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|               |  |                 |            |
|---------------|--|-----------------|------------|
| Assessor name | Mr Adrian Fell   | Assessor number | 3536       |
| Client        |  | Last modified   | 23/05/2019 |
| Address       | B3-A-02-01 West Cromwell Road, Kensington, London, W14 8 |                 |            |

### 1. Overall dwelling dimensions

|                  | Area (m <sup>2</sup> )   |   | Average storey height (m)              |   | Volume (m <sup>3</sup> )                 |
|------------------|--|---|--|---|--|
| Lowest occupied  | <input type="text" value="62.00"/> (1a)                                    | x | <input type="text" value="2.55"/> (2a) | = | <input type="text" value="158.10"/> (3a) |
| Total floor area | (1a) + (1b) + (1c) + (1d)...(1n) = <input type="text" value="62.00"/> (4)  |   |  |   |  |
| Dwelling volume  | (3a) + (3b) + (3c) + (3d)...(3n) = <input type="text" value="158.10"/> (5) |   |  |   |  |

### 2. Ventilation rate

|                              |                                |        | m <sup>3</sup> per hour              |
|------------------------------|--------------------------------|--------|--------------------------------------|
| Number of chimneys           | <input type="text" value="0"/> | x 40 = | <input type="text" value="0"/> (6a)  |
| Number of open flues         | <input type="text" value="0"/> | x 20 = | <input type="text" value="0"/> (6b)  |
| Number of intermittent fans  | <input type="text" value="2"/> | x 10 = | <input type="text" value="20"/> (7a) |
| Number of passive vents      | <input type="text" value="0"/> | x 10 = | <input type="text" value="0"/> (7b)  |
| Number of flueless gas fires | <input type="text" value="0"/> | x 40 = | <input type="text" value="0"/> (7c)  |

|   |  | Air changes per hour                          |
|---|--|---|
| Infiltration due to chimneys, flues, fans, PSVs | (6a) + (6b) + (7a) + (7b) + (7c) = <input type="text" value="20"/> | ÷ (5) = <input type="text" value="0.13"/> (8) |

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

|  |  |
|--|--|
| Air permeability value, q <sub>50</sub> , expressed in cubic metres per hour per square metre of envelope area | <input type="text" value="5.00"/> (17) |
|--|--|

|  |  |
|--|--|
| If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16) | <input type="text" value="0.38"/> (18) |
|--|--|

|  |                                     |
|--|-------------------------------------|
| Number of sides on which the dwelling is sheltered | <input type="text" value="3"/> (19) |
|--|-------------------------------------|

|                |   |
|----------------|---|
| Shelter factor | 1 - [0.075 x (19)] = <input type="text" value="0.78"/> (20) |
|----------------|---|

|  |  |
|--|--|
| Infiltration rate incorporating shelter factor | (18) x (20) = <input type="text" value="0.29"/> (21) |
|--|--|

Infiltration rate modified for monthly wind speed:

|  | Jan                               | Feb                               | Mar                               | Apr                               | May                               | Jun                               | Jul                               | Aug                               | Sep                               | Oct                               | Nov                               | Dec                                    |
|--|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|--|
| Monthly average wind speed from Table U2 | <input type="text" value="5.10"/> | <input type="text" value="5.00"/> | <input type="text" value="4.90"/> | <input type="text" value="4.40"/> | <input type="text" value="4.30"/> | <input type="text" value="3.80"/> | <input type="text" value="3.80"/> | <input type="text" value="3.70"/> | <input type="text" value="4.00"/> | <input type="text" value="4.30"/> | <input type="text" value="4.50"/> | <input type="text" value="4.70"/> (22) |

