7 | = | 186.29 | (75) |
| Northeast 0.9x | 0.77 | x | 8.97 | x | 91.35 | x | 0.63 | x | 0.7 | = | 250.41 | (75) |

# DER WorkSheet: New dwelling design stage

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Northeast | 0.9x | 0.77 | x | 8.97 | x | 97.38 | x | 0.63 | x | 0.7 | = | 266.96 | (75) |
| Northeast | 0.9x | 0.77 | x | 8.97 | x | 91.1 | x | 0.63 | x | 0.7 | = | 249.74 | (75) |
| Northeast | 0.9x | 0.77 | x | 8.97 | x | 72.63 | x | 0.63 | x | 0.7 | = | 199.1 | (75) |
| Northeast | 0.9x | 0.77 | x | 8.97 | x | 50.42 | x | 0.63 | x | 0.7 | = | 138.22 | (75) |
| Northeast | 0.9x | 0.77 | x | 8.97 | x | 28.07 | x | 0.63 | x | 0.7 | = | 76.94 | (75) |
| Northeast | 0.9x | 0.77 | x | 8.97 | x | 14.2 | x | 0.63 | x | 0.7 | = | 38.92 | (75) |
| Northeast | 0.9x | 0.77 | x | 8.97 | x | 9.21 | x | 0.63 | x | 0.7 | = | 25.26 | (75) |

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (83)m= | 30.93 | 62.96 | 113.43 | 186.29 | 250.41 | 266.96 | 249.74 | 199.1 | 138.22 | 76.94 | 38.92 | 25.26 | (83) |

Total gains – internal and solar (84)m = (73)m + (83)m , watts

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (84)m= | 355.94 | 386.26 | 427.01 | 484.32 | 532.94 | 534.34 | 507.13 | 461.32 | 408.31 | 362.75 | 342.76 | 342.36 | (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= | 0.97 | 0.96 | 0.93 | 0.85 | 0.7 | 0.51 | 0.38 | 0.43 | 0.68 | 0.89 | 0.96 | 0.98 | (86) |

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (87)m= | 19.72 | 19.89 | 20.19 | 20.59 | 20.85 | 20.97 | 20.99 | 20.99 | 20.9 | 20.56 | 20.09 | 19.7 | (87) |

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (88)m= | 20.15 | 20.16 | 20.16 | 20.17 | 20.17 | 20.19 | 20.19 | 20.19 | 20.18 | 20.17 | 20.17 | 20.16 | (88) |

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (89)m= | 0.97 | 0.96 | 0.92 | 0.82 | 0.65 | 0.45 | 0.31 | 0.36 | 0.62 | 0.86 | 0.95 | 0.97 | (89) |

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (90)m= | 18.45 | 18.68 | 19.12 | 19.67 | 20.02 | 20.16 | 20.18 | 20.18 | 20.09 | 19.65 | 18.99 | 18.42 | (90) |

fLA = Living area ÷ (4) = | 0.49 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (92)m= | 19.07 | 19.27 | 19.64 | 20.12 | 20.43 | 20.56 | 20.58 | 20.58 | 20.49 | 20.1 | 19.53 | 19.05 | (92) |

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (93)m= | 19.07 | 19.27 | 19.64 | 20.12 | 20.43 | 20.56 | 20.58 | 20.58 | 20.49 | 20.1 | 19.53 | 19.05 | (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= | 0.96 | 0.95 | 0.91 | 0.82 | 0.67 | 0.48 | 0.34 | 0.39 | 0.64 | 0.86 | 0.94 | 0.97 | (94) |
| Useful gains, hmGm , W = (94)m x (84)m | | | | | | | | | | | | | |
| (95)m= | 342.25 | 365.64 | 388.32 | 396.27 | 354.46 | 255.99 | 174.71 | 181.67 | 260.98 | 312.14 | 322.6 | 330.69 | (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= | 686.17 | 665.29 | 606.21 | 508.18 | 393.82 | 263.86 | 176.3 | 184.35 | 285.2 | 428.51 | 565.03 | 679.91 | (97) |
| Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m | | | | | | | | | | | | | |
| (98)m= | 255.88 | 201.37 | 162.11 | 80.57 | 29.28 | 0 | 0 | 0 | 0 | 86.58 | 174.55 | 259.82 | (98) |

# DER WorkSheet: New dwelling design stage

| | | | |
|---|---|---|---|
| | Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = | 1250.16 | (98) |
| Space heating requirement in kWh/m²/year | | 24.7 | (99) |

## 9b. Energy requirements – Community heating scheme

| | | | |
|---|---|---|---|
| This part is used for space heating, space cooling or water heating provided by a community scheme. Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none | | 0 | (301) |
| Fraction of space heat from community system 1 – (301) = | | 1 | (302) |

*The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.*

| | | | |
|---|---|---|---|
| Fraction of heat from Community boilers | | 1 | (303a) |
| Fraction of total space heat from Community boilers | (302) x (303a) = | 1 | (304a) |
| Factor for control and charging method (Table 4c(3)) for community heating system | | 1 | (305) |
| Distribution loss factor (Table 12c) for community heating system | | 1.05 | (306) |
| **Space heating** | | **kWh/year** | |
| Annual space heating requirement | | 1250.16 | |
| Space heat from Community boilers | (98) x (304a) x (305) x (306) = | 1312.67 | (307a) |
| Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) | | 0 | (308 |
| Space heating requirement from secondary/supplementary system | (98) x (301) x 100 ÷ (308) = | 0 | (309) |
| **Water heating** | | | |
| Annual water heating requirement | | 1827.32 | |
| If DHW from community scheme: Water heat from Community boilers | (64) x (303a) x (305) x (306) = | 1918.69 | (310a) |
| Electricity used for heat distribution | 0.01 × [(307a)…(307e) + (310a)…(310e)] = | 32.31 | (313) |
| Cooling System Energy Efficiency Ratio | | 0 | (314) |
| Space cooling (if there is a fixed cooling system, if not enter 0) | = (107) ÷ (314) = | 0 | (315) |
| Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside | | 107.68 | (330a) |
| warm air heating system fans | | 0 | (330b) |
| pump for solar water heating | | 0 | (330g) |
| Total electricity for the above, kWh/year | =(330a) + (330b) + (330g) = | 107.68 | (331) |
| Energy for lighting (calculated in Appendix L) | | 239.96 | (332) |
| Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) = | | 3579 | (338) |

## 12b. CO2 Emissions – Community heating scheme

| | | Energy kWh/year | Emission factor kg CO2/kWh | | Emissions kg CO2/year | |
|---|---|---|---|---|---|---|
| CO2 from other sources of space and water heating (not CHP) Efficiency of heat source 1 (%) | If there is CHP using two fuels repeat (363) to (366) for the second fuel | | | | 96 | (367a) |
| CO2 associated with heat source 1 | [(307b)+(310b)] x 100 ÷ (367b) x | | 0.22 | = | 727.05 | (367) |
| Electrical energy for heat distribution | [(313) x | | 0.52 | = | 16.77 | (372) |

| | | | | | |
|---|---|---|---|---|---|
| Total CO2 associated with community systems | (363)…(366) + (368)...(372) | | = | 743.83 | (373) |
| CO2 associated with space heating (secondary) | (309) x | 0 | = | 0 | (374) |
| CO2 associated with water from immersion heater or instantaneous heater | (312) x | 0.22 | = | 0 | (375) |
| Total CO2 associated with space and water heating | (373) + (374) + (375) = | | | 743.83 | (376) |
| CO2 associated with electricity for pumps and fans within dwelling | (331)) x | 0.52 | = | 55.89 | (378) |
| CO2 associated with electricity for lighting | (332))) x | 0.52 | = | 124.54 | (379) |
| **Total CO2, kg/year** | sum of (376)…(382) = | | | 924.25 | (383) |
| **Dwelling CO2 Emission Rate** | (383) ÷ (4) = | | | 18.26 | (384) |
| **EI rating (section 14)** | | | | 87.05 | (385) |

# Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.50
*Printed on 06 December 2021 at 10:53:38*

## Project Information:

**Assessed By:** Neil Ingham (STRO010943) **Building Type:** Flat

## Dwelling Details:

**NEW DWELLING DESIGN STAGE** Total Floor Area: 63.92m²

**Site Reference :** Highgate Road - GREEN **Plot Reference:** 04 - G

**Address :**

## Client Details:

**Name:**

**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 (c)
Fuel factor: 1.00 (mains gas (c))

| | | |
|---|---|---|
| Target Carbon Dioxide Emission Rate (TER) | 19.33 kg/m² | |
| Dwelling Carbon Dioxide Emission Rate (DER) | 17.12 kg/m² | OK |

## 1b TFEE and DFEE

| | | |
|---|---|---|
| Target Fabric Energy Efficiency (TFEE) | 54.1 kWh/m² | |
| Dwelling Fabric Energy Efficiency (DFEE) | 45.7 kWh/m² | |
| | | OK |

## 2 Fabric U-values

| Element | Average | Highest | |
|---|---|---|---|
| External wall | 0.18 (max. 0.30) | 0.18 (max. 0.70) | OK |
| Party wall | 0.00 (max. 0.20) | - | OK |
| Floor | (no floor) | | |
| Roof | 0.13 (max. 0.20) | 0.13 (max. 0.35) | OK |
| Openings | 1.40 (max. 2.00) | 1.40 (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 | 3.00 (design value) | |
| Maximum | 10.0 | OK |

## 4 Heating efficiency

| | |
|---|---|
| Main Heating system: | Community heating schemes - mains gas |
| Secondary heating system: | None |

## 5 Cylinder insulation

| | |
|---|---|
| Hot water Storage: | No cylinder |

## 6 Controls

| | | |
|---|---|---|
| Space heating controls | Charging system linked to use of community heating, programmer and at least two room thermostats | OK |
| Hot water controls: | No cylinder thermostat<br>No cylinder | |

# Regulations Compliance Report

## 7 Low energy lights

| | | |
|---|---|---|
| Percentage of fixed lights with low-energy fittings | 100.0% | |
| Minimum | 75.0% | **OK** |

## 8 Mechanical ventilation

| | | |
|---|---|---|
| Continuous supply and extract system | | |
| Specific fan power: | 0.47 | |
| Maximum | 1.5 | **OK** |
| MVHR efficiency: | 89% | |
| Minimum | 70% | **OK** |

## 9 Summertime temperature

| | | |
|---|---|---|
| Overheating risk (Thames valley): | Slight | **OK** |
| Based on: | | |
| Overshading: | Average or unknown | |
| Windows facing: North East | 9.56m² | |
| Windows facing: South East | 8.76m² | |
| Ventilation rate: | 6.00 | |

## 10 Key features

| | |
|---|---|
| Air permeablility | 3.0 m³/m²h |
| Party  Walls U-value | 0 W/m²K |
| Community heating, heat from boilers – mains gas | |

# DER WorkSheet: New dwelling design stage

User Details:

| | | | |
|---|---|---|---|
| **Assessor Name:** | Neil Ingham | **Stroma Number:** | STRO010943 |
| **Software Name:** | Stroma FSAP 2012 | **Software Version:** | Version: 1.0.5.50 |

Property Address: 04 - G

**Address :**

## 1. Overall dwelling dimensions:

| | Area(m²) | | Av. Height(m) | | Volume(m³) | |
|---|---|---|---|---|---|---|
| Ground floor | 63.92 | (1a) x | 2.65 | (2a) = | 169.39 | (3a) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n) | 63.92 | (4) | | | | |
| Dwelling volume | | | (3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) = | | 169.39 | (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 | | | | | | | 0 | x 10 = | 0 | (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) = | 0 | ÷ (5) = | 0 | (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 | | 3 | (17) |
| If based on air permeability value, then | (18) = [(17) ÷ 20]+(8), otherwise (18) = (16) | 0.15 | (18) |
| *Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used* | | | |
| Number of sides sheltered | | 0 | (19) |
| Shelter factor | (20) = 1 - [0.075 x (19)] = | 1 | (20) |
| Infiltration rate incorporating shelter factor | (21) = (18) x (20) = | 0.15 | (21) |

Infiltration rate modified for monthly wind speed

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|

Monthly average wind speed from Table 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 |

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 |

# DER WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.19 | 0.19 | 0.18 | 0.16 | 0.16 | 0.14 | 0.14 | 0.14 | 0.15 | 0.16 | 0.17 | 0.18 |

*Calculate effective air change rate for the applicable case*

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 75.65 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24a)m= | 0.31 | 0.31 | 0.31 | 0.29 | 0.28 | 0.26 | 0.26 | 0.26 | 0.27 | 0.28 | 0.29 | 0.3 | (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 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24d) |

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (25)m= | 0.31 | 0.31 | 0.31 | 0.29 | 0.28 | 0.26 | 0.26 | 0.26 | 0.27 | 0.28 | 0.29 | 0.3 | (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 | |
|---|---|---|---|---|---|---|---|---|---|---|
| Windows Type 1 | | | 9.56 | x1/[1/( 1.4 )+ 0.04] | | = | 12.67 | | | (27) |
| Windows Type 2 | | | 8.76 | x1/[1/( 1.4 )+ 0.04] | | = | 11.61 | | | (27) |
| Walls Type1 | 61.09 | 18.32 | 42.77 | x | 0.18 | = | 7.7 | 60 | 2566.2 | (29) |
| Walls Type2 | 3.86 | 0 | 3.86 | x | 0.17 | = | 0.65 | 60 | 231.6 | (29) |
| Roof | 63.92 | 0 | 63.92 | x | 0.13 | = | 8.31 | 9 | 575.28 | (30) |
| Total area of elements, m² | | | 128.87 | | | | | | | (31) |
| Party wall | | | 37.5 | x | 0 | = | 0 | 45 | 1687.5 | (32) |
| Party floor | | | 63.92 | | | | | 40 | 2556.8 | (32a) |
| Internal wall ** | | | 113.47 | | | | | 9 | 1021.23 | (32c) |

** 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) = 40.94 (33)

Heat capacity Cm = S(A x k ) ((28)…(30) + (32) + (32a)…(32e) = 8638.61 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 135.15 (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 8.3 (36)

*if details of thermal bridging are not known (36) = 0.05 x (31)*

Total fabric heat loss (33) + (36) = 49.24 (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= | 17.5 | 17.29 | 17.08 | 16.03 | 15.82 | 14.77 | 14.77 | 14.56 | 15.19 | 15.82 | 16.24 | 16.66 | (38) |

Heat transfer coefficient, W/K (39)m = (37) + (38)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (39)m= | 66.74 | 66.53 | 66.32 | 65.27 | 65.06 | 64.01 | 64.01 | 63.8 | 64.43 | 65.06 | 65.48 | 65.9 | |

Average = Sum(39)$_{1…12}$ /12= 65.22 (39)

# DER WorkSheet: New dwelling design stage

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (40)m= | 1.04 | 1.04 | 1.04 | 1.02 | 1.02 | 1 | 1 | 1 | 1.01 | 1.02 | 1.02 | 1.03 |

Average = Sum(40)$_{1…12}$ /12= 1.02 (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 2.09 (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 83.84 (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= | 92.22 | 88.87 | 85.51 | 82.16 | 78.81 | 75.45 | 75.45 | 78.81 | 82.16 | 85.51 | 88.87 | 92.22 |

Total = Sum(44)$_{1…12}$ = 1006.06 (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= | 136.76 | 119.61 | 123.43 | 107.61 | 103.25 | 89.1 | 82.56 | 94.74 | 95.88 | 111.73 | 121.97 | 132.45 |

Total = Sum(45)$_{1…12}$ = 1319.1 (45)

*If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)*

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (46)m= | 20.51 | 17.94 | 18.51 | 16.14 | 15.49 | 13.37 | 12.38 | 14.21 | 14.38 | 16.76 | 18.29 | 19.87 | (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) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (56)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (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= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (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= | 23.26 | 21.01 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | (59) |

# DER WorkSheet: New dwelling design stage

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 | (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= | 192.04 | 169.54 | 178.71 | 161.1 | 158.53 | 142.59 | 137.84 | 150.02 | 149.37 | 167.01 | 175.46 | 187.72 | (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= | 192.04 | 169.54 | 178.71 | 161.1 | 158.53 | 142.59 | 137.84 | 150.02 | 149.37 | 167.01 | 175.46 | 187.72 | |

Output from water heater (annual)$_{1...12}$ 1969.94 (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= | 89.69 | 79.71 | 85.26 | 78.58 | 78.55 | 72.42 | 71.67 | 75.72 | 74.67 | 81.37 | 83.35 | 88.26 | (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= | 104.5 | 104.5 | 104.5 | 104.5 | 104.5 | 104.5 | 104.5 | 104.5 | 104.5 | 104.5 | 104.5 | 104.5 | (66) |

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (67)m= | 16.29 | 14.47 | 11.77 | 8.91 | 6.66 | 5.62 | 6.07 | 7.9 | 10.6 | 13.46 | 15.7 | 16.74 | (67) |

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (68)m= | 182.71 | 184.61 | 179.83 | 169.66 | 156.82 | 144.75 | 136.69 | 134.8 | 139.57 | 149.75 | 162.58 | 174.65 | (68) |

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (69)m= | 33.45 | 33.45 | 33.45 | 33.45 | 33.45 | 33.45 | 33.45 | 33.45 | 33.45 | 33.45 | 33.45 | 33.45 | (69) |

Pumps and fans gains (Table 5a)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (70)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (70) |

Losses e.g. evaporation (negative values) (Table 5)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (71)m= | -83.6 | -83.6 | -83.6 | -83.6 | -83.6 | -83.6 | -83.6 | -83.6 | -83.6 | -83.6 | -83.6 | -83.6 | (71) |

Water heating gains (Table 5)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (72)m= | 120.56 | 118.62 | 114.6 | 109.13 | 105.58 | 100.58 | 96.34 | 101.78 | 103.71 | 109.37 | 115.76 | 118.63 | (72) |

**Total internal gains =** (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (73)m= | 373.91 | 372.05 | 360.55 | 342.05 | 323.41 | 305.31 | 293.45 | 298.82 | 308.23 | 326.92 | 348.4 | 364.37 | (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 | 9.56 | x | 11.28 | x | 0.63 | x | 0.7 | = | 32.96 | (75) |
| Northeast 0.9x | 0.77 | x | 9.56 | x | 22.97 | x | 0.63 | x | 0.7 | = | 67.1 | (75) |
| Northeast 0.9x | 0.77 | x | 9.56 | x | 41.38 | x | 0.63 | x | 0.7 | = | 120.89 | (75) |
| Northeast 0.9x | 0.77 | x | 9.56 | x | 67.96 | x | 0.63 | x | 0.7 | = | 198.54 | (75) |
| Northeast 0.9x | 0.77 | x | 9.56 | x | 91.35 | x | 0.63 | x | 0.7 | = | 266.88 | (75) |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Northeast | 0.9x | 0.77 | x | 9.56 | x | 97.38 | x | 0.63 | x | 0.7 | = | 284.52 | (75) |
| Northeast | 0.9x | 0.77 | x | 9.56 | x | 91.1 | x | 0.63 | x | 0.7 | = | 266.17 | (75) |
| Northeast | 0.9x | 0.77 | x | 9.56 | x | 72.63 | x | 0.63 | x | 0.7 | = | 212.19 | (75) |
| Northeast | 0.9x | 0.77 | x | 9.56 | x | 50.42 | x | 0.63 | x | 0.7 | = | 147.31 | (75) |
| Northeast | 0.9x | 0.77 | x | 9.56 | x | 28.07 | x | 0.63 | x | 0.7 | = | 82 | (75) |
| Northeast | 0.9x | 0.77 | x | 9.56 | x | 14.2 | x | 0.63 | x | 0.7 | = | 41.48 | (75) |
| Northeast | 0.9x | 0.77 | x | 9.56 | x | 9.21 | x | 0.63 | x | 0.7 | = | 26.92 | (75) |
| Southeast | 0.9x | 0.77 | x | 8.76 | x | 36.79 | x | 0.63 | x | 0.7 | = | 98.5 | (77) |
| Southeast | 0.9x | 0.77 | x | 8.76 | x | 62.67 | x | 0.63 | x | 0.7 | = | 167.79 | (77) |
| Southeast | 0.9x | 0.77 | x | 8.76 | x | 85.75 | x | 0.63 | x | 0.7 | = | 229.57 | (77) |
| Southeast | 0.9x | 0.77 | x | 8.76 | x | 106.25 | x | 0.63 | x | 0.7 | = | 284.45 | (77) |
| Southeast | 0.9x | 0.77 | x | 8.76 | x | 119.01 | x | 0.63 | x | 0.7 | = | 318.61 | (77) |
| Southeast | 0.9x | 0.77 | x | 8.76 | x | 118.15 | x | 0.63 | x | 0.7 | = | 316.31 | (77) |
| Southeast | 0.9x | 0.77 | x | 8.76 | x | 113.91 | x | 0.63 | x | 0.7 | = | 304.95 | (77) |
| Southeast | 0.9x | 0.77 | x | 8.76 | x | 104.39 | x | 0.63 | x | 0.7 | = | 279.47 | (77) |
| Southeast | 0.9x | 0.77 | x | 8.76 | x | 92.85 | x | 0.63 | x | 0.7 | = | 248.58 | (77) |
| Southeast | 0.9x | 0.77 | x | 8.76 | x | 69.27 | x | 0.63 | x | 0.7 | = | 185.44 | (77) |
| Southeast | 0.9x | 0.77 | x | 8.76 | x | 44.07 | x | 0.63 | x | 0.7 | = | 117.98 | (77) |
| Southeast | 0.9x | 0.77 | x | 8.76 | x | 31.49 | x | 0.63 | x | 0.7 | = | 84.3 | (77) |

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (83)m= | 131.47 | 234.89 | 350.47 | 483 | 585.49 | 600.83 | 571.12 | 491.66 | 395.89 | 267.44 | 159.46 | 111.22 | (83) |

Total gains – internal and solar (84)m = (73)m + (83)m , watts

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (84)m= | 505.38 | 606.94 | 711.02 | 825.05 | 908.91 | 906.14 | 864.57 | 790.48 | 704.13 | 594.37 | 507.86 | 475.59 | (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= | 0.96 | 0.93 | 0.87 | 0.76 | 0.6 | 0.44 | 0.32 | 0.36 | 0.58 | 0.82 | 0.94 | 0.97 | (86) |

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (87)m= | 19.5 | 19.8 | 20.19 | 20.61 | 20.86 | 20.97 | 20.99 | 20.99 | 20.91 | 20.55 | 19.96 | 19.45 | (87) |

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (88)m= | 20.05 | 20.05 | 20.05 | 20.07 | 20.07 | 20.08 | 20.08 | 20.08 | 20.08 | 20.07 | 20.06 | 20.06 | (88) |

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (89)m= | 0.96 | 0.92 | 0.85 | 0.73 | 0.55 | 0.38 | 0.26 | 0.29 | 0.51 | 0.79 | 0.92 | 0.96 | (89) |

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (90)m= | 18.07 | 18.48 | 19.03 | 19.61 | 19.92 | 20.05 | 20.08 | 20.08 | 20 | 19.55 | 18.73 | 18 | (90) |

fLA = Living area ÷ (4) = 0.38 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (92)m= | 18.61 | 18.98 | 19.47 | 19.99 | 20.28 | 20.4 | 20.42 | 20.42 | 20.34 | 19.93 | 19.2 | 18.55 | (92) |

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (93)m= | 18.61 | 18.98 | 19.47 | 19.99 | 20.28 | 20.4 | 20.42 | 20.42 | 20.34 | 19.93 | 19.2 | 18.55 | (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= | 0.94 | 0.91 | 0.84 | 0.72 | 0.56 | 0.4 | 0.28 | 0.32 | 0.53 | 0.78 | 0.91 | 0.95 | (94) |
| Useful gains, hmGm , W = (94)m x (84)m | | | | | | | | | | | | | |
| (95)m= | 476.23 | 549.73 | 597.81 | 595.72 | 513.13 | 361.46 | 242.67 | 253.25 | 375.54 | 465.92 | 462.07 | 452.07 | (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= | 955.2 | 936.83 | 860.35 | 723.65 | 558.12 | 371.3 | 244.8 | 256.62 | 402.24 | 607.14 | 792.19 | 945.94 | (97) |
| Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m | | | | | | | | | | | | | |
| (98)m= | 356.35 | 260.14 | 195.33 | 92.11 | 33.47 | 0 | 0 | 0 | 0 | 105.06 | 237.69 | 367.43 | |

| | | | |
|---|---|---|---|
| | Total per year (kWh/year) = $Sum(98)_{1...5,9...12}$ = | 1647.58 | (98) |
| Space heating requirement in kWh/m²/year | | 25.78 | (99) |

## 9b. Energy requirements – Community heating scheme

| | | | |
|---|---|---|---|
| This part is used for space heating, space cooling or water heating provided by a community scheme. Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none | | 0 | (301) |
| Fraction of space heat from community system 1 – (301) = | | 1 | (302) |