|                       |                                   |                                   |                                   |                                   |                                   |                                   |                                   |                                   |                                   |                                   |                                   |   |
|-----------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|---|
| Wind factor (22)m ÷ 4 | <input type="text" value="1.28"/> | <input type="text" value="1.25"/> | <input type="text" value="1.23"/> | <input type="text" value="1.10"/> | <input type="text" value="1.08"/> | <input type="text" value="0.95"/> | <input type="text" value="0.95"/> | <input type="text" value="0.93"/> | <input type="text" value="1.00"/> | <input type="text" value="1.08"/> | <input type="text" value="1.13"/> | <input type="text" value="1.18"/> (22a) |
|-----------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|---|

|   |                                   |                                   |                                   |                                   |                                   |                                   |                                   |                                   |                                   |                                   |                                   |   |
|---|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|---|
| Adjusted infiltration rate (allowing for shelter and wind factor) (21) x (22a)m | <input type="text" value="0.37"/> | <input type="text" value="0.36"/> | <input type="text" value="0.36"/> | <input type="text" value="0.32"/> | <input type="text" value="0.31"/> | <input type="text" value="0.28"/> | <input type="text" value="0.28"/> | <input type="text" value="0.27"/> | <input type="text" value="0.29"/> | <input type="text" value="0.31"/> | <input type="text" value="0.33"/> | <input type="text" value="0.34"/> (22b) |
|---|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|---|

Calculate effective air change rate for the applicable case:

|   |  |
|---|--|
| If mechanical ventilation: air change rate through system | <input type="text" value="N/A"/> (23a) |
|---|--|

|  |  |
|--|--|
| If balanced with heat recovery: efficiency in % allowing for in-use factor from Table 4h | <input type="text" value="N/A"/> (23c) |
|--|--|

|  |                                   |                                   |                                   |                                   |                                   |                                   |                                   |                                   |                                   |                                   |                                   |   |
|--|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|---|
| d) natural ventilation or whole house positive input ventilation from loft | <input type="text" value="0.57"/> | <input type="text" value="0.57"/> | <input type="text" value="0.56"/> | <input type="text" value="0.55"/> | <input type="text" value="0.55"/> | <input type="text" value="0.54"/> | <input type="text" value="0.54"/> | <input type="text" value="0.54"/> | <input type="text" value="0.54"/> | <input type="text" value="0.55"/> | <input type="text" value="0.55"/> | <input type="text" value="0.56"/> (24d) |
|--|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|---|

|  |                                   |                                   |                                   |                                   |                                   |                                   |                                   |                                   |                                   |                                   |                                   |  |
|--|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|--|
| Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in (25) | <input type="text" value="0.57"/> | <input type="text" value="0.57"/> | <input type="text" value="0.56"/> | <input type="text" value="0.55"/> | <input type="text" value="0.55"/> | <input type="text" value="0.54"/> | <input type="text" value="0.54"/> | <input type="text" value="0.54"/> | <input type="text" value="0.54"/> | <input type="text" value="0.55"/> | <input type="text" value="0.55"/> | <input type="text" value="0.56"/> (25) |
|--|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|--|

### 3. Heat losses and heat loss parameter

| Element   | Gross<br>area, m <sup>2</sup> | Openings<br>m <sup>2</sup> | Net area<br>A, m <sup>2</sup> | U-value<br>W/m <sup>2</sup> K | A x U W/K                            | κ-value,<br>kJ/m <sup>2</sup> .K | A x κ,<br>kJ/K |       |       |       |       |       |      |
|---|-------------------------------|----------------------------|-------------------------------|-------------------------------|--------------------------------------|----------------------------------|----------------|-------|-------|-------|-------|-------|------|
| Window  |                               |                            | 15.04                         | x 1.33                        | = 19.94                              |                                  | (27)           |       |       |       |       |       |      |
| Ground floor  |                               |                            | 62.00                         | x 0.13                        | = 8.06                               |                                  | (28a)          |       |       |       |       |       |      |
| External wall   |                               |                            | 25.15                         | x 0.18                        | = 4.53                               |                                  | (29a)          |       |       |       |       |       |      |
| Party wall  |                               |                            | 43.50                         | x 0.00                        | = 0.00                               |                                  | (32)           |       |       |       |       |       |      |
| Total area of external elements ΣA, m <sup>2</sup>          |                               |                            | 102.19                        |                               |                                      |                                  | (31)           |       |       |       |       |       |      |
| Fabric heat loss, W/K = Σ(A × U)                            |                               |                            |                               |                               | (26)...(30) + (32) =                 | 32.53                            | (33)           |       |       |       |       |       |      |
| Heat capacity Cm = Σ(A x κ)                                 |                               |                            |                               |                               | (28)...(30) + (32) + (32a)...(32e) = | N/A                              | (34)           |       |       |       |       |       |      |
| Thermal mass parameter (TMP) in kJ/m <sup>2</sup> K         |                               |                            |                               |                               |                                      | 250.00                           | (35)           |       |       |       |       |       |      |
| Thermal bridges: Σ(L x Ψ) calculated using Appendix K       |                               |                            |                               |                               |                                      | 5.11                             | (36)           |       |       |       |       |       |      |
| Total fabric heat loss                                      |                               |                            |                               |                               | (33) + (36) =                        | 37.64                            | (37)           |       |       |       |       |       |      |
|   | Jan                           | Feb                        | Mar                           | Apr                           | May                                  | Jun                              | Jul            | Aug   | Sep   | Oct   | Nov   | Dec   |      |
| Ventilation heat loss calculated monthly 0.33 x (25)m x (5) | 29.70                         | 29.56                      | 29.42                         | 28.77                         | 28.65                                | 28.09                            | 28.09          | 27.99 | 28.31 | 28.65 | 28.90 | 29.15 | (38) |
| Heat transfer coefficient, W/K (37)m + (38)m                | 67.33                         | 67.19                      | 67.06                         | 66.41                         | 66.29                                | 65.73                            | 65.73          | 65.62 | 65.94 | 66.29 | 66.53 | 66.79 |      |
|   | Average = Σ(39)1...12/12 =    |                            |                               |                               |                                      |                                  |                |       |       |       |       | 66.41 | (39) |
| Heat loss parameter (HLP), W/m <sup>2</sup> K (39)m ÷ (4)   | 1.09                          | 1.08                       | 1.08                          | 1.07                          | 1.07                                 | 1.06                             | 1.06           | 1.06  | 1.06  | 1.07  | 1.07  | 1.08  |      |
|   | Average = Σ(40)1...12/12 =    |                            |                               |                               |                                      |                                  |                |       |       |       |       | 1.07  | (40) |
| Number of days in month (Table 1a)                          | 31.00                         | 28.00                      | 31.00                         | 30.00                         | 31.00                                | 30.00                            | 31.00          | 31.00 | 30.00 | 31.00 | 30.00 | 31.00 | (40) |