*The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.*

| | | | |
|---|---|---|---|
| Fraction of heat from Community boilers | | 1 | (303a) |
| Fraction of total space heat from Community boilers | (302) x (303a) = | 1 | (304a) |
| Factor for control and charging method (Table 4c(3)) for community heating system | | 1 | (305) |
| Distribution loss factor (Table 12c) for community heating system | | 1.05 | (306) |
| **Space heating** | | **kWh/year** | |
| Annual space heating requirement | | 1647.58 | |
| Space heat from Community boilers | (98) x (304a) x (305) x (306) = | 1729.96 | (307a) |
| Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) | | 0 | (308 |
| Space heating requirement from secondary/supplementary system | (98) x (301) x 100 ÷ (308) = | 0 | (309) |
| **Water heating** | | | |
| Annual water heating requirement | | 1969.94 | |
| If DHW from community scheme: Water heat from Community boilers | (64) x (303a) x (305) x (306) = | 2068.44 | (310a) |
| Electricity used for heat distribution | 0.01 × [(307a)…(307e) + (310a)…(310e)] = | 37.98 | (313) |
| Cooling System Energy Efficiency Ratio | | 0 | (314) |
| Space cooling (if there is a fixed cooling system, if not enter 0) | = (107) ÷ (314) = | 0 | (315) |
| Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside | | 135.98 | (330a) |

# DER WorkSheet: New dwelling design stage

| | | | | |
|---|---|---|---|---|
| warm air heating system fans | | | 0 | (330b) |
| pump for solar water heating | | | 0 | (330g) |
| Total electricity for the above, kWh/year | =(330a) + (330b) + (330g) = | | 135.98 | (331) |
| Energy for lighting (calculated in Appendix L) | | | 287.67 | (332) |
| Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) = | | | 4222.04 | (338) |

## 12b. CO2 Emissions – Community heating scheme

| | | Energy kWh/year | Emission factor kg CO2/kWh | | Emissions kg CO2/year | |
|---|---|---|---|---|---|---|
| CO2 from other sources of space and water heating (not CHP) | | | | | | |
| Efficiency of heat source 1 (%) | If there is CHP using two fuels repeat (363) to (366) for the second fuel | | | | 96 | (367a) |
| CO2 associated with heat source 1 | [(307b)+(310b)] x 100 ÷ (367b) x | | 0.22 | = | 854.64 | (367) |
| Electrical energy for heat distribution | [(313) x | | 0.52 | = | 19.71 | (372) |
| Total CO2 associated with community systems | (363)…(366) + (368)...(372) | | | = | 874.35 | (373) |
| CO2 associated with space heating (secondary) | (309) x | | 0 | = | 0 | (374) |
| CO2 associated with water from immersion heater or instantaneous heater | (312) x | | 0.22 | = | 0 | (375) |
| Total CO2 associated with space and water heating | (373) + (374) + (375) = | | | | 874.35 | (376) |
| CO2 associated with electricity for pumps and fans within dwelling | (331)) x | | 0.52 | = | 70.57 | (378) |
| CO2 associated with electricity for lighting | (332))) x | | 0.52 | = | 149.3 | (379) |
| **Total CO2, kg/year** | sum of (376)…(382) = | | | | 1094.23 | (383) |
| **Dwelling CO2 Emission Rate** | (383) ÷ (4) = | | | | 17.12 | (384) |
| **EI rating (section 14)** | | | | | 86.54 | (385) |

# Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.50
*Printed on 06 December 2021 at 10:53:37*

## Project Information:

**Assessed By:** Neil Ingham (STRO010943) **Building Type:** Flat

## Dwelling Details:

**NEW DWELLING DESIGN STAGE** Total Floor Area: 60.34m²

**Site Reference :** Highgate Road - GREEN **Plot Reference:** 04 - H

**Address :**

## Client Details:

**Name:**

**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 (c) | | |
| Fuel factor: 1.00 (mains gas (c)) | | |
| Target Carbon Dioxide Emission Rate (TER) | 19.72 kg/m² | |
| Dwelling Carbon Dioxide Emission Rate (DER) | 17.26 kg/m² | OK |

## 1b TFEE and DFEE

| | | |
|---|---|---|
| Target Fabric Energy Efficiency (TFEE) | 54.2 kWh/m² | |
| Dwelling Fabric Energy Efficiency (DFEE) | 44.9 kWh/m² | |
| | | OK |

## 2 Fabric U-values

| Element | Average | Highest | |
|---|---|---|---|
| External wall | 0.18 (max. 0.30) | 0.18 (max. 0.70) | OK |
| Party wall | 0.00 (max. 0.20) | - | OK |
| Floor | (no floor) | | |
| Roof | 0.13 (max. 0.20) | 0.13 (max. 0.35) | OK |
| Openings | 1.40 (max. 2.00) | 1.40 (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 | 3.00 (design value) | |
| Maximum | 10.0 | OK |

## 4 Heating efficiency

| | |
|---|---|
| Main Heating system: | Community heating schemes - mains gas |
| Secondary heating system: | None |

## 5 Cylinder insulation

| | |
|---|---|
| Hot water Storage: | No cylinder |

## 6 Controls

| | | |
|---|---|---|
| Space heating controls | Charging system linked to use of community heating, programmer and at least two room thermostats | OK |
| Hot water controls: | No cylinder thermostat<br>No cylinder | |

# Regulations Compliance Report

## 7 Low energy lights

| | | |
|---|---|---|
| Percentage of fixed lights with low-energy fittings | 100.0% | |
| Minimum | 75.0% | **OK** |

## 8 Mechanical ventilation

| | | |
|---|---|---|
| Continuous supply and extract system | | |
| Specific fan power: | 0.47 | |
| Maximum | 1.5 | **OK** |
| MVHR efficiency: | 89% | |
| Minimum | 70% | **OK** |

## 9 Summertime temperature

| | | |
|---|---|---|
| Overheating risk (Thames valley): | Slight | **OK** |

Based on:

| | |
|---|---|
| Overshading: | Average or unknown |
| Windows facing: South West | 4.7m² |
| Windows facing: South East | 6.09m² |
| Windows facing: North West | 2.92m² |
| Ventilation rate: | 6.00 |

## 10 Key features

| | |
|---|---|
| Air permeablility | 3.0 m³/m²h |
| Party  Walls U-value | 0 W/m²K |
| Community heating, heat from boilers – mains gas | |

# DER WorkSheet: New dwelling design stage

User Details:

| | | | |
|---|---|---|---|
| **Assessor Name:** | Neil Ingham | **Stroma Number:** | STRO010943 |
| **Software Name:** | Stroma FSAP 2012 | **Software Version:** | Version: 1.0.5.50 |

Property Address: 04 - H

**Address :**

## 1. Overall dwelling dimensions:

| | Area(m²) | | | Av. Height(m) | | | Volume(m³) | |
|---|---|---|---|---|---|---|---|---|
| Ground floor | 60.34 | (1a) | x | 2.65 | (2a) | = | 159.9 | (3a) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n) | 60.34 | (4) | | | | | | |
| Dwelling volume | | | | (3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) = | | | 159.9 | (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 | | | | | | | 0 | x 10 = | 0 | (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) = | 0 | ÷ (5) = | 0 | (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 | | 3 | (17) |
| If based on air permeability value, then | (18) = [(17) ÷ 20]+(8), otherwise (18) = (16) | 0.15 | (18) |
| *Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used* | | | |
| Number of sides sheltered | | 0 | (19) |
| Shelter factor | (20) = 1 - [0.075 x (19)] = | 1 | (20) |
| Infiltration rate incorporating shelter factor | (21) = (18) x (20) = | 0.15 | (21) |

Infiltration rate modified for monthly wind speed

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Monthly average wind speed from Table 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 |
| 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 |

# DER WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.19 | 0.19 | 0.18 | 0.16 | 0.16 | 0.14 | 0.14 | 0.14 | 0.15 | 0.16 | 0.17 | 0.18 |

*Calculate effective air change rate for the applicable case*

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 75.65 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24a)m= | 0.31 | 0.31 | 0.31 | 0.29 | 0.28 | 0.26 | 0.26 | 0.26 | 0.27 | 0.28 | 0.29 | 0.3 | (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 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24d) |

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (25)m= | 0.31 | 0.31 | 0.31 | 0.29 | 0.28 | 0.26 | 0.26 | 0.26 | 0.27 | 0.28 | 0.29 | 0.3 | (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 | |
|---|---|---|---|---|---|---|---|---|---|---|
| Windows Type 1 | | | 4.7 | x1/[1/( 1.4 )+ 0.04] | | = | 6.23 | | | (27) |
| Windows Type 2 | | | 6.09 | x1/[1/( 1.4 )+ 0.04] | | = | 8.07 | | | (27) |
| Windows Type 3 | | | 2.92 | x1/[1/( 1.4 )+ 0.04] | | = | 3.87 | | | (27) |
| Walls Type1 | 52.8 | 13.71 | 39.09 | x | 0.18 | = | 7.04 | 60 | 2345.4 | (29) |
| Walls Type2 | 27.31 | 0 | 27.31 | x | 0.17 | = | 4.59 | 60 | 1638.6 | (29) |
| Roof | 60.34 | 0 | 60.34 | x | 0.13 | = | 7.84 | 9 | 543.06 | (30) |
| Total area of elements, m² | | | 140.45 | | | | | | | (31) |
| Party wall | | | 16.88 | x | 0 | = | 0 | 45 | 759.6 | (32) |
| Party floor | | | 60.34 | | | | | 40 | 2413.6 | (32a) |
| Internal wall ** | | | 107.91 | | | | | 9 | 971.1901 | (32c) |

** 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) = 37.64 (33)

Heat capacity Cm = S(A x k ) ((28)…(30) + (32) + (32a)…(32e) = 8671.45 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 143.71 (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 7.99 (36)

*if details of thermal bridging are not known (36) = 0.05 x (31)*

Total fabric heat loss (33) + (36) = 45.63 (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 |
|---|---|---|---|---|---|---|---|---|---|---|---|

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (38)m= | 16.52 | 16.32 | 16.12 | 15.13 | 14.93 | 13.94 | 13.94 | 13.75 | 14.34 | 14.93 | 15.33 | 15.72 | (38) |

Heat transfer coefficient, W/K (39)m = (37) + (38)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (39)m= | 62.15 | 61.95 | 61.75 | 60.76 | 60.56 | 59.57 | 59.57 | 59.38 | 59.97 | 60.56 | 60.96 | 61.35 | |

Average = Sum(39)$_{1...12}$ /12= 60.71 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (40)m= | 1.03 | 1.03 | 1.02 | 1.01 | 1 | 0.99 | 0.99 | 0.98 | 0.99 | 1 | 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 1.99 (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 81.49 (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)*

*Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)*

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (44)m= | 89.64 | 86.38 | 83.12 | 79.86 | 76.6 | 73.34 | 73.34 | 76.6 | 79.86 | 83.12 | 86.38 | 89.64 |

Total = Sum(44)$_{1...12}$ = 977.9 (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= | 132.93 | 116.27 | 119.98 | 104.6 | 100.36 | 86.61 | 80.25 | 92.09 | 93.19 | 108.61 | 118.55 | 128.74 |

Total = Sum(45)$_{1...12}$ = 1282.18 (45)

*If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)*

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (46)m= | 19.94 | 17.44 | 18 | 15.69 | 15.05 | 12.99 | 12.04 | 13.81 | 13.98 | 16.29 | 17.78 | 19.31 | (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) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (56)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (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= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (57) |

# DER WorkSheet: New dwelling design stage

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= | 23.26 | 21.01 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | (59) |

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 | (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= | 188.21 | 166.19 | 175.25 | 158.09 | 155.64 | 140.1 | 135.53 | 147.37 | 146.69 | 163.88 | 172.05 | 184.02 | (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= | 188.21 | 166.19 | 175.25 | 158.09 | 155.64 | 140.1 | 135.53 | 147.37 | 146.69 | 163.88 | 172.05 | 184.02 |

Output from water heater (annual)$_{1...12}$ | 1933.02 | (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= | 88.42 | 78.6 | 84.11 | 77.57 | 77.59 | 71.59 | 70.91 | 74.84 | 73.78 | 80.33 | 82.21 | 87.03 | (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= | 99.56 | 99.56 | 99.56 | 99.56 | 99.56 | 99.56 | 99.56 | 99.56 | 99.56 | 99.56 | 99.56 | 99.56 | (66) |

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (67)m= | 15.49 | 13.76 | 11.19 | 8.47 | 6.33 | 5.35 | 5.78 | 7.51 | 10.08 | 12.8 | 14.94 | 15.93 | (67) |

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (68)m= | 173.8 | 175.61 | 171.06 | 161.39 | 149.17 | 137.69 | 130.03 | 128.22 | 132.77 | 142.44 | 154.66 | 166.13 | (68) |

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (69)m= | 32.96 | 32.96 | 32.96 | 32.96 | 32.96 | 32.96 | 32.96 | 32.96 | 32.96 | 32.96 | 32.96 | 32.96 | (69) |

Pumps and fans gains (Table 5a)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (70)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (70) |

Losses e.g. evaporation (negative values) (Table 5)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (71)m= | -79.65 | -79.65 | -79.65 | -79.65 | -79.65 | -79.65 | -79.65 | -79.65 | -79.65 | -79.65 | -79.65 | -79.65 | (71) |

Water heating gains (Table 5)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (72)m= | 118.85 | 116.96 | 113.06 | 107.74 | 104.29 | 99.43 | 95.3 | 100.59 | 102.47 | 107.97 | 114.19 | 116.97 | (72) |

**Total internal gains =** (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (73)m= | 361.01 | 359.2 | 348.18 | 330.47 | 312.67 | 295.34 | 283.98 | 289.2 | 298.19 | 316.08 | 336.65 | 351.9 | (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) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Southeast | 0.9x | 0.77 | x | 6.09 | x | 36.79 | x | 0.63 | x | 0.7 | = | 68.48 | (77) |
| Southeast | 0.9x | 0.77 | x | 6.09 | x | 62.67 | x | 0.63 | x | 0.7 | = | 116.65 | (77) |

# DER WorkSheet: New dwelling design stage

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Southeast | 0.9x | 0.77 | x | 6.09 | x | 85.75 | x | 0.63 | x | 0.7 | = | 159.6 | (77) |
| Southeast | 0.9x | 0.77 | x | 6.09 | x | 106.25 | x | 0.63 | x | 0.7 | = | 197.75 | (77) |
| Southeast | 0.9x | 0.77 | x | 6.09 | x | 119.01 | x | 0.63 | x | 0.7 | = | 221.5 | (77) |
| Southeast | 0.9x | 0.77 | x | 6.09 | x | 118.15 | x | 0.63 | x | 0.7 | = | 219.9 | (77) |
| Southeast | 0.9x | 0.77 | x | 6.09 | x | 113.91 | x | 0.63 | x | 0.7 | = | 212.01 | (77) |
| Southeast | 0.9x | 0.77 | x | 6.09 | x | 104.39 | x | 0.63 | x | 0.7 | = | 194.29 | (77) |
| Southeast | 0.9x | 0.77 | x | 6.09 | x | 92.85 | x | 0.63 | x | 0.7 | = | 172.81 | (77) |
| Southeast | 0.9x | 0.77 | x | 6.09 | x | 69.27 | x | 0.63 | x | 0.7 | = | 128.92 | (77) |
| Southeast | 0.9x | 0.77 | x | 6.09 | x | 44.07 | x | 0.63 | x | 0.7 | = | 82.02 | (77) |
| Southeast | 0.9x | 0.77 | x | 6.09 | x | 31.49 | x | 0.63 | x | 0.7 | = | 58.6 | (77) |
| Southwest | 0.9x | 0.77 | x | 4.7 | x | 36.79 | | 0.63 | x | 0.7 | = | 52.85 | (79) |
| Southwest | 0.9x | 0.77 | x | 4.7 | x | 62.67 | | 0.63 | x | 0.7 | = | 90.02 | (79) |
| Southwest | 0.9x | 0.77 | x | 4.7 | x | 85.75 | | 0.63 | x | 0.7 | = | 123.17 | (79) |
| Southwest | 0.9x | 0.77 | x | 4.7 | x | 106.25 | | 0.63 | x | 0.7 | = | 152.62 | (79) |
| Southwest | 0.9x | 0.77 | x | 4.7 | x | 119.01 | | 0.63 | x | 0.7 | = | 170.94 | (79) |
| Southwest | 0.9x | 0.77 | x | 4.7 | x | 118.15 | | 0.63 | x | 0.7 | = | 169.71 | (79) |
| Southwest | 0.9x | 0.77 | x | 4.7 | x | 113.91 | | 0.63 | x | 0.7 | = | 163.62 | (79) |
| Southwest | 0.9x | 0.77 | x | 4.7 | x | 104.39 | | 0.63 | x | 0.7 | = | 149.94 | (79) |
| Southwest | 0.9x | 0.77 | x | 4.7 | x | 92.85 | | 0.63 | x | 0.7 | = | 133.37 | (79) |
| Southwest | 0.9x | 0.77 | x | 4.7 | x | 69.27 | | 0.63 | x | 0.7 | = | 99.49 | (79) |
| Southwest | 0.9x | 0.77 | x | 4.7 | x | 44.07 | | 0.63 | x | 0.7 | = | 63.3 | (79) |
| Southwest | 0.9x | 0.77 | x | 4.7 | x | 31.49 | | 0.63 | x | 0.7 | = | 45.23 | (79) |
| Northwest | 0.9x | 0.77 | x | 2.92 | x | 11.28 | x | 0.63 | x | 0.7 | = | 10.07 | (81) |
| Northwest | 0.9x | 0.77 | x | 2.92 | x | 22.97 | x | 0.63 | x | 0.7 | = | 20.5 | (81) |
| Northwest | 0.9x | 0.77 | x | 2.92 | x | 41.38 | x | 0.63 | x | 0.7 | = | 36.93 | (81) |
| Northwest | 0.9x | 0.77 | x | 2.92 | x | 67.96 | x | 0.63 | x | 0.7 | = | 60.64 | (81) |
| Northwest | 0.9x | 0.77 | x | 2.92 | x | 91.35 | x | 0.63 | x | 0.7 | = | 81.52 | (81) |
| Northwest | 0.9x | 0.77 | x | 2.92 | x | 97.38 | x | 0.63 | x | 0.7 | = | 86.9 | (81) |
| Northwest | 0.9x | 0.77 | x | 2.92 | x | 91.1 | x | 0.63 | x | 0.7 | = | 81.3 | (81) |
| Northwest | 0.9x | 0.77 | x | 2.92 | x | 72.63 | x | 0.63 | x | 0.7 | = | 64.81 | (81) |
| Northwest | 0.9x | 0.77 | x | 2.92 | x | 50.42 | x | 0.63 | x | 0.7 | = | 44.99 | (81) |
| Northwest | 0.9x | 0.77 | x | 2.92 | x | 28.07 | x | 0.63 | x | 0.7 | = | 25.05 | (81) |
| Northwest | 0.9x | 0.77 | x | 2.92 | x | 14.2 | x | 0.63 | x | 0.7 | = | 12.67 | (81) |
| Northwest | 0.9x | 0.77 | x | 2.92 | x | 9.21 | x | 0.63 | x | 0.7 | = | 8.22 | (81) |

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (83)m= | 131.4 | 227.17 | 319.7 | 411.01 | 473.96 | 476.51 | 456.92 | 409.05 | 351.18 | 253.46 | 157.99 | 112.06 | (83) |

Total gains – internal and solar (84)m = (73)m + (83)m , watts

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (84)m= | 492.41 | 586.37 | 667.88 | 741.48 | 786.63 | 771.86 | 740.9 | 698.24 | 649.37 | 569.55 | 494.64 | 463.96 | (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 |
|---|---|---|---|---|---|---|---|---|---|---|---|

# DER WorkSheet: New dwelling design stage

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (86)m= | 0.96 | 0.93 | 0.88 | 0.78 | 0.64 | 0.47 | 0.35 | 0.38 | 0.59 | 0.82 | 0.94 | 0.97 | (86) |

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (87)m= | 19.63 | 19.91 | 20.25 | 20.62 | 20.85 | 20.96 | 20.99 | 20.99 | 20.92 | 20.61 | 20.06 | 19.59 | (87) |

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (88)m= | 20.06 | 20.06 | 20.06 | 20.08 | 20.08 | 20.09 | 20.09 | 20.1 | 20.09 | 20.08 | 20.07 | 20.07 | (88) |

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (89)m= | 0.96 | 0.92 | 0.86 | 0.75 | 0.59 | 0.41 | 0.28 | 0.31 | 0.52 | 0.79 | 0.92 | 0.96 | (89) |

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (90)m= | 18.25 | 18.64 | 19.13 | 19.63 | 19.93 | 20.06 | 20.09 | 20.09 | 20.02 | 19.63 | 18.88 | 18.19 | (90) |

fLA = Living area ÷ (4) = 0.44 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (92)m= | 18.86 | 19.2 | 19.63 | 20.07 | 20.34 | 20.46 | 20.49 | 20.49 | 20.42 | 20.06 | 19.4 | 18.81 | (92) |

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (93)m= | 18.86 | 19.2 | 19.63 | 20.07 | 20.34 | 20.46 | 20.49 | 20.49 | 20.42 | 20.06 | 19.4 | 18.81 | (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= | 0.95 | 0.91 | 0.85 | 0.75 | 0.61 | 0.44 | 0.31 | 0.34 | 0.55 | 0.79 | 0.91 | 0.95 | (94) |
| Useful gains, hmGm , W = (94)m x (84)m | | | | | | | | | | | | | |
| (95)m= | 465.42 | 533.41 | 568.62 | 555.14 | 476.73 | 338.83 | 229.49 | 239.5 | 355.24 | 448.51 | 451.25 | 442.25 | (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= | 905.09 | 886.1 | 810.68 | 678.77 | 523.24 | 349.29 | 231.66 | 242.68 | 378.9 | 573.15 | 750.09 | 896.33 | (97) |
| Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m | | | | | | | | | | | | | |
| (98)m= | 327.12 | 237.01 | 180.1 | 89.01 | 34.61 | 0 | 0 | 0 | 0 | 92.73 | 215.16 | 337.84 | |

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1513.58 (98)

Space heating requirement in kWh/m²/year 25.08 (99)

## 9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

| | | |
|---|---|---|
| Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none | 0 | (301) |
| Fraction of space heat from community system 1 – (301) = | 1 | (302) |

*The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.*

| | | | |
|---|---|---|---|
| Fraction of heat from Community boilers | | 1 | (303a) |
| Fraction of total space heat from Community boilers | (302) x (303a) = | 1 | (304a) |
| Factor for control and charging method (Table 4c(3)) for community heating system | | 1 | (305) |
| Distribution loss factor (Table 12c) for community heating system | | 1.05 | (306) |

| **Space heating** | **kWh/year** |
|---|---|
| Annual space heating requirement | 1513.58 |

# DER WorkSheet: New dwelling design stage

| | | | |
|---|---|---|---|
| Space heat from Community boilers | (98) x (304a) x (305) x (306) = | 1589.26 | (307a) |
| Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) | | 0 | (308 |
| Space heating requirement from secondary/supplementary system | (98) x (301) x 100 ÷ (308) = | 0 | (309) |

**Water heating**

| | | | |
|---|---|---|---|
| Annual water heating requirement | | 1933.02 | |
| If DHW from community scheme:<br>Water heat from Community boilers | (64) x (303a) x (305) x (306) = | 2029.67 | (310a) |
| Electricity used for heat distribution | 0.01 × [(307a)…(307e) + (310a)…(310e)] = | 36.19 | (313) |
| Cooling System Energy Efficiency Ratio | | 0 | (314) |
| Space cooling (if there is a fixed cooling system, if not enter 0) | = (107) ÷ (314) = | 0 | (315) |
| Electricity for pumps and fans within dwelling (Table 4f):<br>mechanical ventilation - balanced, extract or positive input from outside | | 128.36 | (330a) |
| warm air heating system fans | | 0 | (330b) |
| pump for solar water heating | | 0 | (330g) |
| Total electricity for the above, kWh/year | =(330a) + (330b) + (330g) = | 128.36 | (331) |
| Energy for lighting (calculated in Appendix L) | | 273.64 | (332) |
| Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) = | | 4020.94 | (338) |

## 12b. CO2 Emissions – Community heating scheme

| | | Energy kWh/year | Emission factor kg CO2/kWh | | Emissions kg CO2/year | |
|---|---|---|---|---|---|---|
| CO2 from other sources of space and water heating (not CHP)<br>Efficiency of heat source 1 (%) | If there is CHP using two fuels repeat (363) to (366) for the second fuel | | | | 96 | (367a) |
| CO2 associated with heat source 1 | [(307b)+(310b)] x 100 ÷ (367b) x | | 0.22 | = | 814.26 | (367) |
| Electrical energy for heat distribution | [(313) x | | 0.52 | = | 18.78 | (372) |
| Total CO2 associated with community systems | (363)…(366) + (368)...(372) | | | = | 833.04 | (373) |
| CO2 associated with space heating (secondary) | (309) x | | 0 | = | 0 | (374) |
| CO2 associated with water from immersion heater or instantaneous heater | (312) x | | 0.22 | = | 0 | (375) |
| Total CO2 associated with space and water heating | (373) + (374) + (375) = | | | | 833.04 | (376) |
| CO2 associated with electricity for pumps and fans within dwelling | (331)) x | | 0.52 | = | 66.62 | (378) |
| CO2 associated with electricity for lighting | (332))) x | | 0.52 | = | 142.02 | (379) |
| **Total CO2, kg/year** | sum of (376)…(382) = | | | | 1041.68 | (383) |
| **Dwelling CO2 Emission Rate** | (383) ÷ (4) = | | | | 17.26 | (384) |
| **EI rating (section 14)** | | | | | 86.75 | (385) |

# Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.50
*Printed on 06 December 2021 at 10:53:35*

## Project Information:

**Assessed By:** Neil Ingham (STRO010943) **Building Type:** Flat

## Dwelling Details:

**NEW DWELLING DESIGN STAGE** Total Floor Area: 103.81m²

**Site Reference :** Highgate Road - GREEN **Plot Reference:** 05 - A

**Address :**

## Client Details:

**Name:**

**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 (c)
Fuel factor: 1.00 (mains gas (c))

| | | |
|---|---|---|
| Target Carbon Dioxide Emission Rate (TER) | 15.34 kg/m² | |
| Dwelling Carbon Dioxide Emission Rate (DER) | 13.08 kg/m² | OK |

## 1b TFEE and DFEE

| | | |
|---|---|---|
| Target Fabric Energy Efficiency (TFEE) | 45.8 kWh/m² | |
| Dwelling Fabric Energy Efficiency (DFEE) | 37.3 kWh/m² | |
| | | OK |

## 2 Fabric U-values

| Element | Average | Highest | |
|---|---|---|---|
| External wall | 0.18 (max. 0.30) | 0.18 (max. 0.70) | OK |
| Party wall | 0.00 (max. 0.20) | - | OK |
| Floor | (no floor) | | |
| Roof | (no roof) | | |
| Openings | 1.40 (max. 2.00) | 1.40 (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 | 3.00 (design value) | |
| Maximum | 10.0 | OK |

## 4 Heating efficiency

Main Heating system: Community heating schemes - mains gas

Secondary heating system: None

## 5 Cylinder insulation

Hot water Storage: No cylinder

## 6 Controls

| | | |
|---|---|---|
| Space heating controls | Charging system linked to use of community heating, programmer and at least two room thermostats | OK |
| Hot water controls: | No cylinder thermostat<br>No cylinder | |

# Regulations Compliance Report

## 7 Low energy lights

| | | |
|---|---|---|
| Percentage of fixed lights with low-energy fittings | 100.0% | |
| Minimum | 75.0% | **OK** |

## 8 Mechanical ventilation

| | | |
|---|---|---|
| Continuous supply and extract system | | |
| Specific fan power: | 0.54 | |
| Maximum | 1.5 | **OK** |
| MVHR efficiency: | 88% | |
| Minimum | 70% | **OK** |

## 9 Summertime temperature

| | | |
|---|---|---|
| Overheating risk (Thames valley): | Slight | **OK** |

Based on:

| | |
|---|---|
| Overshading: | Average or unknown |
| Windows facing: South West | $13.21m^2$ |
| Windows facing: South East | $5.5m^2$ |
| Windows facing: North West | $4.61m^2$ |
| Ventilation rate: | 6.00 |

## 10 Key features

| | |
|---|---|
| Air permeablility | $3.0\ m^3/m^2h$ |
| Party Walls U-value | $0\ W/m^2K$ |
| Community heating, heat from boilers – mains gas | |

# DER WorkSheet: New dwelling design stage

User Details:

| | | | |
|---|---|---|---|
| **Assessor Name:** | Neil Ingham | **Stroma Number:** | STRO010943 |
| **Software Name:** | Stroma FSAP 2012 | **Software Version:** | Version: 1.0.5.50 |

Property Address: 05 - A

**Address :**

## 1. Overall dwelling dimensions:

| | Area(m²) | | Av. Height(m) | | Volume(m³) | |
|---|---|---|---|---|---|---|
| Ground floor | 103.81 | (1a) x | 2.65 | (2a) = | 275.1 | (3a) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n) | 103.81 | (4) | | | | |
| Dwelling volume | | | (3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) = | | 275.1 | (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 | | | | | | | 0 | x 10 = | 0 | (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) = | 0 | ÷ (5) = | 0 | (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 | | 3 | (17) |
| If based on air permeability value, then | (18) = [(17) ÷ 20]+(8), otherwise (18) = (16) | 0.15 | (18) |

*Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used*

| | | | |
|---|---|---|---|
| Number of sides sheltered | | 0 | (19) |
| Shelter factor | (20) = 1 - [0.075 x (19)] = | 1 | (20) |
| Infiltration rate incorporating shelter factor | (21) = (18) x (20) = | 0.15 | (21) |

Infiltration rate modified for monthly wind speed

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Monthly average wind speed from Table 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 |
| 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 |

# DER WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.19 | 0.19 | 0.18 | 0.16 | 0.16 | 0.14 | 0.14 | 0.14 | 0.15 | 0.16 | 0.17 | 0.18 |

*Calculate effective air change rate for the applicable case*

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 74.8 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24a)m= | 0.32 | 0.31 | 0.31 | 0.29 | 0.29 | 0.27 | 0.27 | 0.26 | 0.28 | 0.29 | 0.29 | 0.3 | (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 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24d) |

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (25)m= | 0.32 | 0.31 | 0.31 | 0.29 | 0.29 | 0.27 | 0.27 | 0.26 | 0.28 | 0.29 | 0.29 | 0.3 | (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 | |
|---|---|---|---|---|---|---|---|---|
| Windows Type 1 | | | 13.21 | x1/[1/( 1.4 )+ 0.04] = | 17.51 | | | (27) |
| Windows Type 2 | | | 5.5 | x1/[1/( 1.4 )+ 0.04] = | 7.29 | | | (27) |
| Windows Type 3 | | | 4.61 | x1/[1/( 1.4 )+ 0.04] = | 6.11 | | | (27) |
| Walls Type1 | 76.16 | 23.32 | 52.84 | x 0.18 = | 9.51 | 60 | 3170.4 | (29) |
| Walls Type2 | 49.77 | 0 | 49.77 | x 0.17 = | 8.36 | 60 | 2986.2 | (29) |
| Total area of elements, m² | | | 125.93 | | | | | (31) |
| Party wall | | | 12.14 | x 0 = | 0 | 45 | 546.3 | (32) |
| Party floor | | | 103.81 | | | 40 | 4152.4 | (32a) |
| Party ceiling | | | 103.81 | | | 30 | 3114.3 | (32b) |
| Internal wall ** | | | 193.17 | | | 9 | 1738.53 | (32c) |

** 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) = 48.78 (33)

Heat capacity Cm = S(A x k ) ((28)…(30) + (32) + (32a)…(32e) = 15708.13 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 151.32 (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 9.77 (36)

*if details of thermal bridging are not known (36) = 0.05 x (31)*

Total fabric heat loss (33) + (36) = 58.55 (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 |
|---|---|---|---|---|---|---|---|---|---|---|---|

# DER WorkSheet: New dwelling design stage

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (38)m= | 28.8 | 28.46 | 28.12 | 26.42 | 26.08 | 24.37 | 24.37 | 24.03 | 25.06 | 26.08 | 26.76 | 27.44 | (38) |

Heat transfer coefficient, W/K (39)m = (37) + (38)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (39)m= | 87.35 | 87.01 | 86.67 | 84.97 | 84.63 | 82.93 | 82.93 | 82.59 | 83.61 | 84.63 | 85.31 | 85.99 | |

Average = Sum(39)1…12 /12= 84.89 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (40)m= | 0.84 | 0.84 | 0.83 | 0.82 | 0.82 | 0.8 | 0.8 | 0.8 | 0.81 | 0.82 | 0.82 | 0.83 | |

Average = Sum(40)1…12 /12= 0.82 (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 2.77 (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) + 36 100.04 (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= | 110.04 | 106.04 | 102.04 | 98.04 | 94.04 | 90.03 | 90.03 | 94.04 | 98.04 | 102.04 | 106.04 | 110.04 | |

Total = Sum(44)1…12 = 1200.45 (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= | 163.19 | 142.73 | 147.28 | 128.4 | 123.2 | 106.32 | 98.52 | 113.05 | 114.4 | 133.32 | 145.53 | 158.04 | |

Total = Sum(45)1…12 = 1573.98 (45)

*If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)*

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (46)m= | 24.48 | 21.41 | 22.09 | 19.26 | 18.48 | 15.95 | 14.78 | 16.96 | 17.16 | 20 | 21.83 | 23.71 | (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) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (56)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (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= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (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= | 23.26 | 21.01 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | (59) |

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 | (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= | 218.46 | 192.65 | 202.56 | 181.9 | 178.48 | 159.81 | 153.79 | 168.33 | 167.89 | 188.6 | 199.03 | 213.32 | (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= | 218.46 | 192.65 | 202.56 | 181.9 | 178.48 | 159.81 | 153.79 | 168.33 | 167.89 | 188.6 | 199.03 | 213.32 |

Output from water heater (annual)$_{1...12}$ | 2224.82 | (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= | 98.48 | 87.4 | 93.19 | 85.49 | 85.19 | 78.15 | 76.98 | 81.81 | 80.83 | 88.55 | 91.18 | 96.77 | (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= | 138.61 | 138.61 | 138.61 | 138.61 | 138.61 | 138.61 | 138.61 | 138.61 | 138.61 | 138.61 | 138.61 | 138.61 | (66) |

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (67)m= | 23.39 | 20.77 | 16.89 | 12.79 | 9.56 | 8.07 | 8.72 | 11.34 | 15.21 | 19.32 | 22.55 | 24.04 | (67) |

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (68)m= | 262.34 | 265.07 | 258.21 | 243.6 | 225.17 | 207.84 | 196.26 | 193.54 | 200.4 | 215.01 | 233.44 | 250.77 | (68) |

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (69)m= | 36.86 | 36.86 | 36.86 | 36.86 | 36.86 | 36.86 | 36.86 | 36.86 | 36.86 | 36.86 | 36.86 | 36.86 | (69) |

Pumps and fans gains (Table 5a)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (70)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (70) |

Losses e.g. evaporation (negative values) (Table 5)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (71)m= | -110.88 | -110.88 | -110.88 | -110.88 | -110.88 | -110.88 | -110.88 | -110.88 | -110.88 | -110.88 | -110.88 | -110.88 | (71) |

Water heating gains (Table 5)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (72)m= | 132.37 | 130.06 | 125.26 | 118.73 | 114.5 | 108.53 | 103.47 | 109.96 | 112.27 | 119.02 | 126.65 | 130.07 | (72) |

**Total internal gains =** (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (73)m= | 482.68 | 480.48 | 464.94 | 439.71 | 413.81 | 389.03 | 373.03 | 379.42 | 392.47 | 417.93 | 447.22 | 469.45 | (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) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Southeast 0.9x | 0.77 | x | 5.5 | x | 36.79 | x | 0.63 | x | 0.7 | = | 61.85 | (77) |
| Southeast 0.9x | 0.77 | x | 5.5 | x | 62.67 | x | 0.63 | x | 0.7 | = | 105.35 | (77) |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Southeast | 0.9x | 0.77 | x | 5.5 | x | 85.75 | x | 0.63 | x | 0.7 | = | 144.14 | (77) |
| Southeast | 0.9x | 0.77 | x | 5.5 | x | 106.25 | x | 0.63 | x | 0.7 | = | 178.6 | (77) |
| Southeast | 0.9x | 0.77 | x | 5.5 | x | 119.01 | x | 0.63 | x | 0.7 | = | 200.04 | (77) |
| Southeast | 0.9x | 0.77 | x | 5.5 | x | 118.15 | x | 0.63 | x | 0.7 | = | 198.6 | (77) |
| Southeast | 0.9x | 0.77 | x | 5.5 | x | 113.91 | x | 0.63 | x | 0.7 | = | 191.47 | (77) |
| Southeast | 0.9x | 0.77 | x | 5.5 | x | 104.39 | x | 0.63 | x | 0.7 | = | 175.47 | (77) |
| Southeast | 0.9x | 0.77 | x | 5.5 | x | 92.85 | x | 0.63 | x | 0.7 | = | 156.07 | (77) |
| Southeast | 0.9x | 0.77 | x | 5.5 | x | 69.27 | x | 0.63 | x | 0.7 | = | 116.43 | (77) |
| Southeast | 0.9x | 0.77 | x | 5.5 | x | 44.07 | x | 0.63 | x | 0.7 | = | 74.08 | (77) |
| Southeast | 0.9x | 0.77 | x | 5.5 | x | 31.49 | x | 0.63 | x | 0.7 | = | 52.93 | (77) |
| Southwest | 0.9x | 0.77 | x | 13.21 | x | 36.79 | | 0.63 | x | 0.7 | = | 148.54 | (79) |
| Southwest | 0.9x | 0.77 | x | 13.21 | x | 62.67 | | 0.63 | x | 0.7 | = | 253.02 | (79) |
| Southwest | 0.9x | 0.77 | x | 13.21 | x | 85.75 | | 0.63 | x | 0.7 | = | 346.2 | (79) |
| Southwest | 0.9x | 0.77 | x | 13.21 | x | 106.25 | | 0.63 | x | 0.7 | = | 428.95 | (79) |
| Southwest | 0.9x | 0.77 | x | 13.21 | x | 119.01 | | 0.63 | x | 0.7 | = | 480.46 | (79) |
| Southwest | 0.9x | 0.77 | x | 13.21 | x | 118.15 | | 0.63 | x | 0.7 | = | 476.99 | (79) |
| Southwest | 0.9x | 0.77 | x | 13.21 | x | 113.91 | | 0.63 | x | 0.7 | = | 459.87 | (79) |
| Southwest | 0.9x | 0.77 | x | 13.21 | x | 104.39 | | 0.63 | x | 0.7 | = | 421.44 | (79) |
| Southwest | 0.9x | 0.77 | x | 13.21 | x | 92.85 | | 0.63 | x | 0.7 | = | 374.86 | (79) |
| Southwest | 0.9x | 0.77 | x | 13.21 | x | 69.27 | | 0.63 | x | 0.7 | = | 279.64 | (79) |
| Southwest | 0.9x | 0.77 | x | 13.21 | x | 44.07 | | 0.63 | x | 0.7 | = | 177.92 | (79) |
| Southwest | 0.9x | 0.77 | x | 13.21 | x | 31.49 | | 0.63 | x | 0.7 | = | 127.12 | (79) |
| Northwest | 0.9x | 0.77 | x | 4.61 | x | 11.28 | x | 0.63 | x | 0.7 | = | 15.9 | (81) |
| Northwest | 0.9x | 0.77 | x | 4.61 | x | 22.97 | x | 0.63 | x | 0.7 | = | 32.36 | (81) |
| Northwest | 0.9x | 0.77 | x | 4.61 | x | 41.38 | x | 0.63 | x | 0.7 | = | 58.3 | (81) |
| Northwest | 0.9x | 0.77 | x | 4.61 | x | 67.96 | x | 0.63 | x | 0.7 | = | 95.74 | (81) |
| Northwest | 0.9x | 0.77 | x | 4.61 | x | 91.35 | x | 0.63 | x | 0.7 | = | 128.7 | (81) |
| Northwest | 0.9x | 0.77 | x | 4.61 | x | 97.38 | x | 0.63 | x | 0.7 | = | 137.2 | (81) |
| Northwest | 0.9x | 0.77 | x | 4.61 | x | 91.1 | x | 0.63 | x | 0.7 | = | 128.35 | (81) |
| Northwest | 0.9x | 0.77 | x | 4.61 | x | 72.63 | x | 0.63 | x | 0.7 | = | 102.32 | (81) |
| Northwest | 0.9x | 0.77 | x | 4.61 | x | 50.42 | x | 0.63 | x | 0.7 | = | 71.04 | (81) |
| Northwest | 0.9x | 0.77 | x | 4.61 | x | 28.07 | x | 0.63 | x | 0.7 | = | 39.54 | (81) |
| Northwest | 0.9x | 0.77 | x | 4.61 | x | 14.2 | x | 0.63 | x | 0.7 | = | 20 | (81) |
| Northwest | 0.9x | 0.77 | x | 4.61 | x | 9.21 | x | 0.63 | x | 0.7 | = | 12.98 | (81) |

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (83)m= | 226.28 | 390.73 | 548.63 | 703.29 | 809.2 | 812.79 | 779.69 | 699.23 | 601.97 | 435.62 | 272 | 193.03 | (83) |

Total gains – internal and solar (84)m = (73)m + (83)m , watts

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (84)m= | 708.96 | 871.2 | 1013.57 | 1143 | 1223.01 | 1201.81 | 1152.72 | 1078.65 | 994.43 | 853.54 | 719.21 | 662.48 | (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 |
|---|---|---|---|---|---|---|---|---|---|---|---|

# DER WorkSheet: New dwelling design stage

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (86)m= | 0.98 | 0.95 | 0.89 | 0.77 | 0.61 | 0.44 | 0.32 | 0.35 | 0.56 | 0.83 | 0.95 | 0.98 | (86) |

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (87)m= | 19.9 | 20.18 | 20.49 | 20.79 | 20.94 | 20.99 | 21 | 21 | 20.97 | 20.75 | 20.28 | 19.86 | (87) |

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (88)m= | 20.22 | 20.22 | 20.22 | 20.24 | 20.24 | 20.25 | 20.25 | 20.26 | 20.25 | 20.24 | 20.23 | 20.23 | (88) |

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (89)m= | 0.97 | 0.94 | 0.87 | 0.74 | 0.57 | 0.39 | 0.26 | 0.29 | 0.5 | 0.8 | 0.94 | 0.98 | (89) |

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (90)m= | 18.75 | 19.14 | 19.58 | 19.99 | 20.18 | 20.25 | 20.25 | 20.26 | 20.22 | 19.95 | 19.3 | 18.69 | (90) |

fLA = Living area ÷ (4) = 0.38 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (92)m= | 19.19 | 19.54 | 19.93 | 20.3 | 20.47 | 20.53 | 20.54 | 20.54 | 20.51 | 20.26 | 19.68 | 19.14 | (92) |

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (93)m= | 19.19 | 19.54 | 19.93 | 20.3 | 20.47 | 20.53 | 20.54 | 20.54 | 20.51 | 20.26 | 19.68 | 19.14 | (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= | 0.97 | 0.93 | 0.86 | 0.74 | 0.58 | 0.4 | 0.28 | 0.32 | 0.52 | 0.8 | 0.94 | 0.97 | (94) |
| **Useful gains, hmGm , W = (94)m x (84)m** | | | | | | | | | | | | | |
| (95)m= | 684.71 | 810.29 | 876.63 | 848.5 | 708.01 | 486.63 | 325.87 | 340.61 | 519.7 | 681.17 | 673.32 | 644.36 | (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= | 1300.79 | 1273.63 | 1164.02 | 968.27 | 742.05 | 491.85 | 326.66 | 341.91 | 535.72 | 817.5 | 1073.07 | 1284.7 | (97) |
| **Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m** | | | | | | | | | | | | | |
| (98)m= | 458.37 | 311.36 | 213.82 | 86.23 | 25.32 | 0 | 0 | 0 | 0 | 101.43 | 287.82 | 476.41 | |

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1960.76 (98)

Space heating requirement in kWh/m²/year 18.89 (99)

## 9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

| | | |
|---|---|---|
| Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none | 0 | (301) |
| Fraction of space heat from community system 1 – (301) = | 1 | (302) |

*The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.*

| | | | |
|---|---|---|---|
| Fraction of heat from Community boilers | | 1 | (303a) |
| Fraction of total space heat from Community boilers | (302) x (303a) = | 1 | (304a) |
| Factor for control and charging method (Table 4c(3)) for community heating system | | 1 | (305) |
| Distribution loss factor (Table 12c) for community heating system | | 1.05 | (306) |

| **Space heating** | **kWh/year** |
|---|---|
| Annual space heating requirement | 1960.76 |

# DER WorkSheet: New dwelling design stage

| | | | |
|---|---|---|---|
| Space heat from Community boilers | (98) x (304a) x (305) x (306) = | 2058.8 | (307a) |
| Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) | | 0 | (308 |
| Space heating requirement from secondary/supplementary system | (98) x (301) x 100 ÷ (308) = | 0 | (309) |

**Water heating**

| | | | |
|---|---|---|---|
| Annual water heating requirement | | 2224.82 | |
| If DHW from community scheme:<br>Water heat from Community boilers | (64) x (303a) x (305) x (306) = | 2336.06 | (310a) |
| Electricity used for heat distribution | 0.01 × [(307a)…(307e) + (310a)…(310e)] = | 43.95 | (313) |
| Cooling System Energy Efficiency Ratio | | 0 | (314) |
| Space cooling (if there is a fixed cooling system, if not enter 0) | = (107) ÷ (314) = | 0 | (315) |
| Electricity for pumps and fans within dwelling (Table 4f):<br>mechanical ventilation - balanced, extract or positive input from outside | | 253.73 | (330a) |
| warm air heating system fans | | 0 | (330b) |
| pump for solar water heating | | 0 | (330g) |
| Total electricity for the above, kWh/year | =(330a) + (330b) + (330g) = | 253.73 | (331) |
| Energy for lighting (calculated in Appendix L) | | 412.99 | (332) |
| Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) = | | 5061.57 | (338) |

## 12b. CO2 Emissions – Community heating scheme

| | | Energy kWh/year | Emission factor kg CO2/kWh | | Emissions kg CO2/year | |
|---|---|---|---|---|---|---|
| CO2 from other sources of space and water heating (not CHP)<br>Efficiency of heat source 1 (%) | If there is CHP using two fuels repeat (363) to (366) for the second fuel | | | | 96 | (367a) |
| CO2 associated with heat source 1 | [(307b)+(310b)] x 100 ÷ (367b) x | | 0.22 | = | 988.84 | (367) |
| Electrical energy for heat distribution | [(313) x | | 0.52 | = | 22.81 | (372) |
| Total CO2 associated with community systems | (363)…(366) + (368)...(372) | | | = | 1011.65 | (373) |
| CO2 associated with space heating (secondary) | (309) x | | 0 | = | 0 | (374) |
| CO2 associated with water from immersion heater or instantaneous heater | (312) x | | 0.22 | = | 0 | (375) |
| Total CO2 associated with space and water heating | (373) + (374) + (375) = | | | | 1011.65 | (376) |
| CO2 associated with electricity for pumps and fans within dwelling | (331)) x | | 0.52 | = | 131.68 | (378) |
| CO2 associated with electricity for lighting | (332))) x | | 0.52 | = | 214.34 | (379) |
| **Total CO2, kg/year** | sum of (376)…(382) = | | | | 1357.68 | (383) |
| **Dwelling CO2 Emission Rate** | (383) ÷ (4) = | | | | 13.08 | (384) |
| **EI rating (section 14)** | | | | | 87.77 | (385) |

# Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.50
*Printed on 06 December 2021 at 10:53:34*

## Project Information:

**Assessed By:** Neil Ingham (STRO010943) **Building Type:** Flat

## Dwelling Details:

**NEW DWELLING DESIGN STAGE** Total Floor Area: 62.56m²

**Site Reference :** Highgate Road - GREEN **Plot Reference:** 05 - B

**Address :**

## Client Details:

**Name:**

**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 (c) | | |
| Fuel factor: 1.00 (mains gas (c)) | | |
| Target Carbon Dioxide Emission Rate (TER) | 18.61 kg/m² | |
| Dwelling Carbon Dioxide Emission Rate (DER) | 16.22 kg/m² | OK |

## 1b TFEE and DFEE

| | | |
|---|---|---|
| Target Fabric Energy Efficiency (TFEE) | 49.8 kWh/m² | |
| Dwelling Fabric Energy Efficiency (DFEE) | 41.0 kWh/m² | |
| | | OK |

## 2 Fabric U-values

| Element | Average | Highest | |
|---|---|---|---|
| External wall | 0.18 (max. 0.30) | 0.18 (max. 0.70) | OK |
| Party wall | 0.00 (max. 0.20) | - | OK |
| Floor | (no floor) | | |
| Roof | (no roof) | | |
| Openings | 1.40 (max. 2.00) | 1.40 (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 | 3.00 (design value) | |
| Maximum | 10.0 | OK |

## 4 Heating efficiency

| | |
|---|---|
| Main Heating system: | Community heating schemes - mains gas |
| Secondary heating system: | None |

## 5 Cylinder insulation

| | |
|---|---|
| Hot water Storage: | No cylinder |

## 6 Controls

| | | |
|---|---|---|
| Space heating controls | Charging system linked to use of community heating, programmer and at least two room thermostats | OK |
| Hot water controls: | No cylinder thermostat<br>No cylinder | |

# Regulations Compliance Report

## 7 Low energy lights

| | | |
|---|---|---|
| Percentage of fixed lights with low-energy fittings | 100.0% | |
| Minimum | 75.0% | **OK** |