### 4. Water heating energy requirement

|  |        |        |        |        |        |       |       |       |       |        |        |                         |         |      |
|--|--------|--------|--------|--------|--------|-------|-------|-------|-------|--------|--------|-------------------------|---------|------|
| Assumed occupancy, N   |        |        |        |        |        |       |       |       |       |        |        | 2.04                    | (42)    |      |
| Annual average hot water usage in litres per day $V_{d,average} = (25 \times N) + 36$                                  |        |        |        |        |        |       |       |       |       |        |        | 82.59                   | (43)    |      |
|  | Jan    | Feb    | Mar    | Apr    | May    | Jun   | Jul   | Aug   | Sep   | Oct    | Nov    | Dec                     |         |      |
| Hot water usage in litres per day for each month $V_{d,m} = \text{factor from Table 1c} \times (43)$                   |        |        |        |        |        |       |       |       |       |        |        |                         |         |      |
|  | 90.85  | 87.55  | 84.24  | 80.94  | 77.64  | 74.33 | 74.33 | 77.64 | 80.94 | 84.24  | 87.55  | 90.85                   |         |      |
|  |        |        |        |        |        |       |       |       |       |        |        | $\Sigma(44)_{1...12} =$ | 991.11  | (44) |
| Energy content of hot water used = $4.18 \times V_{d,m} \times n_m \times T_m / 3600$ kWh/month (see Tables 1b, 1c 1d) |        |        |        |        |        |       |       |       |       |        |        |                         |         |      |
|  | 134.73 | 117.84 | 121.60 | 106.01 | 101.72 | 87.78 | 81.34 | 93.34 | 94.45 | 110.07 | 120.15 | 130.48                  |         |      |
|  |        |        |        |        |        |       |       |       |       |        |        | $\Sigma(45)_{1...12} =$ | 1299.50 | (45) |
| Distribution loss $0.15 \times (45)m$  |        |        |        |        |        |       |       |       |       |        |        |                         |         |      |
|  | 20.21  | 17.68  | 18.24  | 15.90  | 15.26  | 13.17 | 12.20 | 14.00 | 14.17 | 16.51  | 18.02  | 19.57                   | (46)    |      |
| Storage volume (litres) including any solar or WWHRS storage within same vessel  |        |        |        |        |        |       |       |       |       |        |        | 4.00                    | (47)    |      |
| Water storage loss:  |        |        |        |        |        |       |       |       |       |        |        |                         |         |      |
| a) If manufacturer's declared loss factor is known (kWh/day)   |        |        |        |        |        |       |       |       |       |        |        | 0.28                    | (48)    |      |
| Temperature factor from Table 2b   |        |        |        |        |        |       |       |       |       |        |        | 0.54                    | (49)    |      |
| Energy lost from water storage (kWh/day) $(48) \times (49)$  |        |        |        |        |        |       |       |       |       |        |        | 0.15                    | (50)    |      |
| Enter (50) or (54) in (55)   |        |        |        |        |        |       |       |       |       |        |        | 0.15                    | (55)    |      |
| Water storage loss calculated for each month $(55) \times (41)m$   |        |        |        |        |        |       |       |       |       |        |        |                         |         |      |
|  | 4.67   | 4.22   | 4.67   | 4.52   | 4.67   | 4.52  | 4.67  | 4.67  | 4.52  | 4.67   | 4.52   | 4.67                    | (56)    |      |
| If the vessel contains dedicated solar storage or dedicated WWHRS $(56)m \times [(47) - V_s] \div (47)$ , else (56)    |        |        |        |        |        |       |       |       |       |        |        |                         |         |      |
|  | 4.67   | 4.22   | 4.67   | 4.52   | 4.67   | 4.52  | 4.67  | 4.67  | 4.52  | 4.67   | 4.52   | 4.67                    | (57)    |      |
| Primary circuit loss for each month from Table 3   |        |        |        |        |        |       |       |       |       |        |        |                         |         |      |

|       |       |       |       |       |       |       |       |       |       |       |       |      |
|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------|
| 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 for each month from Table 3a, 3b or 3c

|      |      |      |      |      |      |      |      |      |      |      |      |      |
|------|------|------|------|------|------|------|------|------|------|------|------|------|
| 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | (61) |
|------|------|------|------|------|------|------|------|------|------|------|------|------|

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

|        |        |        |        |        |        |        |        |        |        |        |        |      |
|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|------|
| 162.67 | 143.07 | 149.53 | 133.05 | 129.66 | 114.81 | 109.27 | 121.27 | 121.49 | 138.01 | 147.19 | 158.42 | (62) |
|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|------|

Solar DHW input calculated using Appendix G or Appendix H

|      |      |      |      |      |      |      |      |      |      |      |      |      |
|------|------|------|------|------|------|------|------|------|------|------|------|------|
| 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | (63) |
|------|------|------|------|------|------|------|------|------|------|------|------|------|