## 8 Mechanical ventilation

| | | |
|---|---|---|
| Continuous supply and extract system | | |
| Specific fan power: | 0.54 | |
| Maximum | 1.5 | **OK** |
| MVHR efficiency: | 88% | |
| Minimum | 70% | **OK** |

## 9 Summertime temperature

| | | |
|---|---|---|
| Overheating risk (Thames valley): | Slight | **OK** |
| Based on: | | |
| Overshading: | Average or unknown | |
| Windows facing: North East | 12.71m² | |
| Windows facing: North West | 3.46m² | |
| Ventilation rate: | 6.00 | |

## 10 Key features

| | |
|---|---|
| Air permeablility | 3.0 m³/m²h |
| Party Walls U-value | 0 W/m²K |
| Community heating, heat from boilers – mains gas | |

# DER WorkSheet: New dwelling design stage

## User Details:

| | | | |
|---|---|---|---|
| **Assessor Name:** | Neil Ingham | **Stroma Number:** | STRO010943 |
| **Software Name:** | Stroma FSAP 2012 | **Software Version:** | Version: 1.0.5.50 |

Property Address: 05 - B

**Address :**

## 1. Overall dwelling dimensions:

| | Area(m²) | | Av. Height(m) | | Volume(m³) | |
|---|---|---|---|---|---|---|
| Ground floor | 62.56 | (1a) x | 2.65 | (2a) = | 165.78 | (3a) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n) | 62.56 | (4) | | | | |
| Dwelling volume | | | (3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) = | | 165.78 | (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 | | | | | | | 0 | x 10 = | 0 | (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) = | 0 | ÷ (5) = | 0 | (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 | | 3 | (17) |
| If based on air permeability value, then | (18) = [(17) ÷ 20]+(8), otherwise (18) = (16) | 0.15 | (18) |

*Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used*

| | | | |
|---|---|---|---|
| Number of sides sheltered | | 0 | (19) |
| Shelter factor | (20) = 1 - [0.075 x (19)] = | 1 | (20) |
| Infiltration rate incorporating shelter factor | (21) = (18) x (20) = | 0.15 | (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 |

Wind Factor (22a)m = (22)m ÷ 4

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (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

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.19 | 0.19 | 0.18 | 0.16 | 0.16 | 0.14 | 0.14 | 0.14 | 0.15 | 0.16 | 0.17 | 0.18 |

*Calculate effective air change rate for the applicable case*

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 74.8 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24a)m= | 0.32 | 0.31 | 0.31 | 0.29 | 0.29 | 0.27 | 0.27 | 0.26 | 0.28 | 0.29 | 0.29 | 0.3 | (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 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24d) |

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (25)m= | 0.32 | 0.31 | 0.31 | 0.29 | 0.29 | 0.27 | 0.27 | 0.26 | 0.28 | 0.29 | 0.29 | 0.3 | (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 | |
|---|---|---|---|---|---|---|---|---|---|---|
| Windows Type 1 | | | 12.71 | x1/[1/( 1.4 )+ 0.04] | | = | 16.85 | | | (27) |
| Windows Type 2 | | | 3.46 | x1/[1/( 1.4 )+ 0.04] | | = | 4.59 | | | (27) |
| Walls Type1 | 46.72 | 16.17 | 30.55 | x | 0.18 | = | 5.5 | 60 | 1833 | (29) |
| Walls Type2 | 13.75 | 0 | 13.75 | x | 0.17 | = | 2.31 | 60 | 825 | (29) |
| Total area of elements, m² | | | 60.47 | | | | | | | (31) |
| Party wall | | | 30.32 | x | 0 | = | 0 | 45 | 1364.4 | (32) |
| Party floor | | | 62.56 | | | | | 40 | 2502.4 | (32a) |
| Party ceiling | | | 62.56 | | | | | 30 | 1876.8 | (32b) |
| Internal wall ** | | | 100.8 | | | | | 9 | 907.2 | (32c) |

** 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) = 29.25 (33)

Heat capacity Cm = S(A x k ) ((28)…(30) + (32) + (32a)…(32e) = 9308.8 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 148.8 (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 7.08 (36)

*if details of thermal bridging are not known (36) = 0.05 x (31)*

Total fabric heat loss (33) + (36) = 36.33 (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= | 17.36 | 17.15 | 16.95 | 15.92 | 15.72 | 14.69 | 14.69 | 14.48 | 15.1 | 15.72 | 16.13 | 16.54 | (38) |

Heat transfer coefficient, W/K (39)m = (37) + (38)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (39)m= | 53.68 | 53.48 | 53.27 | 52.25 | 52.04 | 51.01 | 51.01 | 50.81 | 51.42 | 52.04 | 52.45 | 52.86 | |

Average = $Sum(39)_{1…12}$ /12= 52.19 (39)

# DER WorkSheet: New dwelling design stage

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (40)m= | 0.86 | 0.85 | 0.85 | 0.84 | 0.83 | 0.82 | 0.82 | 0.81 | 0.82 | 0.83 | 0.84 | 0.84 |

Average = Sum(40)$_{1…12}$ /12= 0.83 (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 2.05 (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 82.96 (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= | 91.25 | 87.94 | 84.62 | 81.3 | 77.98 | 74.66 | 74.66 | 77.98 | 81.3 | 84.62 | 87.94 | 91.25 | |
| Total = Sum(44)$_{1…12}$ = | | | | | | | | | | | | 995.51 | (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= | 135.33 | 118.36 | 122.14 | 106.48 | 102.17 | 88.17 | 81.7 | 93.75 | 94.87 | 110.56 | 120.69 | 131.06 | |
| Total = Sum(45)$_{1…12}$ = | | | | | | | | | | | | 1305.27 | (45) |
| *If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)* | | | | | | | | | | | | | |
| (46)m= | 20.3 | 17.75 | 18.32 | 15.97 | 15.33 | 13.22 | 12.25 | 14.06 | 14.23 | 16.58 | 18.1 | 19.66 | (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) = 110 (50)

b) If manufacturer’s declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (56)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (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= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (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= | 23.26 | 21.01 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | (59) |

# DER WorkSheet: New dwelling design stage

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 | (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= | 190.61 | 168.29 | 177.41 | 159.97 | 157.45 | 141.66 | 136.98 | 149.03 | 148.36 | 165.84 | 174.18 | 186.34 | (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= | 190.61 | 168.29 | 177.41 | 159.97 | 157.45 | 141.66 | 136.98 | 149.03 | 148.36 | 165.84 | 174.18 | 186.34 | |

Output from water heater (annual)$_{1...12}$ 1956.11 (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= | 89.22 | 79.3 | 84.83 | 78.2 | 78.19 | 72.11 | 71.39 | 75.39 | 74.34 | 80.98 | 82.92 | 87.8 | (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= | 102.65 | 102.65 | 102.65 | 102.65 | 102.65 | 102.65 | 102.65 | 102.65 | 102.65 | 102.65 | 102.65 | 102.65 | (66) |

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (67)m= | 15.99 | 14.2 | 11.55 | 8.74 | 6.54 | 5.52 | 5.96 | 7.75 | 10.4 | 13.21 | 15.42 | 16.43 | (67) |

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (68)m= | 179.35 | 181.22 | 176.53 | 166.54 | 153.94 | 142.09 | 134.18 | 132.32 | 137.01 | 146.99 | 159.59 | 171.44 | (68) |

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (69)m= | 33.27 | 33.27 | 33.27 | 33.27 | 33.27 | 33.27 | 33.27 | 33.27 | 33.27 | 33.27 | 33.27 | 33.27 | (69) |

Pumps and fans gains (Table 5a)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (70)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (70) |

Losses e.g. evaporation (negative values) (Table 5)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (71)m= | -82.12 | -82.12 | -82.12 | -82.12 | -82.12 | -82.12 | -82.12 | -82.12 | -82.12 | -82.12 | -82.12 | -82.12 | (71) |

Water heating gains (Table 5)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (72)m= | 119.92 | 118 | 114.02 | 108.61 | 105.1 | 100.15 | 95.95 | 101.34 | 103.25 | 108.85 | 115.17 | 118.01 | (72) |

**Total internal gains =** (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (73)m= | 369.06 | 367.21 | 355.89 | 337.69 | 319.37 | 301.56 | 289.88 | 295.2 | 304.45 | 322.84 | 343.98 | 359.68 | (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 | 12.71 | x | 11.28 | x | 0.63 | x | 0.7 | = | 43.83 | (75) |
| Northeast 0.9x | 0.77 | x | 12.71 | x | 22.97 | x | 0.63 | x | 0.7 | = | 89.21 | (75) |
| Northeast 0.9x | 0.77 | x | 12.71 | x | 41.38 | x | 0.63 | x | 0.7 | = | 160.73 | (75) |
| Northeast 0.9x | 0.77 | x | 12.71 | x | 67.96 | x | 0.63 | x | 0.7 | = | 263.96 | (75) |
| Northeast 0.9x | 0.77 | x | 12.71 | x | 91.35 | x | 0.63 | x | 0.7 | = | 354.82 | (75) |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Northeast | 0.9x | 0.77 | x | 12.71 | x | 97.38 | x | 0.63 | x | 0.7 | = | 378.27 | (75) |
| Northeast | 0.9x | 0.77 | x | 12.71 | x | 91.1 | x | 0.63 | x | 0.7 | = | 353.87 | (75) |
| Northeast | 0.9x | 0.77 | x | 12.71 | x | 72.63 | x | 0.63 | x | 0.7 | = | 282.11 | (75) |
| Northeast | 0.9x | 0.77 | x | 12.71 | x | 50.42 | x | 0.63 | x | 0.7 | = | 195.85 | (75) |
| Northeast | 0.9x | 0.77 | x | 12.71 | x | 28.07 | x | 0.63 | x | 0.7 | = | 109.02 | (75) |
| Northeast | 0.9x | 0.77 | x | 12.71 | x | 14.2 | x | 0.63 | x | 0.7 | = | 55.15 | (75) |
| Northeast | 0.9x | 0.77 | x | 12.71 | x | 9.21 | x | 0.63 | x | 0.7 | = | 35.79 | (75) |
| Northwest | 0.9x | 0.77 | x | 3.46 | x | 11.28 | x | 0.63 | x | 0.7 | = | 11.93 | (81) |
| Northwest | 0.9x | 0.77 | x | 3.46 | x | 22.97 | x | 0.63 | x | 0.7 | = | 24.29 | (81) |
| Northwest | 0.9x | 0.77 | x | 3.46 | x | 41.38 | x | 0.63 | x | 0.7 | = | 43.75 | (81) |
| Northwest | 0.9x | 0.77 | x | 3.46 | x | 67.96 | x | 0.63 | x | 0.7 | = | 71.86 | (81) |
| Northwest | 0.9x | 0.77 | x | 3.46 | x | 91.35 | x | 0.63 | x | 0.7 | = | 96.59 | (81) |
| Northwest | 0.9x | 0.77 | x | 3.46 | x | 97.38 | x | 0.63 | x | 0.7 | = | 102.98 | (81) |
| Northwest | 0.9x | 0.77 | x | 3.46 | x | 91.1 | x | 0.63 | x | 0.7 | = | 96.33 | (81) |
| Northwest | 0.9x | 0.77 | x | 3.46 | x | 72.63 | x | 0.63 | x | 0.7 | = | 76.8 | (81) |
| Northwest | 0.9x | 0.77 | x | 3.46 | x | 50.42 | x | 0.63 | x | 0.7 | = | 53.32 | (81) |
| Northwest | 0.9x | 0.77 | x | 3.46 | x | 28.07 | x | 0.63 | x | 0.7 | = | 29.68 | (81) |
| Northwest | 0.9x | 0.77 | x | 3.46 | x | 14.2 | x | 0.63 | x | 0.7 | = | 15.01 | (81) |
| Northwest | 0.9x | 0.77 | x | 3.46 | x | 9.21 | x | 0.63 | x | 0.7 | = | 9.74 | (81) |

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (83)m= | 55.76 | 113.5 | 204.48 | 335.82 | 451.41 | 481.25 | 450.2 | 358.9 | 249.17 | 138.7 | 70.16 | 45.53 | (83) |

Total gains – internal and solar (84)m = (73)m + (83)m , watts

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (84)m= | 424.81 | 480.71 | 560.38 | 673.51 | 770.78 | 782.81 | 740.09 | 654.1 | 553.62 | 461.54 | 414.13 | 405.21 | (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= | 0.98 | 0.96 | 0.91 | 0.78 | 0.59 | 0.41 | 0.3 | 0.35 | 0.6 | 0.87 | 0.96 | 0.98 | (86) |

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (87)m= | 19.85 | 20.04 | 20.37 | 20.75 | 20.94 | 20.99 | 21 | 21 | 20.95 | 20.66 | 20.2 | 19.82 | (87) |

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (88)m= | 20.2 | 20.21 | 20.21 | 20.22 | 20.23 | 20.24 | 20.24 | 20.24 | 20.23 | 20.23 | 20.22 | 20.21 | (88) |

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (89)m= | 0.97 | 0.95 | 0.9 | 0.76 | 0.55 | 0.36 | 0.25 | 0.3 | 0.55 | 0.84 | 0.95 | 0.98 | (89) |

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (90)m= | 18.66 | 18.94 | 19.41 | 19.93 | 20.16 | 20.23 | 20.24 | 20.24 | 20.19 | 19.83 | 19.18 | 18.63 | (90) |

fLA = Living area ÷ (4) = 0.43 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (92)m= | 19.17 | 19.42 | 19.83 | 20.28 | 20.49 | 20.56 | 20.57 | 20.57 | 20.52 | 20.19 | 19.62 | 19.14 | (92) |

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

# DER WorkSheet: New dwelling design stage

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (93)m= | 19.17 | 19.42 | 19.83 | 20.28 | 20.49 | 20.56 | 20.57 | 20.57 | 20.52 | 20.19 | 19.62 | 19.14 | (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= | 0.97 | 0.95 | 0.89 | 0.76 | 0.57 | 0.38 | 0.27 | 0.32 | 0.57 | 0.84 | 0.94 | 0.97 | (94) |
| Useful gains, hmGm , W = (94)m x (84)m | | | | | | | | | | | | | |
| (95)m= | 410.32 | 454.37 | 499.35 | 510.31 | 436.71 | 300.96 | 201.78 | 210.63 | 315.05 | 388.63 | 390.91 | 393.37 | (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= | 798.2 | 776.21 | 709.91 | 594.7 | 457.66 | 303.93 | 202.28 | 211.64 | 330.02 | 499.01 | 656.71 | 789.76 | (97) |
| Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m | | | | | | | | | | | | | |
| (98)m= | 288.59 | 216.28 | 156.66 | 60.76 | 15.58 | 0 | 0 | 0 | 0 | 82.12 | 191.38 | 294.91 | |

| | | |
|---|---|---|
| Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = | 1306.29 | (98) |
| Space heating requirement in kWh/m²/year | 20.88 | (99) |

## 9b. Energy requirements – Community heating scheme

| | | | |
|---|---|---|---|
| This part is used for space heating, space cooling or water heating provided by a community scheme.<br>Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none | | 0 | (301) |
| Fraction of space heat from community system 1 – (301) = | | 1 | (302) |

*The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.*

| | | | |
|---|---|---|---|
| Fraction of heat from Community boilers | | 1 | (303a) |
| Fraction of total space heat from Community boilers | (302) x (303a) = | 1 | (304a) |
| Factor for control and charging method (Table 4c(3)) for community heating system | | 1 | (305) |
| Distribution loss factor (Table 12c) for community heating system | | 1.05 | (306) |
| **Space heating** | | **kWh/year** | |
| Annual space heating requirement | | 1306.29 | |
| Space heat from Community boilers | (98) x (304a) x (305) x (306) = | 1371.61 | (307a) |
| Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) | | 0 | (308 |
| Space heating requirement from secondary/supplementary system | (98) x (301) x 100 ÷ (308) = | 0 | (309) |
| **Water heating** | | | |
| Annual water heating requirement | | 1956.11 | |
| If DHW from community scheme:<br>Water heat from Community boilers | (64) x (303a) x (305) x (306) = | 2053.91 | (310a) |
| Electricity used for heat distribution | 0.01 × [(307a)…(307e) + (310a)…(310e)] = | 34.26 | (313) |
| Cooling System Energy Efficiency Ratio | | 0 | (314) |
| Space cooling (if there is a fixed cooling system, if not enter 0) | = (107) ÷ (314) = | 0 | (315) |
| Electricity for pumps and fans within dwelling (Table 4f):<br>mechanical ventilation - balanced, extract or positive input from outside | | 152.91 | (330a) |

| | | | | |
|---|---|---|---|---|
| warm air heating system fans | | | 0 | (330b) |
| pump for solar water heating | | | 0 | (330g) |
| Total electricity for the above, kWh/year | =(330a) + (330b) + (330g) = | | 152.91 | (331) |
| Energy for lighting (calculated in Appendix L) | | | 282.38 | (332) |
| Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) = | | | 3860.81 | (338) |

## 12b. CO2 Emissions – Community heating scheme

| | | Energy kWh/year | Emission factor kg CO2/kWh | | Emissions kg CO2/year | |
|---|---|---|---|---|---|---|
| CO2 from other sources of space and water heating (not CHP) | | | | | | |
| Efficiency of heat source 1 (%) | If there is CHP using two fuels repeat (363) to (366) for the second fuel | | | | 96 | (367a) |
| CO2 associated with heat source 1 | [(307b)+(310b)] x 100 ÷ (367b) x | | 0.22 | = | 770.74 | (367) |
| Electrical energy for heat distribution | [(313) x | | 0.52 | = | 17.78 | (372) |
| Total CO2 associated with community systems | (363)…(366) + (368)...(372) | | | = | 788.52 | (373) |
| CO2 associated with space heating (secondary) | (309) x | | 0 | = | 0 | (374) |
| CO2 associated with water from immersion heater or instantaneous heater | (312) x | | 0.22 | = | 0 | (375) |
| Total CO2 associated with space and water heating | (373) + (374) + (375) = | | | | 788.52 | (376) |
| CO2 associated with electricity for pumps and fans within dwelling | (331)) x | | 0.52 | = | 79.36 | (378) |
| CO2 associated with electricity for lighting | (332))) x | | 0.52 | = | 146.56 | (379) |
| **Total CO2, kg/year** | sum of (376)…(382) = | | | | 1014.43 | (383) |
| **Dwelling CO2 Emission Rate** | (383) ÷ (4) = | | | | 16.22 | (384) |
| **EI rating (section 14)** | | | | | 87.36 | (385) |

# Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.50
*Printed on 06 December 2021 at 10:53:32*

## Project Information:

**Assessed By:** Neil Ingham (STRO010943) **Building Type:** Flat

## Dwelling Details:

**NEW DWELLING DESIGN STAGE** Total Floor Area: 72.62m²

**Site Reference :** Highgate Road - GREEN **Plot Reference:** 05 - C

**Address :**

## Client Details:

**Name:**

**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 (c)
Fuel factor: 1.00 (mains gas (c))

| | | |
|---|---|---|
| Target Carbon Dioxide Emission Rate (TER) | 18.46 kg/m² | |
| Dwelling Carbon Dioxide Emission Rate (DER) | 15.74 kg/m² | **OK** |

## 1b TFEE and DFEE

| | | |
|---|---|---|
| Target Fabric Energy Efficiency (TFEE) | 52.6 kWh/m² | |
| Dwelling Fabric Energy Efficiency (DFEE) | 42.5 kWh/m² | |
| | | **OK** |

## 2 Fabric U-values

| Element | Average | Highest | |
|---|---|---|---|
| External wall | 0.18 (max. 0.30) | 0.18 (max. 0.70) | **OK** |
| Party wall | 0.00 (max. 0.20) | - | **OK** |
| Floor | (no floor) | | |
| Roof | (no roof) | | |
| Openings | 1.40 (max. 2.00) | 1.40 (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 | 3.00 (design value) | |
| Maximum | 10.0 | **OK** |

## 4 Heating efficiency

| | |
|---|---|
| Main Heating system: | Community heating schemes - mains gas |
| Secondary heating system: | None |

## 5 Cylinder insulation

| | |
|---|---|
| Hot water Storage: | No cylinder |

## 6 Controls

| | | |
|---|---|---|
| Space heating controls | Charging system linked to use of community heating, programmer and at least two room thermostats | **OK** |
| Hot water controls: | No cylinder thermostat<br>No cylinder | |

# Regulations Compliance Report

## 7 Low energy lights

| | | |
|---|---|---|
| Percentage of fixed lights with low-energy fittings | 100.0% | |
| Minimum | 75.0% | **OK** |

## 8 Mechanical ventilation

| | | |
|---|---|---|
| Continuous supply and extract system | | |
| Specific fan power: | 0.54 | |
| Maximum | 1.5 | **OK** |
| MVHR efficiency: | 88% | |
| Minimum | 70% | **OK** |

## 9 Summertime temperature

| | | |
|---|---|---|
| Overheating risk (Thames valley): | Slight | **OK** |
| Based on: | | |
| Overshading: | Average or unknown | |
| Windows facing: North East | $12.71m^2$ | |
| Windows facing: North West | $3.46m^2$ | |
| Ventilation rate: | 6.00 | |

## 10 Key features

| | |
|---|---|
| Air permeablility | $3.0\ m^3/m^2h$ |
| Party  Walls U-value | $0\ W/m^2K$ |
| Community heating, heat from boilers – mains gas | |

# DER WorkSheet: New dwelling design stage

User Details:

| | | | |
|---|---|---|---|
| **Assessor Name:** | Neil Ingham | **Stroma Number:** | STRO010943 |
| **Software Name:** | Stroma FSAP 2012 | **Software Version:** | Version: 1.0.5.50 |

Property Address: 05 - C

**Address :**

## 1. Overall dwelling dimensions:

| | Area(m²) | | Av. Height(m) | | Volume(m³) | |
|---|---|---|---|---|---|---|
| Ground floor | 72.62 | (1a) x | 2.65 | (2a) = | 192.44 | (3a) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n) | 72.62 | (4) | | | | |
| Dwelling volume | | | | (3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) = | 192.44 | (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 | | | | | | | 0 | x 10 = | 0 | (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) = 0 | ÷ (5) = | 0 | (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 | | 3 | (17) |
| If based on air permeability value, then | (18) = [(17) ÷ 20]+(8), otherwise (18) = (16) | 0.15 | (18) |

*Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used*

| | | | |
|---|---|---|---|
| Number of sides sheltered | | 0 | (19) |
| Shelter factor | (20) = 1 - [0.075 x (19)] = | 1 | (20) |
| Infiltration rate incorporating shelter factor | (21) = (18) x (20) = | 0.15 | (21) |

Infiltration rate modified for monthly wind speed

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Monthly average wind speed from Table 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 |
| 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 |

# DER WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.19 | 0.19 | 0.18 | 0.16 | 0.16 | 0.14 | 0.14 | 0.14 | 0.15 | 0.16 | 0.17 | 0.18 |

*Calculate effective air change rate for the applicable case*

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 74.8 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24a)m= | 0.32 | 0.31 | 0.31 | 0.29 | 0.29 | 0.27 | 0.27 | 0.26 | 0.28 | 0.29 | 0.29 | 0.3 | (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 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24d) |

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (25)m= | 0.32 | 0.31 | 0.31 | 0.29 | 0.29 | 0.27 | 0.27 | 0.26 | 0.28 | 0.29 | 0.29 | 0.3 | (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 | |
|---|---|---|---|---|---|---|---|---|---|---|
| Windows Type 1 | | | 12.71 | x1/[1/( 1.4 )+ 0.04] | | = | 16.85 | | | (27) |
| Windows Type 2 | | | 3.46 | x1/[1/( 1.4 )+ 0.04] | | = | 4.59 | | | (27) |
| Walls Type1 | 72.62 | 16.17 | 56.45 | x | 0.18 | = | 10.16 | 60 | 3387 | (29) |
| Walls Type2 | 17.78 | 0 | 17.78 | x | 0.17 | = | 2.99 | 60 | 1066.8 | (29) |
| Total area of elements, m² | | | 90.4 | | | | | | | (31) |
| Party wall | | | 30.32 | x | 0 | = | 0 | 45 | 1364.4 | (32) |
| Party floor | | | 72.62 | | | | | 40 | 2904.8 | (32a) |
| Party ceiling | | | 72.62 | | | | | 30 | 2178.6 | (32b) |
| Internal wall ** | | | 146.17 | | | | | 9 | 1315.53 | (32c) |

** 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) = 34.58 (33)

Heat capacity Cm = S(A x k ) ((28)…(30) + (32) + (32a)…(32e) = 12217.13 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 168.23 (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 7.11 (36)

*if details of thermal bridging are not known (36) = 0.05 x (31)*

Total fabric heat loss (33) + (36) = 41.69 (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= | 20.15 | 19.91 | 19.67 | 18.48 | 18.24 | 17.05 | 17.05 | 16.81 | 17.53 | 18.24 | 18.72 | 19.19 | (38) |

Heat transfer coefficient, W/K (39)m = (37) + (38)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (39)m= | 61.84 | 61.6 | 61.36 | 60.17 | 59.93 | 58.74 | 58.74 | 58.51 | 59.22 | 59.93 | 60.41 | 60.89 | |

Average = Sum(39)$_{1…12}$ /12= 60.11 (39)

# DER WorkSheet: New dwelling design stage

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (40)m= | 0.85 | 0.85 | 0.84 | 0.83 | 0.83 | 0.81 | 0.81 | 0.81 | 0.82 | 0.83 | 0.83 | 0.84 |

Average = Sum(40)$_{1…12}$ /12= 0.83 (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 2.31 (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 89.02 (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= | 97.92 | 94.36 | 90.8 | 87.24 | 83.67 | 80.11 | 80.11 | 83.67 | 87.24 | 90.8 | 94.36 | 97.92 |

Total = Sum(44)$_{1…12}$ = 1068.18 (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= | 145.21 | 127 | 131.05 | 114.25 | 109.63 | 94.6 | 87.66 | 100.59 | 101.8 | 118.63 | 129.5 | 140.63 |

Total = Sum(45)$_{1…12}$ = 1400.56 (45)

*If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)*

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (46)m= | 21.78 | 19.05 | 19.66 | 17.14 | 16.44 | 14.19 | 13.15 | 15.09 | 15.27 | 17.8 | 19.42 | 21.09 | (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) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (56)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (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= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (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= | 23.26 | 21.01 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | (59) |

# DER WorkSheet: New dwelling design stage

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 | (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= | 200.48 | 176.93 | 186.33 | 167.75 | 164.91 | 148.1 | 142.94 | 155.87 | 155.29 | 173.91 | 182.99 | 195.9 | (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= | 200.48 | 176.93 | 186.33 | 167.75 | 164.91 | 148.1 | 142.94 | 155.87 | 155.29 | 173.91 | 182.99 | 195.9 | |

Output from water heater (annual)$_{1...12}$ 2051.4 (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= | 92.5 | 82.17 | 87.8 | 80.78 | 80.67 | 74.25 | 73.37 | 77.67 | 76.64 | 83.67 | 85.85 | 90.98 | (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= | 115.4 | 115.4 | 115.4 | 115.4 | 115.4 | 115.4 | 115.4 | 115.4 | 115.4 | 115.4 | 115.4 | 115.4 | (66) |

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (67)m= | 18.13 | 16.1 | 13.09 | 9.91 | 7.41 | 6.26 | 6.76 | 8.79 | 11.79 | 14.97 | 17.48 | 18.63 | (67) |

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (68)m= | 203.33 | 205.44 | 200.13 | 188.81 | 174.52 | 161.09 | 152.12 | 150.01 | 155.32 | 166.64 | 180.93 | 194.36 | (68) |

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (69)m= | 34.54 | 34.54 | 34.54 | 34.54 | 34.54 | 34.54 | 34.54 | 34.54 | 34.54 | 34.54 | 34.54 | 34.54 | (69) |

Pumps and fans gains (Table 5a)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (70)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (70) |

Losses e.g. evaporation (negative values) (Table 5)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (71)m= | -92.32 | -92.32 | -92.32 | -92.32 | -92.32 | -92.32 | -92.32 | -92.32 | -92.32 | -92.32 | -92.32 | -92.32 | (71) |

Water heating gains (Table 5)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (72)m= | 124.33 | 122.28 | 118.01 | 112.2 | 108.43 | 103.13 | 98.61 | 104.39 | 106.45 | 112.46 | 119.24 | 122.28 | (72) |

**Total internal gains =** (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (73)m= | 403.41 | 401.44 | 388.85 | 368.54 | 347.98 | 328.09 | 315.11 | 320.81 | 331.19 | 351.69 | 375.27 | 392.9 | (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 | 12.71 | x | 11.28 | x | 0.63 | x | 0.7 | = | 43.83 | (75) |
| Northeast 0.9x | 0.77 | x | 12.71 | x | 22.97 | x | 0.63 | x | 0.7 | = | 89.21 | (75) |
| Northeast 0.9x | 0.77 | x | 12.71 | x | 41.38 | x | 0.63 | x | 0.7 | = | 160.73 | (75) |
| Northeast 0.9x | 0.77 | x | 12.71 | x | 67.96 | x | 0.63 | x | 0.7 | = | 263.96 | (75) |
| Northeast 0.9x | 0.77 | x | 12.71 | x | 91.35 | x | 0.63 | x | 0.7 | = | 354.82 | (75) |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Northeast | 0.9x | 0.77 | x | 12.71 | x | 97.38 | x | 0.63 | x | 0.7 | = | 378.27 | (75) |
| Northeast | 0.9x | 0.77 | x | 12.71 | x | 91.1 | x | 0.63 | x | 0.7 | = | 353.87 | (75) |
| Northeast | 0.9x | 0.77 | x | 12.71 | x | 72.63 | x | 0.63 | x | 0.7 | = | 282.11 | (75) |
| Northeast | 0.9x | 0.77 | x | 12.71 | x | 50.42 | x | 0.63 | x | 0.7 | = | 195.85 | (75) |
| Northeast | 0.9x | 0.77 | x | 12.71 | x | 28.07 | x | 0.63 | x | 0.7 | = | 109.02 | (75) |
| Northeast | 0.9x | 0.77 | x | 12.71 | x | 14.2 | x | 0.63 | x | 0.7 | = | 55.15 | (75) |
| Northeast | 0.9x | 0.77 | x | 12.71 | x | 9.21 | x | 0.63 | x | 0.7 | = | 35.79 | (75) |
| Northwest | 0.9x | 0.77 | x | 3.46 | x | 11.28 | x | 0.63 | x | 0.7 | = | 11.93 | (81) |
| Northwest | 0.9x | 0.77 | x | 3.46 | x | 22.97 | x | 0.63 | x | 0.7 | = | 24.29 | (81) |
| Northwest | 0.9x | 0.77 | x | 3.46 | x | 41.38 | x | 0.63 | x | 0.7 | = | 43.75 | (81) |
| Northwest | 0.9x | 0.77 | x | 3.46 | x | 67.96 | x | 0.63 | x | 0.7 | = | 71.86 | (81) |
| Northwest | 0.9x | 0.77 | x | 3.46 | x | 91.35 | x | 0.63 | x | 0.7 | = | 96.59 | (81) |
| Northwest | 0.9x | 0.77 | x | 3.46 | x | 97.38 | x | 0.63 | x | 0.7 | = | 102.98 | (81) |
| Northwest | 0.9x | 0.77 | x | 3.46 | x | 91.1 | x | 0.63 | x | 0.7 | = | 96.33 | (81) |
| Northwest | 0.9x | 0.77 | x | 3.46 | x | 72.63 | x | 0.63 | x | 0.7 | = | 76.8 | (81) |
| Northwest | 0.9x | 0.77 | x | 3.46 | x | 50.42 | x | 0.63 | x | 0.7 | = | 53.32 | (81) |
| Northwest | 0.9x | 0.77 | x | 3.46 | x | 28.07 | x | 0.63 | x | 0.7 | = | 29.68 | (81) |
| Northwest | 0.9x | 0.77 | x | 3.46 | x | 14.2 | x | 0.63 | x | 0.7 | = | 15.01 | (81) |
| Northwest | 0.9x | 0.77 | x | 3.46 | x | 9.21 | x | 0.63 | x | 0.7 | = | 9.74 | (81) |

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (83)m= | 55.76 | 113.5 | 204.48 | 335.82 | 451.41 | 481.25 | 450.2 | 358.9 | 249.17 | 138.7 | 70.16 | 45.53 | (83) |

Total gains – internal and solar (84)m = (73)m + (83)m , watts

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (84)m= | 459.17 | 514.94 | 593.33 | 704.36 | 799.39 | 809.34 | 765.31 | 679.71 | 580.35 | 490.4 | 445.43 | 438.43 | (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= | 0.99 | 0.98 | 0.94 | 0.84 | 0.65 | 0.46 | 0.34 | 0.39 | 0.66 | 0.91 | 0.98 | 0.99 | (86) |

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (87)m= | 19.91 | 20.08 | 20.38 | 20.74 | 20.93 | 20.99 | 21 | 21 | 20.95 | 20.66 | 20.23 | 19.89 | (87) |

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (88)m= | 20.21 | 20.21 | 20.21 | 20.23 | 20.23 | 20.25 | 20.25 | 20.25 | 20.24 | 20.23 | 20.23 | 20.22 | (88) |

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (89)m= | 0.98 | 0.97 | 0.93 | 0.81 | 0.61 | 0.41 | 0.28 | 0.33 | 0.6 | 0.89 | 0.97 | 0.99 | (89) |

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (90)m= | 18.74 | 18.99 | 19.42 | 19.93 | 20.17 | 20.24 | 20.24 | 20.25 | 20.2 | 19.84 | 19.23 | 18.72 | (90) |

fLA = Living area ÷ (4) = 0.38 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (92)m= | 19.19 | 19.41 | 19.79 | 20.24 | 20.46 | 20.53 | 20.53 | 20.54 | 20.49 | 20.15 | 19.61 | 19.17 | (92) |

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (93)m= | 19.19 | 19.41 | 19.79 | 20.24 | 20.46 | 20.53 | 20.53 | 20.54 | 20.49 | 20.15 | 19.61 | 19.17 | (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= | 0.98 | 0.97 | 0.93 | 0.81 | 0.62 | 0.43 | 0.3 | 0.35 | 0.62 | 0.88 | 0.96 | 0.98 | (94) |
| Useful gains, hmGm , W = (94)m x (84)m | | | | | | | | | | | | | |
| (95)m= | 449.99 | 497.58 | 549.78 | 572.64 | 498.55 | 344.88 | 230.65 | 240.9 | 360.02 | 433.61 | 429.81 | 431.1 | (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= | 920.89 | 893.8 | 815.46 | 682.31 | 525.12 | 348.22 | 231.14 | 241.92 | 378.27 | 572.65 | 755.98 | 911.39 | (97) |
| Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m | | | | | | | | | | | | | |
| (98)m= | 350.35 | 266.26 | 197.66 | 78.97 | 19.77 | 0 | 0 | 0 | 0 | 103.45 | 234.84 | 357.33 | |

| | | | |
|---|---|---|---|
| | Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = | 1608.62 | (98) |
| Space heating requirement in kWh/m²/year | | 22.15 | (99) |

## 9b. Energy requirements – Community heating scheme

| | | | |
|---|---|---|---|
| This part is used for space heating, space cooling or water heating provided by a community scheme.<br>Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none | | 0 | (301) |
| Fraction of space heat from community system 1 – (301) = | | 1 | (302) |

*The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.*

| | | | |
|---|---|---|---|
| Fraction of heat from Community boilers | | 1 | (303a) |
| Fraction of total space heat from Community boilers | (302) x (303a) = | 1 | (304a) |
| Factor for control and charging method (Table 4c(3)) for community heating system | | 1 | (305) |
| Distribution loss factor (Table 12c) for community heating system | | 1.05 | (306) |
| **Space heating** | | **kWh/year** | |
| Annual space heating requirement | | 1608.62 | |
| Space heat from Community boilers | (98) x (304a) x (305) x (306) = | 1689.05 | (307a) |
| Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) | | 0 | (308 |
| Space heating requirement from secondary/supplementary system | (98) x (301) x 100 ÷ (308) = | 0 | (309) |
| **Water heating** | | | |
| Annual water heating requirement | | 2051.4 | |
| If DHW from community scheme:<br>Water heat from Community boilers | (64) x (303a) x (305) x (306) = | 2153.97 | (310a) |
| Electricity used for heat distribution | 0.01 × [(307a)…(307e) + (310a)…(310e)] = | 38.43 | (313) |
| Cooling System Energy Efficiency Ratio | | 0 | (314) |
| Space cooling (if there is a fixed cooling system, if not enter 0) | = (107) ÷ (314) = | 0 | (315) |
| Electricity for pumps and fans within dwelling (Table 4f):<br>mechanical ventilation - balanced, extract or positive input from outside | | 177.49 | (330a) |

| | | | | | |
|---|---|---|---|---|---|
| warm air heating system fans | | | | 0 | (330b) |
| pump for solar water heating | | | | 0 | (330g) |
| Total electricity for the above, kWh/year | =(330a) + (330b) + (330g) = | | | 177.49 | (331) |
| Energy for lighting (calculated in Appendix L) | | | | 320.14 | (332) |
| Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) = | | | | 4340.66 | (338) |

## 12b. CO2 Emissions – Community heating scheme

| | | Energy kWh/year | Emission factor kg CO2/kWh | | Emissions kg CO2/year | |
|---|---|---|---|---|---|---|
| CO2 from other sources of space and water heating (not CHP) | | | | | | |
| Efficiency of heat source 1 (%) | If there is CHP using two fuels repeat (363) to (366) for the second fuel | | | | 96 | (367a) |
| CO2 associated with heat source 1 | [(307b)+(310b)] x 100 ÷ (367b) x | | 0.22 | = | 864.68 | (367) |
| Electrical energy for heat distribution | [(313) x | | 0.52 | = | 19.95 | (372) |
| Total CO2 associated with community systems | (363)…(366) + (368)...(372) | | | = | 884.62 | (373) |
| CO2 associated with space heating (secondary) | (309) x | | 0 | = | 0 | (374) |
| CO2 associated with water from immersion heater or instantaneous heater | (312) x | | 0.22 | = | 0 | (375) |
| Total CO2 associated with space and water heating | (373) + (374) + (375) = | | | | 884.62 | (376) |
| CO2 associated with electricity for pumps and fans within dwelling | (331)) x | | 0.52 | = | 92.12 | (378) |
| CO2 associated with electricity for lighting | (332))) x | | 0.52 | = | 166.15 | (379) |
| **Total CO2, kg/year** | sum of (376)…(382) = | | | | 1142.9 | (383) |
| **Dwelling CO2 Emission Rate** | (383) ÷ (4) = | | | | 15.74 | (384) |
| **EI rating (section 14)** | | | | | 86.98 | (385) |

# Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.50
*Printed on 06 December 2021 at 10:53:31*

## Project Information:

**Assessed By:** Neil Ingham (STRO010943) **Building Type:** Flat

## Dwelling Details:

**NEW DWELLING DESIGN STAGE** Total Floor Area: 53.96m²

**Site Reference :** Highgate Road - GREEN **Plot Reference:** 05 - D

**Address :**

## Client Details:

**Name:**

**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 (c)
Fuel factor: 1.00 (mains gas (c))

| | | |
|---|---|---|
| Target Carbon Dioxide Emission Rate (TER) | 20.99 kg/m² | |
| Dwelling Carbon Dioxide Emission Rate (DER) | 17.99 kg/m² | **OK** |

## 1b TFEE and DFEE

| | | |
|---|---|---|
| Target Fabric Energy Efficiency (TFEE) | 57.6 kWh/m² | |
| Dwelling Fabric Energy Efficiency (DFEE) | 46.3 kWh/m² | |
| | | **OK** |

## 2 Fabric U-values

| Element | Average | Highest | |
|---|---|---|---|
| External wall | 0.17 (max. 0.30) | 0.18 (max. 0.70) | **OK** |
| Party wall | 0.00 (max. 0.20) | - | **OK** |
| Floor | (no floor) | | |
| Roof | 0.13 (max. 0.20) | 0.13 (max. 0.35) | **OK** |
| Openings | 1.40 (max. 2.00) | 1.40 (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 | 3.00 (design value) | |
| Maximum | 10.0 | **OK** |

## 4 Heating efficiency

| | |
|---|---|
| Main Heating system: | Community heating schemes - mains gas |
| Secondary heating system: | None |

## 5 Cylinder insulation

| | |
|---|---|
| Hot water Storage: | No cylinder |

## 6 Controls

| | | |
|---|---|---|
| Space heating controls | Charging system linked to use of community heating, programmer and at least two room thermostats | **OK** |
| Hot water controls: | No cylinder thermostat<br>No cylinder | |

# Regulations Compliance Report

## 7 Low energy lights

| | | |
|---|---|---|
| Percentage of fixed lights with low-energy fittings | 100.0% | |
| Minimum | 75.0% | **OK** |

## 8 Mechanical ventilation

| | | |
|---|---|---|
| Continuous supply and extract system | | |
| Specific fan power: | 0.47 | |
| Maximum | 1.5 | **OK** |
| MVHR efficiency: | 89% | |
| Minimum | 70% | **OK** |

## 9 Summertime temperature

| | | |
|---|---|---|
| Overheating risk (Thames valley): | Medium | **OK** |
| Based on: | | |
| Overshading: | Average or unknown | |
| Windows facing: North East | 12.07m² | |
| Ventilation rate: | 4.00 | |

## 10 Key features

| | |
|---|---|
| Air permeablility | 3.0 m³/m²h |
| Party Walls U-value | 0 W/m²K |
| Community heating, heat from boilers – mains gas | |

# DER WorkSheet: New dwelling design stage

## User Details:

| | | | |
|---|---|---|---|
| **Assessor Name:** | Neil Ingham | **Stroma Number:** | STRO010943 |
| **Software Name:** | Stroma FSAP 2012 | **Software Version:** | Version: 1.0.5.50 |

Property Address: 05 - D

**Address :**

## 1. Overall dwelling dimensions:

| | Area(m²) | | Av. Height(m) | | Volume(m³) | |
|---|---|---|---|---|---|---|
| Ground floor | 53.96 | (1a) x | 2.65 | (2a) = | 142.99 | (3a) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n) | 53.96 | (4) | | | | |
| Dwelling volume | | | | (3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) = | 142.99 | (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 | | | | | | | 0 | x 10 = | 0 | (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) = | 0 | ÷ (5) = | 0 | (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 | | 3 | (17) |
| If based on air permeability value, then | (18) = [(17) ÷ 20]+(8), otherwise (18) = (16) | 0.15 | (18) |
| *Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used* | | | |
| Number of sides sheltered | | 0 | (19) |
| Shelter factor | (20) = 1 - [0.075 x (19)] = | 1 | (20) |
| Infiltration rate incorporating shelter factor | (21) = (18) x (20) = | 0.15 | (21) |

Infiltration rate modified for monthly wind speed

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|

Monthly average wind speed from Table 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 |

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 |

# DER WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.19 | 0.19 | 0.18 | 0.16 | 0.16 | 0.14 | 0.14 | 0.14 | 0.15 | 0.16 | 0.17 | 0.18 |

*Calculate effective air change rate for the applicable case*

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 75.65 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24a)m= | 0.31 | 0.31 | 0.31 | 0.29 | 0.28 | 0.26 | 0.26 | 0.26 | 0.27 | 0.28 | 0.29 | 0.3 | (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 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24d) |

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (25)m= | 0.31 | 0.31 | 0.31 | 0.29 | 0.28 | 0.26 | 0.26 | 0.26 | 0.27 | 0.28 | 0.29 | 0.3 | (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 | |
|---|---|---|---|---|---|---|---|---|---|---|
| Windows | | | 12.07 | x1/[1/( 1.4 )+ 0.04] | | = | 16 | | | (27) |
| Walls Type1 | 27.66 | 12.07 | 15.59 | x | 0.18 | = | 2.81 | 60 | 935.4 | (29) |
| Walls Type2 | 24.24 | 0 | 24.24 | x | 0.17 | = | 4.07 | 60 | 1454.4 | (29) |
| Roof | 53.96 | 0 | 53.96 | x | 0.13 | = | 7.01 | 9 | 485.64 | (30) |
| Total area of elements, m² | | | 105.86 | | | | | | | (31) |
| Party wall | | | 31.67 | x | 0 | = | 0 | 45 | 1425.15 | (32) |
| Party floor | | | 53.96 | | | | | 40 | 2158.4 | (32a) |
| Internal wall ** | | | 95.03 | | | | | 9 | 855.27 | (32c) |

** 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) = 29.89 (33)

Heat capacity Cm = S(A x k ) ((28)…(30) + (32) + (32a)…(32e) = 7314.26 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 135.55 (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 6.35 (36)

*if details of thermal bridging are not known (36) = 0.05 x (31)*

Total fabric heat loss (33) + (36) = 36.25 (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= | 14.77 | 14.59 | 14.42 | 13.53 | 13.35 | 12.47 | 12.47 | 12.29 | 12.82 | 13.35 | 13.71 | 14.06 | (38) |

Heat transfer coefficient, W/K (39)m = (37) + (38)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (39)m= | 51.01 | 50.84 | 50.66 | 49.78 | 49.6 | 48.71 | 48.71 | 48.54 | 49.07 | 49.6 | 49.95 | 50.31 | |

Average = Sum(39)$_{1\ldots12}$ /12= 49.73 (39)

Heat loss parameter (HLP), W/m²K — (40)m = (39)m ÷ (4)

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (40)m= | 0.95 | 0.94 | 0.94 | 0.92 | 0.92 | 0.9 | 0.9 | 0.9 | 0.91 | 0.92 | 0.93 | 0.93 |

Average = Sum(40)$_{1…12}$ /12= 0.92 (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 — 1.81 (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 — 77.11 (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= | 84.82 | 81.74 | 78.65 | 75.57 | 72.49 | 69.4 | 69.4 | 72.49 | 75.57 | 78.65 | 81.74 | 84.82 |

Total = Sum(44)$_{1…12}$ = 925.35 (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= | 125.79 | 110.02 | 113.53 | 98.98 | 94.97 | 81.95 | 75.94 | 87.14 | 88.18 | 102.77 | 112.18 | 121.82 |

Total = Sum(45)$_{1…12}$ = 1213.27 (45)

*If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)*

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (46)m= | 18.87 | 16.5 | 17.03 | 14.85 | 14.25 | 12.29 | 11.39 | 13.07 | 13.23 | 15.42 | 16.83 | 18.27 | (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) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) — 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a — 1.03 (52)

Temperature factor from Table 2b — 0.6 (53)

Energy lost from water storage, kWh/year — (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) — 1.03 (55)

Water storage loss calculated for each month — ((56)m = (55) × (41)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (56)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (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= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (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= | 23.26 | 21.01 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | (59) |

# DER WorkSheet: New dwelling design stage

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 | (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= | 181.07 | 159.94 | 168.8 | 152.47 | 150.25 | 135.45 | 131.22 | 142.42 | 141.68 | 158.05 | 165.67 | 177.1 | (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= | 181.07 | 159.94 | 168.8 | 152.47 | 150.25 | 135.45 | 131.22 | 142.42 | 141.68 | 158.05 | 165.67 | 177.1 | |

Output from water heater (annual)$_{1...12}$ 1864.11 (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= | 86.05 | 76.52 | 81.97 | 75.7 | 75.8 | 70.04 | 69.47 | 73.2 | 72.12 | 78.39 | 80.1 | 84.73 | (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= | 90.34 | 90.34 | 90.34 | 90.34 | 90.34 | 90.34 | 90.34 | 90.34 | 90.34 | 90.34 | 90.34 | 90.34 | (66) |

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (67)m= | 14.04 | 12.47 | 10.14 | 7.68 | 5.74 | 4.85 | 5.24 | 6.81 | 9.13 | 11.6 | 13.54 | 14.43 | (67) |

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (68)m= | 157.5 | 159.14 | 155.02 | 146.25 | 135.18 | 124.78 | 117.83 | 116.2 | 120.31 | 129.08 | 140.15 | 150.55 | (68) |

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (69)m= | 32.03 | 32.03 | 32.03 | 32.03 | 32.03 | 32.03 | 32.03 | 32.03 | 32.03 | 32.03 | 32.03 | 32.03 | (69) |

Pumps and fans gains (Table 5a)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (70)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (70) |

Losses e.g. evaporation (negative values) (Table 5)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (71)m= | -72.27 | -72.27 | -72.27 | -72.27 | -72.27 | -72.27 | -72.27 | -72.27 | -72.27 | -72.27 | -72.27 | -72.27 | (71) |

Water heating gains (Table 5)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (72)m= | 115.65 | 113.87 | 110.17 | 105.15 | 101.88 | 97.28 | 93.38 | 98.38 | 100.16 | 105.37 | 111.24 | 113.88 | (72) |