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

|                      |        |        |        |        |        |        |        |        |        |        |         |      |
|----------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|---------|------|
| 162.67               | 143.07 | 149.53 | 133.05 | 129.66 | 114.81 | 109.27 | 121.27 | 121.49 | 138.01 | 147.19 | 158.42  |      |
| $\Sigma(64)1...12 =$ |        |        |        |        |        |        |        |        |        |        | 1628.44 | (64) |

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

|       |       |       |       |       |       |       |       |       |       |       |       |      |
|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------|
| 67.15 | 59.37 | 62.78 | 56.88 | 56.17 | 50.81 | 49.39 | 53.38 | 53.03 | 58.95 | 61.58 | 65.73 | (65) |
|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------|

## 5. Internal gains

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

Metabolic gains (Table 5)

|        |        |        |        |        |        |        |        |        |        |        |        |      |
|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|------|
| 101.88 | 101.88 | 101.88 | 101.88 | 101.88 | 101.88 | 101.88 | 101.88 | 101.88 | 101.88 | 101.88 | 101.88 | (66) |
|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|------|

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

|       |       |       |      |      |      |      |      |       |       |       |       |      |
|-------|-------|-------|------|------|------|------|------|-------|-------|-------|-------|------|
| 15.87 | 14.09 | 11.46 | 8.68 | 6.49 | 5.48 | 5.92 | 7.69 | 10.32 | 13.11 | 15.30 | 16.31 | (67) |
|-------|-------|-------|------|------|------|------|------|-------|-------|-------|-------|------|

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

|        |        |        |        |        |        |        |        |        |        |        |        |      |
|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|------|
| 177.96 | 179.81 | 175.15 | 165.25 | 152.74 | 140.99 | 133.14 | 131.29 | 135.94 | 145.85 | 158.36 | 170.11 | (68) |
|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|------|

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

|       |       |       |       |       |       |       |       |       |       |       |       |      |
|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------|
| 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) |
|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------|

Pump and fan gains (Table 5a)

|      |      |      |      |      |      |      |      |      |      |      |      |      |
|------|------|------|------|------|------|------|------|------|------|------|------|------|
| 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | (70) |
|------|------|------|------|------|------|------|------|------|------|------|------|------|

Losses e.g. evaporation (Table 5)

|        |        |        |        |        |        |        |        |        |        |        |        |      |
|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|------|
| -81.50 | -81.50 | -81.50 | -81.50 | -81.50 | -81.50 | -81.50 | -81.50 | -81.50 | -81.50 | -81.50 | -81.50 | (71) |
|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|------|

Water heating gains (Table 5)

|       |       |       |       |       |       |       |       |       |       |       |       |      |
|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------|
| 90.25 | 88.34 | 84.38 | 79.00 | 75.50 | 70.58 | 66.39 | 71.75 | 73.66 | 79.23 | 85.53 | 88.35 | (72) |
|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------|

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

|        |        |        |        |        |        |        |        |        |        |        |        |      |
|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|------|
| 340.64 | 338.81 | 327.56 | 309.48 | 291.29 | 273.60 | 262.01 | 267.30 | 276.49 | 294.75 | 315.74 | 331.33 | (73) |
|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|------|

## 6. Solar gains

|           | Access factor<br>Table 6d | Area<br>m <sup>2</sup> | Solar flux<br>W/m <sup>2</sup> | g<br>specific data<br>or Table 6b | FF<br>specific data<br>or Table 6c | Gains<br>W |              |
|-----------|---------------------------|------------------------|--------------------------------|-----------------------------------|------------------------------------|------------|--------------|
| SouthEast | 0.77                      | x 7.28                 | x 36.79                        | x 0.9                             | x 0.63                             | x 0.70     | = 81.86 (77) |
| SouthWest | 0.77                      | x 7.76                 | x 36.79                        | x 0.9                             | x 0.63                             | x 0.70     | = 87.26 (79) |

Solar gains in watts  $\Sigma(74)m...(82)m$

|        |        |        |        |        |        |        |        |        |        |        |        |      |
|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|------|
| 169.12 | 288.07 | 394.16 | 488.38 | 547.02 | 543.07 | 523.57 | 479.82 | 426.79 | 318.38 | 202.57 | 144.73 | (83) |
|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|------|

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

|        |        |        |        |        |        |        |        |        |        |        |        |      |
|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|------|
| 509.76 | 626.88 | 721.72 | 797.86 | 838.31 | 816.67 | 785.58 | 747.12 | 703.27 | 613.13 | 518.31 | 476.06 | (84) |
|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|------|

## 7. Mean internal temperature (heating season)

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

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

Utilisation factor for gains for living area n1,m (see Table 9a)

|      |      |      |      |      |      |      |      |      |      |      |      |      |
|------|------|------|------|------|------|------|------|------|------|------|------|------|
| 0.99 | 0.98 | 0.94 | 0.84 | 0.69 | 0.51 | 0.37 | 0.40 | 0.62 | 0.89 | 0.98 | 0.99 | (86) |
|------|------|------|------|------|------|------|------|------|------|------|------|------|

Mean internal temp of living area T1 (steps 3 to 7 in Table 9c)

|       |       |       |       |       |       |       |       |       |       |       |       |      |
|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------|
| 20.05 | 20.28 | 20.55 | 20.80 | 20.94 | 20.99 | 21.00 | 21.00 | 20.97 | 20.78 | 20.36 | 20.00 | (87) |
|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------|

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

|       |       |       |       |       |       |       |       |       |       |       |       |      |
|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------|
| 20.01 | 20.01 | 20.02 | 20.02 | 20.03 | 20.03 | 20.03 | 20.03 | 20.03 | 20.03 | 20.02 | 20.02 | (88) |
|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------|

Utilisation factor for gains for rest of dwelling n2,m

|      |      |      |      |      |      |      |      |      |      |      |      |      |
|------|------|------|------|------|------|------|------|------|------|------|------|------|
| 0.99 | 0.97 | 0.92 | 0.81 | 0.63 | 0.43 | 0.29 | 0.32 | 0.55 | 0.85 | 0.97 | 0.99 | (89) |
|------|------|------|------|------|------|------|------|------|------|------|------|------|

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

|       |       |       |       |       |       |       |       |       |       |       |       |      |
|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------|
| 18.77 | 19.10 | 19.47 | 19.81 | 19.98 | 20.03 | 20.03 | 20.03 | 20.01 | 19.79 | 19.22 | 18.71 | (90) |
|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------|

Living area fraction

Living area ÷ (4) = 0.69 (91)

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

|       |       |       |       |       |       |       |       |       |       |       |       |      |
|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------|
| 19.65 | 19.91 | 20.21 | 20.49 | 20.64 | 20.69 | 20.70 | 20.70 | 20.67 | 20.47 | 20.00 | 19.60 | (92) |
|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------|

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

|       |       |       |       |       |       |       |       |       |       |       |       |      |
|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------|
| 19.65 | 19.91 | 20.21 | 20.49 | 20.64 | 20.69 | 20.70 | 20.70 | 20.67 | 20.47 | 20.00 | 19.60 | (93) |
|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------|

## 8. Space heating requirement

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

Utilisation factor for gains, ηm

|      |      |      |      |      |      |      |      |      |      |      |      |      |
|------|------|------|------|------|------|------|------|------|------|------|------|------|
| 0.99 | 0.97 | 0.92 | 0.83 | 0.67 | 0.48 | 0.34 | 0.38 | 0.60 | 0.87 | 0.97 | 0.99 | (94) |
|------|------|------|------|------|------|------|------|------|------|------|------|------|