**Total internal gains =** (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (73)m= | 337.3 | 335.58 | 325.44 | 309.18 | 292.9 | 277.01 | 266.54 | 271.49 | 279.71 | 296.15 | 315.03 | 328.97 | (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 | 12.07 | x | 11.28 | x | 0.63 | x | 0.7 | = | 41.62 | (75) |
| Northeast 0.9x | 0.77 | x | 12.07 | x | 22.97 | x | 0.63 | x | 0.7 | = | 84.72 | (75) |
| Northeast 0.9x | 0.77 | x | 12.07 | x | 41.38 | x | 0.63 | x | 0.7 | = | 152.64 | (75) |
| Northeast 0.9x | 0.77 | x | 12.07 | x | 67.96 | x | 0.63 | x | 0.7 | = | 250.67 | (75) |
| Northeast 0.9x | 0.77 | x | 12.07 | x | 91.35 | x | 0.63 | x | 0.7 | = | 336.95 | (75) |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Northeast | 0.9x | 0.77 | x | 12.07 | x | 97.38 | x | 0.63 | x | 0.7 | = | 359.23 | (75) |
| Northeast | 0.9x | 0.77 | x | 12.07 | x | 91.1 | x | 0.63 | x | 0.7 | = | 336.05 | (75) |
| Northeast | 0.9x | 0.77 | x | 12.07 | x | 72.63 | x | 0.63 | x | 0.7 | = | 267.9 | (75) |
| Northeast | 0.9x | 0.77 | x | 12.07 | x | 50.42 | x | 0.63 | x | 0.7 | = | 185.99 | (75) |
| Northeast | 0.9x | 0.77 | x | 12.07 | x | 28.07 | x | 0.63 | x | 0.7 | = | 103.53 | (75) |
| Northeast | 0.9x | 0.77 | x | 12.07 | x | 14.2 | x | 0.63 | x | 0.7 | = | 52.37 | (75) |
| Northeast | 0.9x | 0.77 | x | 12.07 | x | 9.21 | x | 0.63 | x | 0.7 | = | 33.99 | (75) |

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (83)m= | 41.62 | 84.72 | 152.64 | 250.67 | 336.95 | 359.23 | 336.05 | 267.9 | 185.99 | 103.53 | 52.37 | 33.99 | (83) |

Total gains – internal and solar (84)m = (73)m + (83)m , watts

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (84)m= | 378.92 | 420.3 | 478.07 | 559.85 | 629.86 | 636.24 | 602.59 | 539.39 | 465.7 | 399.68 | 367.4 | 362.95 | (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= | 0.97 | 0.96 | 0.92 | 0.82 | 0.65 | 0.47 | 0.35 | 0.41 | 0.65 | 0.88 | 0.95 | 0.97 | (86) |

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (87)m= | 19.6 | 19.79 | 20.14 | 20.58 | 20.85 | 20.97 | 20.99 | 20.99 | 20.9 | 20.52 | 20 | 19.57 | (87) |

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (88)m= | 20.13 | 20.13 | 20.13 | 20.15 | 20.15 | 20.17 | 20.17 | 20.17 | 20.16 | 20.15 | 20.15 | 20.14 | (88) |

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (89)m= | 0.97 | 0.95 | 0.9 | 0.79 | 0.61 | 0.42 | 0.29 | 0.34 | 0.59 | 0.85 | 0.94 | 0.97 | (89) |

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (90)m= | 18.26 | 18.54 | 19.03 | 19.64 | 20 | 20.14 | 20.16 | 20.16 | 20.06 | 19.58 | 18.84 | 18.22 | (90) |

fLA = Living area ÷ (4) = 0.47 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (92)m= | 18.89 | 19.13 | 19.56 | 20.08 | 20.4 | 20.53 | 20.55 | 20.55 | 20.46 | 20.02 | 19.39 | 18.86 | (92) |

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (93)m= | 18.89 | 19.13 | 19.56 | 20.08 | 20.4 | 20.53 | 20.55 | 20.55 | 20.46 | 20.02 | 19.39 | 18.86 | (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= | 0.96 | 0.94 | 0.89 | 0.79 | 0.62 | 0.44 | 0.32 | 0.37 | 0.61 | 0.85 | 0.93 | 0.96 | (94) |
| Useful gains, hmGm , W = (94)m x (84)m | | | | | | | | | | | | | |
| (95)m= | 362.43 | 394.14 | 426.56 | 439.99 | 391.78 | 280.7 | 190.8 | 198.37 | 285.09 | 337.91 | 343.31 | 349 | (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= | 744.25 | 723.35 | 661.41 | 556.62 | 431.6 | 288.86 | 192.56 | 201.41 | 311.87 | 467.27 | 613.87 | 737.48 | (97) |
| Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m | | | | | | | | | | | | | |
| (98)m= | 284.07 | 221.23 | 174.73 | 83.98 | 29.63 | 0 | 0 | 0 | 0 | 96.24 | 194.8 | 289.02 | |

# DER WorkSheet: New dwelling design stage

| | | | |
|---|---|---|---|
| | Total per year (kWh/year) = Sum(98)1...5,9...12 = | 1373.7 | (98) |
| Space heating requirement in kWh/m²/year | | 25.46 | (99) |

## 9b. Energy requirements – Community heating scheme

| | | | |
|---|---|---|---|
| This part is used for space heating, space cooling or water heating provided by a community scheme. Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none | | 0 | (301) |
| Fraction of space heat from community system 1 – (301) = | | 1 | (302) |

*The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.*

| | | | |
|---|---|---|---|
| Fraction of heat from Community boilers | | 1 | (303a) |
| Fraction of total space heat from Community boilers | (302) x (303a) = | 1 | (304a) |
| Factor for control and charging method (Table 4c(3)) for community heating system | | 1 | (305) |
| Distribution loss factor (Table 12c) for community heating system | | 1.05 | (306) |
| **Space heating** | | **kWh/year** | |
| Annual space heating requirement | | 1373.7 | |
| Space heat from Community boilers | (98) x (304a) x (305) x (306) = | 1442.38 | (307a) |
| Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) | | 0 | (308 |
| Space heating requirement from secondary/supplementary system | (98) x (301) x 100 ÷ (308) = | 0 | (309) |
| **Water heating** | | | |
| Annual water heating requirement | | 1864.11 | |
| If DHW from community scheme: Water heat from Community boilers | (64) x (303a) x (305) x (306) = | 1957.32 | (310a) |
| Electricity used for heat distribution | 0.01 × [(307a)…(307e) + (310a)…(310e)] = | 34 | (313) |
| Cooling System Energy Efficiency Ratio | | 0 | (314) |
| Space cooling (if there is a fixed cooling system, if not enter 0) | = (107) ÷ (314) = | 0 | (315) |
| Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside | | 114.79 | (330a) |
| warm air heating system fans | | 0 | (330b) |
| pump for solar water heating | | 0 | (330g) |
| Total electricity for the above, kWh/year | =(330a) + (330b) + (330g) = | 114.79 | (331) |
| Energy for lighting (calculated in Appendix L) | | 247.96 | (332) |
| Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) = | | 3762.45 | (338) |

## 12b. CO2 Emissions – Community heating scheme

| | | Energy kWh/year | Emission factor kg CO2/kWh | | Emissions kg CO2/year | |
|---|---|---|---|---|---|---|
| CO2 from other sources of space and water heating (not CHP) Efficiency of heat source 1 (%) | If there is CHP using two fuels repeat (363) to (366) for the second fuel | | | | 96 | (367a) |
| CO2 associated with heat source 1 | [(307b)+(310b)] x 100 ÷ (367b) x | | 0.22 | = | 764.93 | (367) |
| Electrical energy for heat distribution | [(313) x | | 0.52 | = | 17.64 | (372) |

# DER WorkSheet: New dwelling design stage

| | | | | | |
|---|---|---|---|---|---|
| Total CO2 associated with community systems | (363)…(366) + (368)...(372) | | = | 782.58 | (373) |
| CO2 associated with space heating (secondary) | (309) x | 0 | = | 0 | (374) |
| CO2 associated with water from immersion heater or instantaneous heater | (312) x | 0.22 | = | 0 | (375) |
| Total CO2 associated with space and water heating | (373) + (374) + (375) = | | | 782.58 | (376) |
| CO2 associated with electricity for pumps and fans within dwelling | (331)) x | 0.52 | = | 59.58 | (378) |
| CO2 associated with electricity for lighting | (332))) x | 0.52 | = | 128.69 | (379) |
| **Total CO2, kg/year** | sum of (376)…(382) = | | | 970.85 | (383) |
| **Dwelling CO2 Emission Rate** | (383) ÷ (4) = | | | 17.99 | (384) |
| **EI rating (section 14)** | | | | 86.85 | (385) |

# Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.50
*Printed on 06 December 2021 at 10:53:30*

## Project Information:

**Assessed By:** Neil Ingham (STRO010943) **Building Type:** Flat

## Dwelling Details:

**NEW DWELLING DESIGN STAGE** Total Floor Area: 86.78m²

**Site Reference :** Highgate Road - GREEN **Plot Reference:** 05 - E

**Address :**

## Client Details:

**Name:**

**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 (c)
Fuel factor: 1.00 (mains gas (c))

| | | |
|---|---|---|
| Target Carbon Dioxide Emission Rate (TER) | 18.07 kg/m² | |
| Dwelling Carbon Dioxide Emission Rate (DER) | 16.12 kg/m² | OK |

## 1b TFEE and DFEE

| | | |
|---|---|---|
| Target Fabric Energy Efficiency (TFEE) | 55.1 kWh/m² | |
| Dwelling Fabric Energy Efficiency (DFEE) | 46.7 kWh/m² | |
| | | OK |

## 2 Fabric U-values

| Element | Average | Highest | |
|---|---|---|---|
| External wall | 0.18 (max. 0.30) | 0.18 (max. 0.70) | OK |
| Party wall | 0.00 (max. 0.20) | - | OK |
| Floor | (no floor) | | |
| Roof | 0.13 (max. 0.20) | 0.13 (max. 0.35) | OK |
| Openings | 1.40 (max. 2.00) | 1.40 (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 | 3.00 (design value) | |
| Maximum | 10.0 | OK |

## 4 Heating efficiency

Main Heating system: Community heating schemes - mains gas

Secondary heating system: None

## 5 Cylinder insulation

Hot water Storage: No cylinder

## 6 Controls

| | | |
|---|---|---|
| Space heating controls | Charging system linked to use of community heating, programmer and at least two room thermostats | OK |
| Hot water controls: | No cylinder thermostat<br>No cylinder | |

# Regulations Compliance Report

| | | |
|---|---|---|
| **7 Low energy lights** | | |
| Percentage of fixed lights with low-energy fittings | 100.0% | |
| Minimum | 75.0% | **OK** |
| **8 Mechanical ventilation** | | |
| Continuous supply and extract system | | |
| Specific fan power: | 0.54 | |
| Maximum | 1.5 | **OK** |
| MVHR efficiency: | 88% | |
| Minimum | 70% | **OK** |
| **9 Summertime temperature** | | |
| Overheating risk (Thames valley): | Slight | **OK** |
| Based on: | | |
| Overshading: | Average or unknown | |
| Windows facing: North East | 15.46m² | |
| Windows facing: South West | 5.57m² | |
| Windows facing: South West | 5.9m² | |
| Ventilation rate: | 6.00 | |
| **10 Key features** | | |
| Air permeablility | 3.0 m³/m²h | |
| Party  Walls U-value | 0 W/m²K | |
| Community heating, heat from boilers – mains gas | | |

# DER WorkSheet: New dwelling design stage

User Details:

| | | | |
|---|---|---|---|
| **Assessor Name:** | Neil Ingham | **Stroma Number:** | STRO010943 |
| **Software Name:** | Stroma FSAP 2012 | **Software Version:** | Version: 1.0.5.50 |

Property Address: 05 - E

**Address :**

## 1. Overall dwelling dimensions:

| | Area(m²) | | | Av. Height(m) | | | Volume(m³) | |
|---|---|---|---|---|---|---|---|---|
| Ground floor | 86.78 | (1a) | x | 2.65 | (2a) | = | 229.97 | (3a) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n) | 86.78 | (4) | | | | | | |
| Dwelling volume | | | | (3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) = | | | 229.97 | (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 | | | | | | | 0 | x 10 = | 0 | (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) = | 0 | ÷ (5) = | 0 | (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 | | 3 | (17) |
| If based on air permeability value, then | (18) = [(17) ÷ 20]+(8), otherwise (18) = (16) | 0.15 | (18) |

*Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used*

| | | | |
|---|---|---|---|
| Number of sides sheltered | | 0 | (19) |
| Shelter factor | (20) = 1 - [0.075 x (19)] = | 1 | (20) |
| Infiltration rate incorporating shelter factor | (21) = (18) x (20) = | 0.15 | (21) |

Infiltration rate modified for monthly wind speed

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Monthly average wind speed from Table 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 |
| 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 |

# DER WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.19 | 0.19 | 0.18 | 0.16 | 0.16 | 0.14 | 0.14 | 0.14 | 0.15 | 0.16 | 0.17 | 0.18 |

*Calculate effective air change rate for the applicable case*

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 74.8 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24a)m= | 0.32 | 0.31 | 0.31 | 0.29 | 0.29 | 0.27 | 0.27 | 0.26 | 0.28 | 0.29 | 0.29 | 0.3 | (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 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24d) |

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (25)m= | 0.32 | 0.31 | 0.31 | 0.29 | 0.29 | 0.27 | 0.27 | 0.26 | 0.28 | 0.29 | 0.29 | 0.3 | (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 | |
|---|---|---|---|---|---|---|---|---|---|---|
| Windows Type 1 | | | 15.46 | x1/[1/( 1.4 )+ 0.04] | | = | 20.5 | | | (27) |
| Windows Type 2 | | | 5.57 | x1/[1/( 1.4 )+ 0.04] | | = | 7.38 | | | (27) |
| Windows Type 3 | | | 5.9 | x1/[1/( 1.4 )+ 0.04] | | = | 7.82 | | | (27) |
| Walls Type1 | 62.71 | 26.93 | 35.78 | x | 0.18 | = | 6.44 | 60 | 2146.8 | (29) |
| Walls Type2 | 20.9 | 0 | 20.9 | x | 0.17 | = | 3.51 | 60 | 1254 | (29) |
| Roof | 86.78 | 0 | 86.78 | x | 0.13 | = | 11.28 | 9 | 781.02 | (30) |
| Total area of elements, m² | | | 170.39 | | | | | | | (31) |
| Party wall | | | 26.3 | x | 0 | = | 0 | 45 | 1183.5 | (32) |
| Party floor | | | 86.78 | | | | | 40 | 3471.2 | (32a) |
| Internal wall ** | | | 169.02 | | | | | 9 | 1521.18 | (32c) |

** 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) = 56.93 (33)

Heat capacity Cm = S(A x k ) ((28)…(30) + (32) + (32a)…(32e) = 10357.7 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 119.36 (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 8.51 (36)

*if details of thermal bridging are not known (36) = 0.05 x (31)*

Total fabric heat loss (33) + (36) = 65.44 (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 |
|---|---|---|---|---|---|---|---|---|---|---|---|

# DER WorkSheet: New dwelling design stage

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (38)m= | 24.08 | 23.79 | 23.51 | 22.08 | 21.8 | 20.38 | 20.38 | 20.09 | 20.95 | 21.8 | 22.37 | 22.94 | (38) |

Heat transfer coefficient, W/K (39)m = (37) + (38)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (39)m= | 89.52 | 89.24 | 88.95 | 87.53 | 87.24 | 85.82 | 85.82 | 85.54 | 86.39 | 87.24 | 87.81 | 88.38 | |

Average = $Sum(39)_{1...12}$ /12= 87.46 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (40)m= | 1.03 | 1.03 | 1.03 | 1.01 | 1.01 | 0.99 | 0.99 | 0.99 | 1 | 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 2.58 (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 95.45 (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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (44)m= | 105 | 101.18 | 97.36 | 93.54 | 89.72 | 85.91 | 85.91 | 89.72 | 93.54 | 97.36 | 101.18 | 105 |

*Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)*

Total = $Sum(44)_{1...12}$ = 1145.42 (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= | 155.71 | 136.18 | 140.53 | 122.52 | 117.56 | 101.44 | 94 | 107.87 | 109.16 | 127.21 | 138.86 | 150.79 |

Total = $Sum(45)_{1...12}$ = 1501.83 (45)

*If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)*

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (46)m= | 23.36 | 20.43 | 21.08 | 18.38 | 17.63 | 15.22 | 14.1 | 16.18 | 16.37 | 19.08 | 20.83 | 22.62 | (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) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (56)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (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= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (57) |

# DER WorkSheet: New dwelling design stage

| | | |
|---|---|---|
| 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= | 23.26 | 21.01 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | (59) |

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 | (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= | 210.98 | 186.11 | 195.81 | 176.01 | 172.83 | 154.94 | 149.28 | 163.15 | 162.65 | 182.49 | 192.36 | 206.07 | (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= | 210.98 | 186.11 | 195.81 | 176.01 | 172.83 | 154.94 | 149.28 | 163.15 | 162.65 | 182.49 | 192.36 | 206.07 |

| | | |
|---|---|---|
| Output from water heater (annual)$_{1...12}$ | 2152.67 | (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= | 95.99 | 85.22 | 90.95 | 83.53 | 83.31 | 76.52 | 75.48 | 80.09 | 79.09 | 86.52 | 88.97 | 94.36 | (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= | 128.95 | 128.95 | 128.95 | 128.95 | 128.95 | 128.95 | 128.95 | 128.95 | 128.95 | 128.95 | 128.95 | 128.95 | (66) |

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (67)m= | 20.77 | 18.45 | 15.01 | 11.36 | 8.49 | 7.17 | 7.75 | 10.07 | 13.52 | 17.16 | 20.03 | 21.35 | (67) |

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (68)m= | 233.03 | 235.45 | 229.35 | 216.38 | 200 | 184.61 | 174.33 | 171.91 | 178.01 | 190.98 | 207.36 | 222.75 | (68) |

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (69)m= | 35.9 | 35.9 | 35.9 | 35.9 | 35.9 | 35.9 | 35.9 | 35.9 | 35.9 | 35.9 | 35.9 | 35.9 | (69) |

Pumps and fans gains (Table 5a)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (70)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (70) |

Losses e.g. evaporation (negative values) (Table 5)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (71)m= | -103.16 | -103.16 | -103.16 | -103.16 | -103.16 | -103.16 | -103.16 | -103.16 | -103.16 | -103.16 | -103.16 | -103.16 | (71) |

Water heating gains (Table 5)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (72)m= | 129.02 | 126.82 | 122.24 | 116.02 | 111.97 | 106.28 | 101.45 | 107.64 | 109.85 | 116.29 | 123.56 | 126.83 | (72) |

**Total internal gains =** (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (73)m= | 444.51 | 442.4 | 428.28 | 405.44 | 382.16 | 359.75 | 345.21 | 351.31 | 363.06 | 386.12 | 412.63 | 432.61 | (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 | 15.46 | x | 11.28 | x | 0.63 | x | 0.7 | = | 53.31 | (75) |
| Northeast | 0.9x | 0.77 | x | 15.46 | x | 22.97 | x | 0.63 | x | 0.7 | = | 108.51 | (75) |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Northeast 0.9x | 0.77 | x | 15.46 | x | 41.38 | x | 0.63 | x | 0.7 | = | 195.51 | (75) |
| Northeast 0.9x | 0.77 | x | 15.46 | x | 67.96 | x | 0.63 | x | 0.7 | = | 321.08 | (75) |
| Northeast 0.9x | 0.77 | x | 15.46 | x | 91.35 | x | 0.63 | x | 0.7 | = | 431.59 | (75) |
| Northeast 0.9x | 0.77 | x | 15.46 | x | 97.38 | x | 0.63 | x | 0.7 | = | 460.12 | (75) |
| Northeast 0.9x | 0.77 | x | 15.46 | x | 91.1 | x | 0.63 | x | 0.7 | = | 430.43 | (75) |
| Northeast 0.9x | 0.77 | x | 15.46 | x | 72.63 | x | 0.63 | x | 0.7 | = | 343.15 | (75) |
| Northeast 0.9x | 0.77 | x | 15.46 | x | 50.42 | x | 0.63 | x | 0.7 | = | 238.23 | (75) |
| Northeast 0.9x | 0.77 | x | 15.46 | x | 28.07 | x | 0.63 | x | 0.7 | = | 132.61 | (75) |
| Northeast 0.9x | 0.77 | x | 15.46 | x | 14.2 | x | 0.63 | x | 0.7 | = | 67.08 | (75) |
| Northeast 0.9x | 0.77 | x | 15.46 | x | 9.21 | x | 0.63 | x | 0.7 | = | 43.54 | (75) |
| Southwest 0.9x | 0.77 | x | 5.57 | x | 36.79 | | 0.63 | x | 0.7 | = | 62.63 | (79) |
| Southwest 0.9x | 0.77 | x | 5.9 | x | 36.79 | | 0.63 | x | 0.7 | = | 66.34 | (79) |
| Southwest 0.9x | 0.77 | x | 5.57 | x | 62.67 | | 0.63 | x | 0.7 | = | 106.69 | (79) |
| Southwest 0.9x | 0.77 | x | 5.9 | x | 62.67 | | 0.63 | x | 0.7 | = | 113.01 | (79) |
| Southwest 0.9x | 0.77 | x | 5.57 | x | 85.75 | | 0.63 | x | 0.7 | = | 145.97 | (79) |
| Southwest 0.9x | 0.77 | x | 5.9 | x | 85.75 | | 0.63 | x | 0.7 | = | 154.62 | (79) |
| Southwest 0.9x | 0.77 | x | 5.57 | x | 106.25 | | 0.63 | x | 0.7 | = | 180.87 | (79) |
| Southwest 0.9x | 0.77 | x | 5.9 | x | 106.25 | | 0.63 | x | 0.7 | = | 191.58 | (79) |
| Southwest 0.9x | 0.77 | x | 5.57 | x | 119.01 | | 0.63 | x | 0.7 | = | 202.59 | (79) |
| Southwest 0.9x | 0.77 | x | 5.9 | x | 119.01 | | 0.63 | x | 0.7 | = | 214.59 | (79) |
| Southwest 0.9x | 0.77 | x | 5.57 | x | 118.15 | | 0.63 | x | 0.7 | = | 201.12 | (79) |
| Southwest 0.9x | 0.77 | x | 5.9 | x | 118.15 | | 0.63 | x | 0.7 | = | 213.04 | (79) |
| Southwest 0.9x | 0.77 | x | 5.57 | x | 113.91 | | 0.63 | x | 0.7 | = | 193.9 | (79) |
| Southwest 0.9x | 0.77 | x | 5.9 | x | 113.91 | | 0.63 | x | 0.7 | = | 205.39 | (79) |
| Southwest 0.9x | 0.77 | x | 5.57 | x | 104.39 | | 0.63 | x | 0.7 | = | 177.7 | (79) |
| Southwest 0.9x | 0.77 | x | 5.9 | x | 104.39 | | 0.63 | x | 0.7 | = | 188.23 | (79) |
| Southwest 0.9x | 0.77 | x | 5.57 | x | 92.85 | | 0.63 | x | 0.7 | = | 158.06 | (79) |
| Southwest 0.9x | 0.77 | x | 5.9 | x | 92.85 | | 0.63 | x | 0.7 | = | 167.42 | (79) |
| Southwest 0.9x | 0.77 | x | 5.57 | x | 69.27 | | 0.63 | x | 0.7 | = | 117.91 | (79) |
| Southwest 0.9x | 0.77 | x | 5.9 | x | 69.27 | | 0.63 | x | 0.7 | = | 124.9 | (79) |
| Southwest 0.9x | 0.77 | x | 5.57 | x | 44.07 | | 0.63 | x | 0.7 | = | 75.02 | (79) |
| Southwest 0.9x | 0.77 | x | 5.9 | x | 44.07 | | 0.63 | x | 0.7 | = | 79.46 | (79) |
| Southwest 0.9x | 0.77 | x | 5.57 | x | 31.49 | | 0.63 | x | 0.7 | = | 53.6 | (79) |
| Southwest 0.9x | 0.77 | x | 5.9 | x | 31.49 | | 0.63 | x | 0.7 | = | 56.78 | (79) |

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (83)m= | 182.29 | 328.21 | 496.1 | 693.53 | 848.77 | 874.28 | 829.73 | 709.07 | 563.71 | 375.42 | 221.56 | 153.91 | (83) |

Total gains – internal and solar (84)m = (73)m + (83)m , watts

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (84)m= | 626.8 | 770.61 | 924.39 | 1098.97 | 1230.92 | 1234.03 | 1174.94 | 1060.39 | 926.76 | 761.54 | 634.2 | 586.52 | (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= | 0.96 | 0.93 | 0.87 | 0.75 | 0.59 | 0.43 | 0.32 | 0.36 | 0.58 | 0.82 | 0.94 | 0.97 | (86) |

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (87)m= | 19.29 | 19.62 | 20.06 | 20.54 | 20.83 | 20.96 | 20.99 | 20.98 | 20.88 | 20.46 | 19.79 | 19.24 | (87) |

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (88)m= | 20.06 | 20.06 | 20.06 | 20.08 | 20.08 | 20.09 | 20.09 | 20.1 | 20.09 | 20.08 | 20.07 | 20.07 | (88) |

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (89)m= | 0.96 | 0.92 | 0.85 | 0.72 | 0.54 | 0.37 | 0.25 | 0.29 | 0.52 | 0.79 | 0.92 | 0.96 | (89) |

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (90)m= | 17.78 | 18.25 | 18.88 | 19.53 | 19.9 | 20.06 | 20.08 | 20.08 | 19.98 | 19.45 | 18.51 | 17.71 | (90) |

fLA = Living area ÷ (4) = 0.51 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (92)m= | 18.55 | 18.95 | 19.48 | 20.05 | 20.37 | 20.51 | 20.54 | 20.54 | 20.44 | 19.96 | 19.16 | 18.49 | (92) |