Useful gains, ηmGm, W (94)m x (84)m

|        |        |        |        |        |        |        |        |        |        |        |        |      |
|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|------|
| 503.43 | 606.51 | 666.39 | 659.34 | 561.91 | 395.79 | 268.71 | 281.02 | 420.43 | 532.19 | 503.64 | 471.71 | (95) |
|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|------|

Monthly average external temperature from Table U1

|      |      |      |      |       |       |       |       |       |       |      |      |      |
|------|------|------|------|-------|-------|-------|-------|-------|-------|------|------|------|
| 4.30 | 4.90 | 6.50 | 8.90 | 11.70 | 14.60 | 16.60 | 16.40 | 14.10 | 10.60 | 7.10 | 4.20 | (96) |
|------|------|------|------|-------|-------|-------|-------|-------|-------|------|------|------|

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

|         |         |        |        |        |        |        |        |        |        |        |         |      |
|---------|---------|--------|--------|--------|--------|--------|--------|--------|--------|--------|---------|------|
| 1033.59 | 1008.52 | 919.31 | 769.82 | 592.70 | 400.28 | 269.27 | 281.96 | 433.51 | 654.19 | 858.51 | 1028.42 | (97) |
|---------|---------|--------|--------|--------|--------|--------|--------|--------|--------|--------|---------|------|

Space heating requirement, kWh/month 0.024 x [(97)m - (95)m] x (41)m

|        |        |        |       |       |      |      |      |      |       |        |        |  |
|--------|--------|--------|-------|-------|------|------|------|------|-------|--------|--------|--|
| 394.44 | 270.16 | 188.17 | 79.54 | 22.91 | 0.00 | 0.00 | 0.00 | 0.00 | 90.76 | 255.50 | 414.19 |  |
|--------|--------|--------|-------|-------|------|------|------|------|-------|--------|--------|--|

Σ(98)1...5, 10...12 = 1715.67 (98)

Space heating requirement kWh/m²/year

(98) ÷ (4) = 27.67 (99)

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

### Space heating

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

0.00 (201)

Fraction of space heat from main system(s)

1 - (201) = 1.00 (202)

Fraction of space heat from main system 2

0.00 (202)

Fraction of total space heat from main system 1

(202) x [1- (203)] = 1.00 (204)

Fraction of total space heat from main system 2

(202) x (203) = 0.00 (205)

Efficiency of main system 1 (%)

93.50 (206)

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

Space heating fuel (main system 1), kWh/month

|        |        |        |       |       |      |      |      |      |       |        |        |  |
|--------|--------|--------|-------|-------|------|------|------|------|-------|--------|--------|--|
| 421.86 | 288.94 | 201.25 | 85.07 | 24.50 | 0.00 | 0.00 | 0.00 | 0.00 | 97.07 | 273.26 | 442.99 |  |
|--------|--------|--------|-------|-------|------|------|------|------|-------|--------|--------|--|

Σ(211)1...5, 10...12 = 1834.94 (211)

### Water heating

Efficiency of water heater

|       |       |       |       |       |       |       |       |       |       |       |       |       |
|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 87.09 | 86.49 | 85.43 | 83.49 | 81.24 | 79.80 | 79.80 | 79.80 | 79.80 | 83.73 | 86.27 | 87.26 | (217) |
|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|

Water heating fuel, kWh/month

|        |        |        |        |        |        |        |        |        |        |        |        |  |
|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--|
| 186.78 | 165.43 | 175.04 | 159.35 | 159.59 | 143.87 | 136.94 | 151.97 | 152.24 | 164.83 | 170.61 | 181.54 |  |
|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--|

Σ(219a)1...12 = 1948.19 (219)

### Annual totals

Space heating fuel - main system 1

1834.94

|   |  |         |               |
|---|--|---------|---------------|
| Water heating fuel  |  | 1948.19 |               |
| Electricity for pumps, fans and electric keep-hot (Table 4f)    |  |         |               |
| central heating pump or water pump within warm air heating unit | 30.00                                    |         | (230c)        |
| boiler flue fan   | 45.00                                    |         | (230e)        |
| Total electricity for the above, kWh/year                       |  | 75.00   | (231)         |
| Electricity for lighting (Appendix L)                           |  | 280.19  | (232)         |
| Total delivered energy for all uses                             | (211)...(221) + (231) + (232)...(237b) = |         | 4138.32 (238) |

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

|                               | Fuel<br>kWh/year |   | Fuel price                      |          | Fuel<br>cost £/year |       |
|-------------------------------|------------------|---|---------------------------------|----------|---------------------|-------|
| Space heating - main system 1 | 1834.94          | x | 3.48                            | x 0.01 = | 63.86               | (240) |
| Water heating                 | 1948.19          | x | 3.48                            | x 0.01 = | 67.80               | (247) |
| Pumps and fans                | 75.00            | x | 13.19                           | x 0.01 = | 9.89                | (249) |
| Electricity for lighting      | 280.19           | x | 13.19                           | x 0.01 = | 36.96               | (250) |
| Additional standing charges   |                  |   |                                 |          | 120.00              | (251) |
| Total energy cost             |                  |   | (240)...(242) + (245)...(254) = |          | 298.50              | (255) |

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

|                                 |       |       |
|---------------------------------|-------|-------|
| Energy cost deflator (Table 12) | 0.42  | (256) |
| Energy cost factor (ECF)        | 1.17  | (257) |
| SAP value                       | 83.65 |       |
| SAP rating (section 13)         | 84    | (258) |
| SAP band                        | B     |       |

#### 12a. CO<sub>2</sub> emissions - individual heating systems including micro-CHP

|  | Energy<br>kWh/year |   | Emission factor<br>kg CO <sub>2</sub> /kWh |   | Emissions<br>kg CO <sub>2</sub> /year |       |
|--|--------------------|---|--|---|---------------------------------------|-------|
| Space heating - main system 1          | 1834.94            | x | 0.216                                      | = | 396.35                                | (261) |
| Water heating                          | 1948.19            | x | 0.216                                      | = | 420.81                                | (264) |
| Space and water heating                |                    |   | (261) + (262) + (263) + (264) =            |   | 817.16                                | (265) |
| Pumps and fans                         | 75.00              | x | 0.519                                      | = | 38.93                                 | (267) |
| Electricity for lighting               | 280.19             | x | 0.519                                      | = | 145.42                                | (268) |
| Total CO <sub>2</sub> , kg/year        |                    |   | (265)...(271) =                            |   | 1001.50                               | (272) |
| Dwelling CO <sub>2</sub> emission rate |                    |   | (272) ÷ (4) =                              |   | 16.15                                 | (273) |
| EI value                               |                    |   |  |   | 87.46                                 |       |
| EI rating (section 14)                 |                    |   |  |   | 87                                    | (274) |
| EI band                                |                    |   |  |   | B                                     |       |

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

|   | Energy<br>kWh/year |   | Primary factor                  |   | Primary Energy<br>kWh/year |       |
|---|--------------------|---|---------------------------------|---|----------------------------|-------|
| Space heating - main system 1                         | 1834.94            | x | 1.22                            | = | 2238.63                    | (261) |
| Water heating   | 1948.19            | x | 1.22                            | = | 2376.80                    | (264) |
| Space and water heating                               |                    |   | (261) + (262) + (263) + (264) = |   | 4615.43                    | (265) |
| Pumps and fans  | 75.00              | x | 3.07                            | = | 230.25                     | (267) |
| Electricity for lighting                              | 280.19             | x | 3.07                            | = | 860.18                     | (268) |
| Primary energy kWh/year                               |                    |   |                                 |   | 5705.85                    | (272) |
| Dwelling primary energy rate kWh/m <sup>2</sup> /year |                    |   |                                 |   | 92.03                      | (273) |