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (93)m= | 18.55 | 18.95 | 19.48 | 20.05 | 20.37 | 20.51 | 20.54 | 20.54 | 20.44 | 19.96 | 19.16 | 18.49 | (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= | 0.94 | 0.9 | 0.84 | 0.71 | 0.56 | 0.4 | 0.28 | 0.33 | 0.54 | 0.79 | 0.91 | 0.95 | (94) |
| Useful gains, hmGm , W = (94)m x (84)m | | | | | | | | | | | | | |
| (95)m= | 590.72 | 696.66 | 772.99 | 785.01 | 686.06 | 490.24 | 334.19 | 347.32 | 501.44 | 599.93 | 577.95 | 557.72 | (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= | 1275.65 | 1253.55 | 1154.83 | 975.65 | 756.71 | 507.51 | 338.52 | 354.11 | 547.61 | 816.8 | 1059.45 | 1262.67 | (97) |
| Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m | | | | | | | | | | | | | |
| (98)m= | 509.59 | 374.23 | 284.08 | 137.26 | 52.57 | 0 | 0 | 0 | 0 | 161.35 | 346.68 | 524.48 | |

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2390.24 (98)

Space heating requirement in kWh/m²/year 27.54 (99)

## 9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

| | | |
|---|---|---|
| Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none | 0 | (301) |
| Fraction of space heat from community system 1 – (301) = | 1 | (302) |

*The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.*

| | | |
|---|---|---|
| Fraction of heat from Community boilers | 1 | (303a) |
| Fraction of total space heat from Community boilers (302) x (303a) = | 1 | (304a) |
| Factor for control and charging method (Table 4c(3)) for community heating system | 1 | (305) |
| Distribution loss factor (Table 12c) for community heating system | 1.05 | (306) |

| **Space heating** | **kWh/year** |
|---|---|
| Annual space heating requirement | 2390.24 |

# DER WorkSheet: New dwelling design stage

| | | | |
|---|---|---|---|
| Space heat from Community boilers | (98) x (304a) x (305) x (306) = | 2509.76 | (307a) |
| Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) | | 0 | (308 |
| Space heating requirement from secondary/supplementary system | (98) x (301) x 100 ÷ (308) = | 0 | (309) |

**Water heating**

| | | | |
|---|---|---|---|
| Annual water heating requirement | | 2152.67 | |
| If DHW from community scheme:<br>Water heat from Community boilers | (64) x (303a) x (305) x (306) = | 2260.31 | (310a) |
| Electricity used for heat distribution | 0.01 × [(307a)…(307e) + (310a)…(310e)] = | 47.7 | (313) |
| Cooling System Energy Efficiency Ratio | | 0 | (314) |
| Space cooling (if there is a fixed cooling system, if not enter 0) | = (107) ÷ (314) = | 0 | (315) |
| Electricity for pumps and fans within dwelling (Table 4f):<br>mechanical ventilation - balanced, extract or positive input from outside | | 212.1 | (330a) |
| warm air heating system fans | | 0 | (330b) |
| pump for solar water heating | | 0 | (330g) |
| Total electricity for the above, kWh/year | =(330a) + (330b) + (330g) = | 212.1 | (331) |
| Energy for lighting (calculated in Appendix L) | | 366.89 | (332) |
| Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) = | | 5349.05 | (338) |

## 12b. CO2 Emissions – Community heating scheme

| | | Energy kWh/year | Emission factor kg CO2/kWh | | Emissions kg CO2/year | |
|---|---|---|---|---|---|---|
| CO2 from other sources of space and water heating (not CHP)<br>Efficiency of heat source 1 (%) | If there is CHP using two fuels repeat (363) to (366) for the second fuel | | | | 96 | (367a) |
| CO2 associated with heat source 1 | [(307b)+(310b)] x 100 ÷ (367b) x | | 0.22 | = | 1073.26 | (367) |
| Electrical energy for heat distribution | [(313) x | | 0.52 | = | 24.76 | (372) |
| Total CO2 associated with community systems | (363)…(366) + (368)...(372) | | | = | 1098.02 | (373) |
| CO2 associated with space heating (secondary) | (309) x | | 0 | = | 0 | (374) |
| CO2 associated with water from immersion heater or instantaneous heater | (312) x | | 0.22 | = | 0 | (375) |
| Total CO2 associated with space and water heating | (373) + (374) + (375) = | | | | 1098.02 | (376) |
| CO2 associated with electricity for pumps and fans within dwelling | (331)) x | | 0.52 | = | 110.08 | (378) |
| CO2 associated with electricity for lighting | (332))) x | | 0.52 | = | 190.41 | (379) |
| **Total CO2, kg/year** | sum of (376)…(382) = | | | | 1398.52 | (383) |
| **Dwelling CO2 Emission Rate** | (383) ÷ (4) = | | | | 16.12 | (384) |
| **EI rating (section 14)** | | | | | 85.78 | (385) |

# Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.50
*Printed on 06 December 2021 at 10:53:29*

## Project Information:

**Assessed By:** Neil Ingham (STRO010943) **Building Type:** Flat

## Dwelling Details:

**NEW DWELLING DESIGN STAGE** Total Floor Area: 103.81m²

**Site Reference :** Highgate Road - GREEN **Plot Reference:** 06 - A

**Address :**

## Client Details:

**Name:**

**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 (c)
Fuel factor: 1.00 (mains gas (c))

| | | |
|---|---|---|
| Target Carbon Dioxide Emission Rate (TER) | 17.03 kg/m² | |
| Dwelling Carbon Dioxide Emission Rate (DER) | 14.76 kg/m² | OK |

## 1b TFEE and DFEE

| | | |
|---|---|---|
| Target Fabric Energy Efficiency (TFEE) | 54.4 kWh/m² | |
| Dwelling Fabric Energy Efficiency (DFEE) | 44.2 kWh/m² | |
| | | OK |

## 2 Fabric U-values

| Element | Average | Highest | |
|---|---|---|---|
| External wall | 0.18 (max. 0.30) | 0.18 (max. 0.70) | OK |
| Party wall | 0.00 (max. 0.20) | - | OK |
| Floor | (no floor) | | |
| Roof | 0.13 (max. 0.20) | 0.13 (max. 0.35) | OK |
| Openings | 1.40 (max. 2.00) | 1.40 (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 | 3.00 (design value) | |
| Maximum | 10.0 | OK |

## 4 Heating efficiency

Main Heating system: Community heating schemes - mains gas

Secondary heating system: None

## 5 Cylinder insulation

Hot water Storage: No cylinder

## 6 Controls

| | | |
|---|---|---|
| Space heating controls | Charging system linked to use of community heating, programmer and at least two room thermostats | OK |
| Hot water controls: | No cylinder thermostat<br>No cylinder | |

# Regulations Compliance Report

## 7 Low energy lights

| | | |
|---|---|---|
| Percentage of fixed lights with low-energy fittings | 100.0% | |
| Minimum | 75.0% | **OK** |

## 8 Mechanical ventilation

| | | |
|---|---|---|
| Continuous supply and extract system | | |
| Specific fan power: | 0.54 | |
| Maximum | 1.5 | **OK** |
| MVHR efficiency: | 88% | |
| Minimum | 70% | **OK** |

## 9 Summertime temperature

| | | |
|---|---|---|
| Overheating risk (Thames valley): | Slight | **OK** |

Based on:

| | |
|---|---|
| Overshading: | Average or unknown |
| Windows facing: South West | 13.21m² |
| Windows facing: South East | 5.5m² |
| Windows facing: North West | 4.61m² |
| Ventilation rate: | 6.00 |

## 10 Key features

| | |
|---|---|
| Air permeablility | 3.0 m³/m²h |
| Party  Walls U-value | 0 W/m²K |
| Community heating, heat from boilers – mains gas | |

# DER WorkSheet: New dwelling design stage

## User Details:

| | | | |
|---|---|---|---|
| **Assessor Name:** | Neil Ingham | **Stroma Number:** | STRO010943 |
| **Software Name:** | Stroma FSAP 2012 | **Software Version:** | Version: 1.0.5.50 |

Property Address: 06 - A

**Address :**

## 1. Overall dwelling dimensions:

| | Area(m²) | | Av. Height(m) | | Volume(m³) | |
|---|---|---|---|---|---|---|
| Ground floor | 103.81 | (1a) x | 2.65 | (2a) = | 275.1 | (3a) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n) | 103.81 | (4) | | | | |
| Dwelling volume | | | (3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) = | | 275.1 | (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 | | | | | | | 0 | x 10 = | 0 | (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) = | 0 | ÷ (5) = | 0 | (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 | | 3 | (17) |
| If based on air permeability value, then | (18) = [(17) ÷ 20]+(8), otherwise (18) = (16) | 0.15 | (18) |

*Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used*

| | | | |
|---|---|---|---|
| Number of sides sheltered | | 0 | (19) |
| Shelter factor | (20) = 1 - [0.075 x (19)] = | 1 | (20) |
| Infiltration rate incorporating shelter factor | (21) = (18) x (20) = | 0.15 | (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 |

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 |

# DER WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.19 | 0.19 | 0.18 | 0.16 | 0.16 | 0.14 | 0.14 | 0.14 | 0.15 | 0.16 | 0.17 | 0.18 |

*Calculate effective air change rate for the applicable case*

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 74.8 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24a)m= | 0.32 | 0.31 | 0.31 | 0.29 | 0.29 | 0.27 | 0.27 | 0.26 | 0.28 | 0.29 | 0.29 | 0.3 | (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 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24d) |

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (25)m= | 0.32 | 0.31 | 0.31 | 0.29 | 0.29 | 0.27 | 0.27 | 0.26 | 0.28 | 0.29 | 0.29 | 0.3 | (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 | |
|---|---|---|---|---|---|---|---|---|
| Windows Type 1 | | | 13.21 | x1/[1/( 1.4 )+ 0.04] = | 17.51 | | | (27) |
| Windows Type 2 | | | 5.5 | x1/[1/( 1.4 )+ 0.04] = | 7.29 | | | (27) |
| Windows Type 3 | | | 4.61 | x1/[1/( 1.4 )+ 0.04] = | 6.11 | | | (27) |
| Walls Type1 | 76.16 | 23.32 | 52.84 | x 0.18 = | 9.51 | 60 | 3170.4 | (29) |
| Walls Type2 | 49.77 | 0 | 49.77 | x 0.17 = | 8.36 | 60 | 2986.2 | (29) |
| Roof | 103.81 | 0 | 103.81 | x 0.13 = | 13.5 | 9 | 934.29 | (30) |
| Total area of elements, m² | | | 229.74 | | | | | (31) |
| Party wall | | | 12.14 | x 0 = | 0 | 45 | 546.3 | (32) |
| Party floor | | | 103.81 | | | 40 | 4152.4 | (32a) |
| Internal wall ** | | | 193.17 | | | 9 | 1738.53 | (32c) |

** 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) = 62.28 (33)

Heat capacity Cm = S(A x k ) ((28)…(30) + (32) + (32a)…(32e) = 13528.12 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 130.32 (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 10.29 (36)

*if details of thermal bridging are not known (36) = 0.05 x (31)*

Total fabric heat loss (33) + (36) = 72.57 (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 |
|---|---|---|---|---|---|---|---|---|---|---|---|

# DER WorkSheet: New dwelling design stage

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (38)m= | 28.8 | 28.46 | 28.12 | 26.42 | 26.08 | 24.37 | 24.37 | 24.03 | 25.06 | 26.08 | 26.76 | 27.44 | (38) |

Heat transfer coefficient, W/K (39)m = (37) + (38)m

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (39)m= | 101.37 | 101.03 | 100.69 | 98.99 | 98.65 | 96.94 | 96.94 | 96.6 | 97.63 | 98.65 | 99.33 | 100.01 |

Average = Sum(39)$_{1…12}$ /12= 98.9 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (40)m= | 0.98 | 0.97 | 0.97 | 0.95 | 0.95 | 0.93 | 0.93 | 0.93 | 0.94 | 0.95 | 0.96 | 0.96 |

Average = Sum(40)$_{1…12}$ /12= 0.95 (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 2.77 (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) + 36 100.04 (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= | 110.04 | 106.04 | 102.04 | 98.04 | 94.04 | 90.03 | 90.03 | 94.04 | 98.04 | 102.04 | 106.04 | 110.04 |

Total = Sum(44)$_{1…12}$ = 1200.45 (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= | 163.19 | 142.73 | 147.28 | 128.4 | 123.2 | 106.32 | 98.52 | 113.05 | 114.4 | 133.32 | 145.53 | 158.04 |

Total = Sum(45)$_{1…12}$ = 1573.98 (45)

*If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)*

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (46)m= | 24.48 | 21.41 | 22.09 | 19.26 | 18.48 | 15.95 | 14.78 | 16.96 | 17.16 | 20 | 21.83 | 23.71 | (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) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (56)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (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= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (57) |

# DER WorkSheet: New dwelling design stage

| | | |
|---|---|---|
| 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= | 23.26 | 21.01 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | (59) |

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 | (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= | 218.46 | 192.65 | 202.56 | 181.9 | 178.48 | 159.81 | 153.79 | 168.33 | 167.89 | 188.6 | 199.03 | 213.32 | (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= | 218.46 | 192.65 | 202.56 | 181.9 | 178.48 | 159.81 | 153.79 | 168.33 | 167.89 | 188.6 | 199.03 | 213.32 |

Output from water heater (annual)1…12 | 2224.82 | (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= | 98.48 | 87.4 | 93.19 | 85.49 | 85.19 | 78.15 | 76.98 | 81.81 | 80.83 | 88.55 | 91.18 | 96.77 | (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= | 138.61 | 138.61 | 138.61 | 138.61 | 138.61 | 138.61 | 138.61 | 138.61 | 138.61 | 138.61 | 138.61 | 138.61 | (66) |

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (67)m= | 23.39 | 20.77 | 16.89 | 12.79 | 9.56 | 8.07 | 8.72 | 11.34 | 15.21 | 19.32 | 22.55 | 24.04 | (67) |

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (68)m= | 262.34 | 265.07 | 258.21 | 243.6 | 225.17 | 207.84 | 196.26 | 193.54 | 200.4 | 215.01 | 233.44 | 250.77 | (68) |

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (69)m= | 36.86 | 36.86 | 36.86 | 36.86 | 36.86 | 36.86 | 36.86 | 36.86 | 36.86 | 36.86 | 36.86 | 36.86 | (69) |

Pumps and fans gains (Table 5a)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (70)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (70) |

Losses e.g. evaporation (negative values) (Table 5)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (71)m= | -110.88 | -110.88 | -110.88 | -110.88 | -110.88 | -110.88 | -110.88 | -110.88 | -110.88 | -110.88 | -110.88 | -110.88 | (71) |

Water heating gains (Table 5)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (72)m= | 132.37 | 130.06 | 125.26 | 118.73 | 114.5 | 108.53 | 103.47 | 109.96 | 112.27 | 119.02 | 126.65 | 130.07 | (72) |

**Total internal gains =** (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (73)m= | 482.68 | 480.48 | 464.94 | 439.71 | 413.81 | 389.03 | 373.03 | 379.42 | 392.47 | 417.93 | 447.22 | 469.45 | (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) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Southeast 0.9x | 0.77 | x | 5.5 | x | 36.79 | x | 0.63 | x | 0.7 | = | 61.85 | (77) |
| Southeast 0.9x | 0.77 | x | 5.5 | x | 62.67 | x | 0.63 | x | 0.7 | = | 105.35 | (77) |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Southeast 0.9x | 0.77 | x | 5.5 | x | 85.75 | x | 0.63 | x | 0.7 | = | 144.14 | (77) |
| Southeast 0.9x | 0.77 | x | 5.5 | x | 106.25 | x | 0.63 | x | 0.7 | = | 178.6 | (77) |
| Southeast 0.9x | 0.77 | x | 5.5 | x | 119.01 | x | 0.63 | x | 0.7 | = | 200.04 | (77) |
| Southeast 0.9x | 0.77 | x | 5.5 | x | 118.15 | x | 0.63 | x | 0.7 | = | 198.6 | (77) |
| Southeast 0.9x | 0.77 | x | 5.5 | x | 113.91 | x | 0.63 | x | 0.7 | = | 191.47 | (77) |
| Southeast 0.9x | 0.77 | x | 5.5 | x | 104.39 | x | 0.63 | x | 0.7 | = | 175.47 | (77) |
| Southeast 0.9x | 0.77 | x | 5.5 | x | 92.85 | x | 0.63 | x | 0.7 | = | 156.07 | (77) |
| Southeast 0.9x | 0.77 | x | 5.5 | x | 69.27 | x | 0.63 | x | 0.7 | = | 116.43 | (77) |
| Southeast 0.9x | 0.77 | x | 5.5 | x | 44.07 | x | 0.63 | x | 0.7 | = | 74.08 | (77) |
| Southeast 0.9x | 0.77 | x | 5.5 | x | 31.49 | x | 0.63 | x | 0.7 | = | 52.93 | (77) |
| Southwest 0.9x | 0.77 | x | 13.21 | x | 36.79 | | 0.63 | x | 0.7 | = | 148.54 | (79) |
| Southwest 0.9x | 0.77 | x | 13.21 | x | 62.67 | | 0.63 | x | 0.7 | = | 253.02 | (79) |
| Southwest 0.9x | 0.77 | x | 13.21 | x | 85.75 | | 0.63 | x | 0.7 | = | 346.2 | (79) |
| Southwest 0.9x | 0.77 | x | 13.21 | x | 106.25 | | 0.63 | x | 0.7 | = | 428.95 | (79) |
| Southwest 0.9x | 0.77 | x | 13.21 | x | 119.01 | | 0.63 | x | 0.7 | = | 480.46 | (79) |
| Southwest 0.9x | 0.77 | x | 13.21 | x | 118.15 | | 0.63 | x | 0.7 | = | 476.99 | (79) |
| Southwest 0.9x | 0.77 | x | 13.21 | x | 113.91 | | 0.63 | x | 0.7 | = | 459.87 | (79) |
| Southwest 0.9x | 0.77 | x | 13.21 | x | 104.39 | | 0.63 | x | 0.7 | = | 421.44 | (79) |
| Southwest 0.9x | 0.77 | x | 13.21 | x | 92.85 | | 0.63 | x | 0.7 | = | 374.86 | (79) |
| Southwest 0.9x | 0.77 | x | 13.21 | x | 69.27 | | 0.63 | x | 0.7 | = | 279.64 | (79) |
| Southwest 0.9x | 0.77 | x | 13.21 | x | 44.07 | | 0.63 | x | 0.7 | = | 177.92 | (79) |
| Southwest 0.9x | 0.77 | x | 13.21 | x | 31.49 | | 0.63 | x | 0.7 | = | 127.12 | (79) |
| Northwest 0.9x | 0.77 | x | 4.61 | x | 11.28 | x | 0.63 | x | 0.7 | = | 15.9 | (81) |
| Northwest 0.9x | 0.77 | x | 4.61 | x | 22.97 | x | 0.63 | x | 0.7 | = | 32.36 | (81) |
| Northwest 0.9x | 0.77 | x | 4.61 | x | 41.38 | x | 0.63 | x | 0.7 | = | 58.3 | (81) |
| Northwest 0.9x | 0.77 | x | 4.61 | x | 67.96 | x | 0.63 | x | 0.7 | = | 95.74 | (81) |
| Northwest 0.9x | 0.77 | x | 4.61 | x | 91.35 | x | 0.63 | x | 0.7 | = | 128.7 | (81) |
| Northwest 0.9x | 0.77 | x | 4.61 | x | 97.38 | x | 0.63 | x | 0.7 | = | 137.2 | (81) |
| Northwest 0.9x | 0.77 | x | 4.61 | x | 91.1 | x | 0.63 | x | 0.7 | = | 128.35 | (81) |
| Northwest 0.9x | 0.77 | x | 4.61 | x | 72.63 | x | 0.63 | x | 0.7 | = | 102.32 | (81) |
| Northwest 0.9x | 0.77 | x | 4.61 | x | 50.42 | x | 0.63 | x | 0.7 | = | 71.04 | (81) |
| Northwest 0.9x | 0.77 | x | 4.61 | x | 28.07 | x | 0.63 | x | 0.7 | = | 39.54 | (81) |
| Northwest 0.9x | 0.77 | x | 4.61 | x | 14.2 | x | 0.63 | x | 0.7 | = | 20 | (81) |
| Northwest 0.9x | 0.77 | x | 4.61 | x | 9.21 | x | 0.63 | x | 0.7 | = | 12.98 | (81) |

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (83)m= | 226.28 | 390.73 | 548.63 | 703.29 | 809.2 | 812.79 | 779.69 | 699.23 | 601.97 | 435.62 | 272 | 193.03 | (83) |

Total gains – internal and solar (84)m = (73)m + (83)m , watts

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (84)m= | 708.96 | 871.2 | 1013.57 | 1143 | 1223.01 | 1201.81 | 1152.72 | 1078.65 | 994.43 | 853.54 | 719.21 | 662.48 | (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 |
|---|---|---|---|---|---|---|---|---|---|---|---|

# DER WorkSheet: New dwelling design stage

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (86)m= | 0.97 | 0.94 | 0.89 | 0.8 | 0.66 | 0.49 | 0.36 | 0.4 | 0.61 | 0.85 | 0.95 | 0.98 | (86) |

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (87)m= | 19.46 | 19.77 | 20.15 | 20.56 | 20.82 | 20.95 | 20.99 | 20.98 | 20.9 | 20.53 | 19.92 | 19.41 | (87) |

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (88)m= | 20.1 | 20.11 | 20.11 | 20.12 | 20.12 | 20.14 | 20.14 | 20.14 | 20.13 | 20.12 | 20.12 | 20.11 | (88) |

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (89)m= | 0.97 | 0.93 | 0.88 | 0.77 | 0.61 | 0.43 | 0.29 | 0.33 | 0.55 | 0.82 | 0.94 | 0.97 | (89) |

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (90)m= | 18.04 | 18.48 | 19.03 | 19.6 | 19.94 | 20.1 | 20.13 | 20.13 | 20.04 | 19.57 | 18.72 | 17.98 | (90) |

fLA = Living area ÷ (4) = 0.38 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (92)m= | 18.59 | 18.97 | 19.46 | 19.96 | 20.28 | 20.43 | 20.46 | 20.46 | 20.37 | 19.94 | 19.18 | 18.53 | (92) |

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (93)m= | 18.59 | 18.97 | 19.46 | 19.96 | 20.28 | 20.43 | 20.46 | 20.46 | 20.37 | 19.94 | 19.18 | 18.53 | (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= | 0.96 | 0.92 | 0.86 | 0.76 | 0.62 | 0.45 | 0.32 | 0.36 | 0.57 | 0.81 | 0.93 | 0.96 | (94) |
| Useful gains, hmGm , W = (94)m x (84)m | | | | | | | | | | | | | |
| (95)m= | 677.35 | 802.16 | 875.29 | 871.39 | 759.09 | 544.33 | 369.74 | 385.37 | 565.31 | 690.11 | 666.56 | 637.87 | (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= | 1448.29 | 1421.99 | 1304.63 | 1095.25 | 846.29 | 565 | 374.25 | 392.01 | 612.12 | 921.41 | 1200.31 | 1432.83 | (97) |
| Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m | | | | | | | | | | | | | |
| (98)m= | 573.58 | 416.52 | 319.43 | 161.18 | 64.88 | 0 | 0 | 0 | 0 | 172.08 | 384.3 | 591.45 | |

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2683.43 (98)

Space heating requirement in kWh/m²/year 25.85 (99)

## 9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

| | | |
|---|---|---|
| Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none | 0 | (301) |
| Fraction of space heat from community system 1 – (301) = | 1 | (302) |

*The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.*

| | | | |
|---|---|---|---|
| Fraction of heat from Community boilers | | 1 | (303a) |
| Fraction of total space heat from Community boilers | (302) x (303a) = | 1 | (304a) |
| Factor for control and charging method (Table 4c(3)) for community heating system | | 1 | (305) |
| Distribution loss factor (Table 12c) for community heating system | | 1.05 | (306) |

| **Space heating** | **kWh/year** |
|---|---|
| Annual space heating requirement | 2683.43 |

# DER WorkSheet: New dwelling design stage

| | | | |
|---|---|---|---|
| Space heat from Community boilers | (98) x (304a) x (305) x (306) = | 2817.6 | (307a) |
| Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) | | 0 | (308 |
| Space heating requirement from secondary/supplementary system | (98) x (301) x 100 ÷ (308) = | 0 | (309) |

**Water heating**

| | | | |
|---|---|---|---|
| Annual water heating requirement | | 2224.82 | |
| If DHW from community scheme:<br>Water heat from Community boilers | (64) x (303a) x (305) x (306) = | 2336.06 | (310a) |
| Electricity used for heat distribution | 0.01 × [(307a)…(307e) + (310a)…(310e)] = | 51.54 | (313) |
| Cooling System Energy Efficiency Ratio | | 0 | (314) |
| Space cooling (if there is a fixed cooling system, if not enter 0) | = (107) ÷ (314) = | 0 | (315) |
| Electricity for pumps and fans within dwelling (Table 4f):<br>mechanical ventilation - balanced, extract or positive input from outside | | 253.73 | (330a) |
| warm air heating system fans | | 0 | (330b) |
| pump for solar water heating | | 0 | (330g) |
| Total electricity for the above, kWh/year | =(330a) + (330b) + (330g) = | 253.73 | (331) |
| Energy for lighting (calculated in Appendix L) | | 412.99 | (332) |
| Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) = | | 5820.38 | (338) |

## 12b. CO2 Emissions – Community heating scheme

| | | Energy kWh/year | Emission factor kg CO2/kWh | | Emissions kg CO2/year | |
|---|---|---|---|---|---|---|
| CO2 from other sources of space and water heating (not CHP)<br>Efficiency of heat source 1 (%) | If there is CHP using two fuels repeat (363) to (366) for the second fuel | | | | 96 | (367a) |
| CO2 associated with heat source 1 | [(307b)+(310b)] x 100 ÷ (367b) x | | 0.22 | = | 1159.57 | (367) |
| Electrical energy for heat distribution | [(313) x | | 0.52 | = | 26.75 | (372) |
| Total CO2 associated with community systems | (363)…(366) + (368)...(372) | | | = | 1186.32 | (373) |
| CO2 associated with space heating (secondary) | (309) x | | 0 | = | 0 | (374) |
| CO2 associated with water from immersion heater or instantaneous heater | (312) x | | 0.22 | = | 0 | (375) |
| Total CO2 associated with space and water heating | (373) + (374) + (375) = | | | | 1186.32 | (376) |
| CO2 associated with electricity for pumps and fans within dwelling | (331)) x | | 0.52 | = | 131.68 | (378) |
| CO2 associated with electricity for lighting | (332))) x | | 0.52 | = | 214.34 | (379) |
| **Total CO2, kg/year** | sum of (376)…(382) = | | | | 1532.35 | (383) |
| **Dwelling CO2 Emission Rate** | (383) ÷ (4) = | | | | 14.76 | (384) |
| **EI rating (section 14)** | | | | | 86.2 | (385) |

# Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.50
*Printed on 06 December 2021 at 10:53:28*

## Project Information:

| | | | |
|---|---|---|---|
| **Assessed By:** | Neil Ingham (STRO010943) | **Building Type:** | Flat |

## Dwelling Details:

**NEW DWELLING DESIGN STAGE** — Total Floor Area: 133.02m²

| | | | |
|---|---|---|---|
| **Site Reference :** | Highgate Road - GREEN | **Plot Reference:** | 06 - B |

**Address :**

## Client Details:

**Name:**
**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 (c)
Fuel factor: 1.00 (mains gas (c))

| | | |
|---|---|---|
| Target Carbon Dioxide Emission Rate (TER) | 17.24 kg/m² | |
| Dwelling Carbon Dioxide Emission Rate (DER) | 15.11 kg/m² | OK |

## 1b TFEE and DFEE

| | | |
|---|---|---|
| Target Fabric Energy Efficiency (TFEE) | 61.2 kWh/m² | |
| Dwelling Fabric Energy Efficiency (DFEE) | 50.3 kWh/m² | |
| | | OK |

## 2 Fabric U-values

| Element | Average | Highest | |
|---|---|---|---|
| External wall | 0.18 (max. 0.30) | 0.18 (max. 0.70) | OK |
| Party wall | 0.00 (max. 0.20) | - | OK |
| Floor | (no floor) | | |
| Roof | 0.13 (max. 0.20) | 0.13 (max. 0.35) | OK |
| Openings | 1.40 (max. 2.00) | 1.40 (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 | 3.00 (design value) | |
| Maximum | 10.0 | OK |

## 4 Heating efficiency

| | |
|---|---|
| Main Heating system: | Community heating schemes - mains gas |
| Secondary heating system: | None |

## 5 Cylinder insulation

| | |
|---|---|
| Hot water Storage: | No cylinder |

## 6 Controls

| | | |
|---|---|---|
| Space heating controls | Charging system linked to use of community heating, programmer and at least two room thermostats | OK |
| Hot water controls: | No cylinder thermostat<br>No cylinder | |

# Regulations Compliance Report

## 7 Low energy lights

| | | |
|---|---|---|
| Percentage of fixed lights with low-energy fittings | 100.0% | |
| Minimum | 75.0% | **OK** |

## 8 Mechanical ventilation

| | | |
|---|---|---|
| Continuous supply and extract system | | |
| Specific fan power: | 0.54 | |
| Maximum | 1.5 | **OK** |
| MVHR efficiency: | 88% | |
| Minimum | 70% | **OK** |

## 9 Summertime temperature

| | | |
|---|---|---|
| Overheating risk (Thames valley): | Slight | **OK** |
| Based on: | | |
| Overshading: | Average or unknown | |
| Windows facing: North East | 28.56m² | |
| Windows facing: South East | 5.5m² | |
| Windows facing: North West | 5.47m² | |
| Ventilation rate: | 6.00 | |

## 10 Key features

| | |
|---|---|
| Air permeablility | 3.0 m³/m²h |
| Party  Walls U-value | 0 W/m²K |
| Community heating, heat from boilers – mains gas | |

# DER WorkSheet: New dwelling design stage

User Details:

| | | | |
|---|---|---|---|
| **Assessor Name:** | Neil Ingham | **Stroma Number:** | STRO010943 |
| **Software Name:** | Stroma FSAP 2012 | **Software Version:** | Version: 1.0.5.50 |

Property Address: 06 - B

**Address :**

## 1. Overall dwelling dimensions:

| | Area(m²) | | Av. Height(m) | | Volume(m³) | |
|---|---|---|---|---|---|---|
| Ground floor | 133.02 | (1a) x | 2.65 | (2a) = | 352.5 | (3a) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n) | 133.02 | (4) | | | | |
| Dwelling volume | | | | (3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) = | 352.5 | (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 | | | | | | | 0 | x 10 = | 0 | (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) = | 0 ÷ (5) = | 0 | (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 | | 3 | (17) |
| If based on air permeability value, then | (18) = [(17) ÷ 20]+(8), otherwise (18) = (16) | 0.15 | (18) |
| *Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used* | | | |
| Number of sides sheltered | | 0 | (19) |
| Shelter factor | (20) = 1 - [0.075 x (19)] = | 1 | (20) |
| Infiltration rate incorporating shelter factor | (21) = (18) x (20) = | 0.15 | (21) |

Infiltration rate modified for monthly wind speed

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|

Monthly average wind speed from Table 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 |

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 |

# DER WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.19 | 0.19 | 0.18 | 0.16 | 0.16 | 0.14 | 0.14 | 0.14 | 0.15 | 0.16 | 0.17 | 0.18 |

*Calculate effective air change rate for the applicable case*

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 74.8 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24a)m= | 0.32 | 0.31 | 0.31 | 0.29 | 0.29 | 0.27 | 0.27 | 0.26 | 0.28 | 0.29 | 0.29 | 0.3 | (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 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24d) |

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (25)m= | 0.32 | 0.31 | 0.31 | 0.29 | 0.29 | 0.27 | 0.27 | 0.26 | 0.28 | 0.29 | 0.29 | 0.3 | (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 | |
|---|---|---|---|---|---|---|---|---|---|---|
| Windows Type 1 | | | 28.56 | x1/[1/( 1.4 )+ 0.04] | | = | 37.86 | | | (27) |
| Windows Type 2 | | | 5.5 | x1/[1/( 1.4 )+ 0.04] | | = | 7.29 | | | (27) |
| Windows Type 3 | | | 5.47 | x1/[1/( 1.4 )+ 0.04] | | = | 7.25 | | | (27) |
| Walls Type1 | 95.16 | 39.53 | 55.63 | x | 0.18 | = | 10.01 | 60 | 3337.8 | (29) |
| Walls Type2 | 41.02 | 0 | 41.02 | x | 0.17 | = | 6.89 | 60 | 2461.2 | (29) |
| Roof | 133.02 | 0 | 133.02 | x | 0.13 | = | 17.29 | 9 | 1197.18 | (30) |
| Total area of elements, m² | | | 269.2 | | | | | | | (31) |
| Party wall | | | 12.16 | x | 0 | = | 0 | 45 | 547.2 | (32) |
| Party floor | | | 133.02 | | | | | 40 | 5320.8 | (32a) |
| Internal wall ** | | | 196.47 | | | | | 9 | 1768.23 | (32c) |

** 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) = 86.6 (33)

Heat capacity Cm = S(A x k ) ((28)…(30) + (32) + (32a)…(32e) = 14632.41 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 110 (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 11.16 (36)

*if details of thermal bridging are not known (36) = 0.05 x (31)*

Total fabric heat loss (33) + (36) = 97.77 (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 |
|---|---|---|---|---|---|---|---|---|---|---|---|

# DER WorkSheet: New dwelling design stage

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (38)m= | 36.9 | 36.47 | 36.03 | 33.85 | 33.41 | 31.23 | 31.23 | 30.8 | 32.11 | 33.41 | 34.29 | 35.16 | (38) |

Heat transfer coefficient, W/K (39)m = (37) + (38)m

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (39)m= | 134.67 | 134.23 | 133.8 | 131.62 | 131.18 | 129 | 129 | 128.56 | 129.87 | 131.18 | 132.05 | 132.93 |

Average = Sum(39)$_{1...12}$ /12= 131.51 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (40)m= | 1.01 | 1.01 | 1.01 | 0.99 | 0.99 | 0.97 | 0.97 | 0.97 | 0.98 | 0.99 | 0.99 | 1 |

Average = Sum(40)$_{1...12}$ /12= 0.99 (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 2.9 (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) + 36 103.13 (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= | 113.45 | 109.32 | 105.2 | 101.07 | 96.94 | 92.82 | 92.82 | 96.94 | 101.07 | 105.2 | 109.32 | 113.45 |

Total = Sum(44)$_{1...12}$ = 1237.59 (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= | 168.24 | 147.14 | 151.84 | 132.37 | 127.02 | 109.61 | 101.57 | 116.55 | 117.94 | 137.45 | 150.03 | 162.93 |

Total = Sum(45)$_{1...12}$ = 1622.67 (45)

*If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)*

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (46)m= | 25.24 | 22.07 | 22.78 | 19.86 | 19.05 | 16.44 | 15.23 | 17.48 | 17.69 | 20.62 | 22.51 | 24.44 | (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) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (56)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (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= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (57) |

# DER WorkSheet: New dwelling design stage

| | | |
|---|---|---|
| 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= | 23.26 | 21.01 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | (59) |

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 | (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= | 223.51 | 197.07 | 207.11 | 185.87 | 182.29 | 163.1 | 156.84 | 171.82 | 171.43 | 192.72 | 203.53 | 218.2 | (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= | 223.51 | 197.07 | 207.11 | 185.87 | 182.29 | 163.1 | 156.84 | 171.82 | 171.43 | 192.72 | 203.53 | 218.2 | |

| | | |
|---|---|---|
| Output from water heater (annual) 1…12 | 2273.51 | (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= | 100.16 | 88.87 | 94.71 | 86.81 | 86.45 | 79.24 | 77.99 | 82.97 | 82.01 | 89.92 | 92.68 | 98.4 | (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= | 145.12 | 145.12 | 145.12 | 145.12 | 145.12 | 145.12 | 145.12 | 145.12 | 145.12 | 145.12 | 145.12 | 145.12 | (66) |

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (67)m= | 26.86 | 23.86 | 19.4 | 14.69 | 10.98 | 9.27 | 10.02 | 13.02 | 17.48 | 22.19 | 25.9 | 27.61 | (67) |

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (68)m= | 301.32 | 304.45 | 296.57 | 279.8 | 258.62 | 238.72 | 225.43 | 222.3 | 230.18 | 246.95 | 268.13 | 288.03 | (68) |

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (69)m= | 37.51 | 37.51 | 37.51 | 37.51 | 37.51 | 37.51 | 37.51 | 37.51 | 37.51 | 37.51 | 37.51 | 37.51 | (69) |

Pumps and fans gains (Table 5a)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (70)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (70) |

Losses e.g. evaporation (negative values) (Table 5)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (71)m= | -116.1 | -116.1 | -116.1 | -116.1 | -116.1 | -116.1 | -116.1 | -116.1 | -116.1 | -116.1 | -116.1 | -116.1 | (71) |

Water heating gains (Table 5)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (72)m= | 134.62 | 132.24 | 127.29 | 120.57 | 116.2 | 110.05 | 104.83 | 111.52 | 113.9 | 120.86 | 128.72 | 132.25 | (72) |

**Total internal gains =** (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (73)m= | 529.35 | 527.09 | 509.81 | 481.59 | 452.34 | 424.58 | 406.81 | 413.38 | 428.09 | 456.54 | 489.29 | 514.43 | (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 | 28.56 | x | 11.28 | x | 0.63 | x | 0.7 | = | 98.48 | (75) |
| Northeast | 0.9x | 0.77 | x | 28.56 | x | 22.97 | x | 0.63 | x | 0.7 | = | 200.46 | (75) |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Northeast 0.9x | 0.77 | x | 28.56 | x | 41.38 | x | 0.63 | x | 0.7 | = | 361.17 | (75) |
| Northeast 0.9x | 0.77 | x | 28.56 | x | 67.96 | x | 0.63 | x | 0.7 | = | 593.14 | (75) |
| Northeast 0.9x | 0.77 | x | 28.56 | x | 91.35 | x | 0.63 | x | 0.7 | = | 797.3 | (75) |
| Northeast 0.9x | 0.77 | x | 28.56 | x | 97.38 | x | 0.63 | x | 0.7 | = | 850 | (75) |
| Northeast 0.9x | 0.77 | x | 28.56 | x | 91.1 | x | 0.63 | x | 0.7 | = | 795.16 | (75) |
| Northeast 0.9x | 0.77 | x | 28.56 | x | 72.63 | x | 0.63 | x | 0.7 | = | 633.91 | (75) |
| Northeast 0.9x | 0.77 | x | 28.56 | x | 50.42 | x | 0.63 | x | 0.7 | = | 440.09 | (75) |
| Northeast 0.9x | 0.77 | x | 28.56 | x | 28.07 | x | 0.63 | x | 0.7 | = | 244.98 | (75) |
| Northeast 0.9x | 0.77 | x | 28.56 | x | 14.2 | x | 0.63 | x | 0.7 | = | 123.91 | (75) |
| Northeast 0.9x | 0.77 | x | 28.56 | x | 9.21 | x | 0.63 | x | 0.7 | = | 80.42 | (75) |
| Southeast 0.9x | 0.77 | x | 5.5 | x | 36.79 | x | 0.63 | x | 0.7 | = | 61.85 | (77) |
| Southeast 0.9x | 0.77 | x | 5.5 | x | 62.67 | x | 0.63 | x | 0.7 | = | 105.35 | (77) |
| Southeast 0.9x | 0.77 | x | 5.5 | x | 85.75 | x | 0.63 | x | 0.7 | = | 144.14 | (77) |
| Southeast 0.9x | 0.77 | x | 5.5 | x | 106.25 | x | 0.63 | x | 0.7 | = | 178.6 | (77) |
| Southeast 0.9x | 0.77 | x | 5.5 | x | 119.01 | x | 0.63 | x | 0.7 | = | 200.04 | (77) |
| Southeast 0.9x | 0.77 | x | 5.5 | x | 118.15 | x | 0.63 | x | 0.7 | = | 198.6 | (77) |
| Southeast 0.9x | 0.77 | x | 5.5 | x | 113.91 | x | 0.63 | x | 0.7 | = | 191.47 | (77) |
| Southeast 0.9x | 0.77 | x | 5.5 | x | 104.39 | x | 0.63 | x | 0.7 | = | 175.47 | (77) |
| Southeast 0.9x | 0.77 | x | 5.5 | x | 92.85 | x | 0.63 | x | 0.7 | = | 156.07 | (77) |
| Southeast 0.9x | 0.77 | x | 5.5 | x | 69.27 | x | 0.63 | x | 0.7 | = | 116.43 | (77) |
| Southeast 0.9x | 0.77 | x | 5.5 | x | 44.07 | x | 0.63 | x | 0.7 | = | 74.08 | (77) |
| Southeast 0.9x | 0.77 | x | 5.5 | x | 31.49 | x | 0.63 | x | 0.7 | = | 52.93 | (77) |
| Northwest 0.9x | 0.77 | x | 5.47 | x | 11.28 | x | 0.63 | x | 0.7 | = | 18.86 | (81) |
| Northwest 0.9x | 0.77 | x | 5.47 | x | 22.97 | x | 0.63 | x | 0.7 | = | 38.39 | (81) |
| Northwest 0.9x | 0.77 | x | 5.47 | x | 41.38 | x | 0.63 | x | 0.7 | = | 69.17 | (81) |
| Northwest 0.9x | 0.77 | x | 5.47 | x | 67.96 | x | 0.63 | x | 0.7 | = | 113.6 | (81) |
| Northwest 0.9x | 0.77 | x | 5.47 | x | 91.35 | x | 0.63 | x | 0.7 | = | 152.7 | (81) |
| Northwest 0.9x | 0.77 | x | 5.47 | x | 97.38 | x | 0.63 | x | 0.7 | = | 162.8 | (81) |
| Northwest 0.9x | 0.77 | x | 5.47 | x | 91.1 | x | 0.63 | x | 0.7 | = | 152.29 | (81) |
| Northwest 0.9x | 0.77 | x | 5.47 | x | 72.63 | x | 0.63 | x | 0.7 | = | 121.41 | (81) |
| Northwest 0.9x | 0.77 | x | 5.47 | x | 50.42 | x | 0.63 | x | 0.7 | = | 84.29 | (81) |
| Northwest 0.9x | 0.77 | x | 5.47 | x | 28.07 | x | 0.63 | x | 0.7 | = | 46.92 | (81) |
| Northwest 0.9x | 0.77 | x | 5.47 | x | 14.2 | x | 0.63 | x | 0.7 | = | 23.73 | (81) |
| Northwest 0.9x | 0.77 | x | 5.47 | x | 9.21 | x | 0.63 | x | 0.7 | = | 15.4 | (81) |

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (83)m= | 179.19 | 344.2 | 574.48 | 885.34 | 1150.04 | 1211.39 | 1138.92 | 930.79 | 680.45 | 408.33 | 221.72 | 148.75 | (83) |

Total gains – internal and solar (84)m = (73)m + (83)m , watts

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (84)m= | 708.54 | 871.29 | 1084.29 | 1366.93 | 1602.38 | 1635.98 | 1545.73 | 1344.17 | 1108.54 | 864.87 | 711.01 | 663.18 | (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 |
|---|---|---|---|---|---|---|---|---|---|---|---|

# DER WorkSheet: New dwelling design stage

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (86)m= | 0.98 | 0.96 | 0.92 | 0.81 | 0.64 | 0.47 | 0.36 | 0.42 | 0.67 | 0.89 | 0.97 | 0.98 | (86) |

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (87)m= | 18.94 | 19.24 | 19.74 | 20.35 | 20.75 | 20.93 | 20.98 | 20.96 | 20.79 | 20.21 | 19.47 | 18.89 | (87) |

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (88)m= | 20.07 | 20.08 | 20.08 | 20.09 | 20.09 | 20.11 | 20.11 | 20.11 | 20.1 | 20.09 | 20.09 | 20.08 | (88) |

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (89)m= | 0.98 | 0.95 | 0.9 | 0.78 | 0.6 | 0.42 | 0.29 | 0.35 | 0.61 | 0.87 | 0.96 | 0.98 | (89) |

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (90)m= | 17.29 | 17.73 | 18.45 | 19.3 | 19.82 | 20.05 | 20.09 | 20.09 | 19.9 | 19.13 | 18.07 | 17.23 | (90) |

fLA = Living area ÷ (4) = 0.51 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (92)m= | 18.12 | 18.49 | 19.1 | 19.83 | 20.29 | 20.49 | 20.54 | 20.53 | 20.35 | 19.67 | 18.77 | 18.07 | (92) |

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (93)m= | 18.12 | 18.49 | 19.1 | 19.83 | 20.29 | 20.49 | 20.54 | 20.53 | 20.35 | 19.67 | 18.77 | 18.07 | (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= | 0.97 | 0.94 | 0.89 | 0.77 | 0.61 | 0.44 | 0.32 | 0.38 | 0.63 | 0.86 | 0.95 | 0.97 | (94) |
| Useful gains, hmGm , W = (94)m x (84)m | | | | | | | | | | | | | |
| (95)m= | 684.11 | 819.77 | 961.78 | 1055.9 | 977.49 | 720.69 | 497.42 | 512.66 | 696.57 | 742.71 | 673.27 | 643.87 | (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= | 1861.34 | 1824.82 | 1686.06 | 1438.35 | 1126.8 | 760.2 | 508.39 | 530.98 | 812.05 | 1190.36 | 1541.61 | 1843.77 | (97) |
| Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m | | | | | | | | | | | | | |
| (98)m= | 875.86 | 675.39 | 538.87 | 275.36 | 111.09 | 0 | 0 | 0 | 0 | 333.05 | 625.21 | 892.72 | |

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 4327.55 (98)

Space heating requirement in kWh/m²/year 32.53 (99)

## 9b. Energy requirements – Community heating scheme

| | | | |
|---|---|---|---|
| This part is used for space heating, space cooling or water heating provided by a community scheme. Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none | | 0 | (301) |
| Fraction of space heat from community system 1 – (301) = | | 1 | (302) |

*The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.*

| | | | |
|---|---|---|---|
| Fraction of heat from Community boilers | | 1 | (303a) |
| Fraction of total space heat from Community boilers | (302) x (303a) = | 1 | (304a) |
| Factor for control and charging method (Table 4c(3)) for community heating system | | 1 | (305) |
| Distribution loss factor (Table 12c) for community heating system | | 1.05 | (306) |
| **Space heating** | | **kWh/year** | |
| Annual space heating requirement | | 4327.55 | |

# DER WorkSheet: New dwelling design stage

| | | | |
|---|---|---|---|
| Space heat from Community boilers | (98) x (304a) x (305) x (306) = | 4543.92 | (307a) |
| Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) | | 0 | (308 |
| Space heating requirement from secondary/supplementary system | (98) x (301) x 100 ÷ (308) = | 0 | (309) |

**Water heating**

| | | | |
|---|---|---|---|
| Annual water heating requirement | | 2273.51 | |
| If DHW from community scheme:<br>Water heat from Community boilers | (64) x (303a) x (305) x (306) = | 2387.19 | (310a) |
| Electricity used for heat distribution | 0.01 × [(307a)…(307e) + (310a)…(310e)] = | 69.31 | (313) |
| Cooling System Energy Efficiency Ratio | | 0 | (314) |
| Space cooling (if there is a fixed cooling system, if not enter 0) | = (107) ÷ (314) = | 0 | (315) |
| Electricity for pumps and fans within dwelling (Table 4f):<br>mechanical ventilation - balanced, extract or positive input from outside | | 325.12 | (330a) |
| warm air heating system fans | | 0 | (330b) |
| pump for solar water heating | | 0 | (330g) |
| Total electricity for the above, kWh/year | =(330a) + (330b) + (330g) = | 325.12 | (331) |
| Energy for lighting (calculated in Appendix L) | | 474.41 | (332) |
| Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) = | | 7730.65 | (338) |

## 12b. CO2 Emissions – Community heating scheme

| | | Energy kWh/year | Emission factor kg CO2/kWh | | Emissions kg CO2/year | |
|---|---|---|---|---|---|---|
| CO2 from other sources of space and water heating (not CHP)<br>Efficiency of heat source 1 (%) | If there is CHP using two fuels repeat (363) to (366) for the second fuel | | | | 96 | (367a) |
| CO2 associated with heat source 1 | [(307b)+(310b)] x 100 ÷ (367b) x | | 0.22 | = | 1559.5 | (367) |
| Electrical energy for heat distribution | [(313) x | | 0.52 | = | 35.97 | (372) |
| Total CO2 associated with community systems | (363)…(366) + (368)...(372) | | | = | 1595.47 | (373) |
| CO2 associated with space heating (secondary) | (309) x | | 0 | = | 0 | (374) |
| CO2 associated with water from immersion heater or instantaneous heater | (312) x | | 0.22 | = | 0 | (375) |
| Total CO2 associated with space and water heating | (373) + (374) + (375) = | | | | 1595.47 | (376) |
| CO2 associated with electricity for pumps and fans within dwelling | (331)) x | | 0.52 | = | 168.74 | (378) |
| CO2 associated with electricity for lighting | (332))) x | | 0.52 | = | 246.22 | (379) |
| **Total CO2, kg/year** | sum of (376)…(382) = | | | | 2010.43 | (383) |
| **Dwelling CO2 Emission Rate** | (383) ÷ (4) = | | | | 15.11 | (384) |
| **EI rating (section 14)** | | | | | 84.87 | (385) |