

This design submission has been carried out using Approved SAP software. It has been prepared from plans and specifications and may not reflect the property as constructed.

| | | | |
|---------------|--|-----------------|------------|
| Assessor name | Miss Michelle Wang | Assessor number | 2018 |
| Client | | Last modified | 23/10/2019 |
| Address | Manor Road Richmond Block 4, Richmond, TW9 | | |

1. Overall dwelling dimensions

| | Area (m ²) | Average storey height (m) | Volume (m ³) |
|------------------|---|--|--|
| Lowest occupied | <input type="text" value="70.29"/> (1a) | <input type="text" value="2.62"/> (2a) | <input type="text" value="184.16"/> (3a) |
| Total floor area | (1a) + (1b) + (1c) + (1d)...(1n) = | | <input type="text" value="70.29"/> (4) |
| Dwelling volume | (3a) + (3b) + (3c) + (3d)...(3n) = | | <input type="text" value="184.16"/> (5) |

2. Ventilation rate

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

| | Air changes per hour |
|---|------------------------------------|
| Infiltration due to chimneys, flues, fans, PSVs | <input type="text" value="0"/> (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 ₅₀ , expressed in cubic metres per hour per square metre of envelope area | <input type="text" value="3.00"/> (17) |
| If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16) | <input type="text" value="0.15"/> (18) |
| Number of sides on which the dwelling is sheltered | <input type="text" value="3"/> (19) |
| Shelter factor | <input type="text" value="0.78"/> (20) |
| Infiltration rate incorporating shelter factor | <input type="text" value="0.12"/> (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"/> |

Wind factor (22)m ÷ 4

| | | | | | | | | | | | | |
|-----------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|
| 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"/> |
|-----------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|

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

| | | | | | | | | | | | | |
|---|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|
| Adjusted infiltration rate (allowing for shelter and wind factor) (21) x (22a)m | <input type="text" value="0.15"/> | <input type="text" value="0.15"/> | <input type="text" value="0.14"/> | <input type="text" value="0.13"/> | <input type="text" value="0.12"/> | <input type="text" value="0.11"/> | <input type="text" value="0.11"/> | <input type="text" value="0.11"/> | <input type="text" value="0.12"/> | <input type="text" value="0.12"/> | <input type="text" value="0.13"/> | <input type="text" value="0.14"/> |
|---|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|

Calculate effective air change rate for the applicable case:

If mechanical ventilation: air change rate through system (23a)

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

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

| | | | | | | | | | | | | |
|--|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|
| a) If balanced mechanical ventilation with heat recovery (MVHR) (22b)m + (23b) x [1 - (23c) ÷ 100] | <input type="text" value="0.27"/> | <input type="text" value="0.26"/> | <input type="text" value="0.26"/> | <input type="text" value="0.25"/> | <input type="text" value="0.24"/> | <input type="text" value="0.23"/> | <input type="text" value="0.23"/> | <input type="text" value="0.23"/> | <input type="text" value="0.23"/> | <input type="text" value="0.24"/> | <input type="text" value="0.25"/> | <input type="text" value="0.25"/> |
|--|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|

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

| | | | | | | | | | | | | |
|--|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|
| Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in (25) | <input type="text" value="0.27"/> | <input type="text" value="0.26"/> | <input type="text" value="0.26"/> | <input type="text" value="0.25"/> | <input type="text" value="0.24"/> | <input type="text" value="0.23"/> | <input type="text" value="0.23"/> | <input type="text" value="0.23"/> | <input type="text" value="0.23"/> | <input type="text" value="0.24"/> | <input type="text" value="0.25"/> | <input type="text" value="0.25"/> |
|--|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|

3. Heat losses and heat loss parameter

| Element | Gross area, m ² | Openings m ² | Net area A, m ² | U-value W/m ² K | A x U W/K | κ-value, kJ/m ² .K | A x κ, kJ/K | | | | | | |
|---|----------------------------|-------------------------|----------------------------|----------------------------|--------------------------------------|-------------------------------|-------------|-------|-------|-------|-------|-------|------|
| Window | | | 13.66 | 1.33 | 18.11 | | (27) | | | | | | |
| External wall | | | 27.03 | 0.15 | 4.05 | | (29a) | | | | | | |
| External wall | | | 30.94 | 0.01 | 0.31 | | (29a) | | | | | | |
| Party wall | | | 33.03 | 0.00 | 0.00 | | (32) | | | | | | |
| Total area of external elements ΣA, m ² | | | 71.63 | | | | (31) | | | | | | |
| Fabric heat loss, W/K = Σ(A x U) | | | | | (26)...(30) + (32) = | 22.47 | (33) | | | | | | |
| Heat capacity Cm = Σ(A x κ) | | | | | (28)...(30) + (32) + (32a)...(32e) = | N/A | (34) | | | | | | |
| Thermal mass parameter (TMP) in kJ/m ² K | | | | | | 100.00 | (35) | | | | | | |
| Thermal bridges: Σ(L x Ψ) calculated using Appendix K | | | | | | 12.49 | (36) | | | | | | |
| Total fabric heat loss | | | | | (33) + (36) = | 34.97 | (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) | 16.15 | 15.97 | 15.80 | 14.91 | 14.74 | 13.85 | 13.85 | 13.68 | 14.21 | 14.74 | 15.09 | 15.44 | |
| Heat transfer coefficient, W/K (37)m + (38)m | 51.12 | 50.94 | 50.76 | 49.88 | 49.70 | 48.82 | 48.82 | 48.64 | 49.17 | 49.70 | 50.06 | 50.41 | |
| | Average = Σ(39)1...12/12 = | | | | | | | | | | | 49.84 | (39) |
| Heat loss parameter (HLP), W/m ² K (39)m ÷ (4) | 0.73 | 0.72 | 0.72 | 0.71 | 0.71 | 0.69 | 0.69 | 0.69 | 0.70 | 0.71 | 0.71 | 0.72 | |
| | Average = Σ(40)1...12/12 = | | | | | | | | | | | 0.71 | (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 | |

4. Water heating energy requirement

| | | | | | | | | | | | | | | |
|---|---------------|--------|--------|--------|--------|-------|-------|-------|--------|--------|--------|---------|------|------|
| Assumed occupancy, N | | 2.25 | (42) | | | | | | | | | | | |
| Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 | | 87.71 | (43) | | | | | | | | | | | |
| | 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) | 96.48 | 92.97 | 89.47 | 85.96 | 82.45 | 78.94 | 78.94 | 82.45 | 85.96 | 89.47 | 92.97 | 96.48 | | |
| | Σ(44)1...12 = | | | | | | | | | | | 1052.55 | (44) | |
| Energy content of hot water used = 4.18 x Vd,m x nm x Tm/3600 kWh/month (see Tables 1b, 1c 1d) | 143.08 | 125.14 | 129.13 | 112.58 | 108.03 | 93.22 | 86.38 | 99.12 | 100.31 | 116.90 | 127.60 | 138.57 | | |
| | Σ(45)1...12 = | | | | | | | | | | | 1380.05 | (45) | |
| Distribution loss 0.15 x (45)m | 21.46 | 18.77 | 19.37 | 16.89 | 16.20 | 13.98 | 12.96 | 14.87 | 15.05 | 17.53 | 19.14 | 20.79 | | |
| Storage volume (litres) including any solar or WWHRS storage within same vessel | | | | | | | | | | | | 145.00 | (47) | |
| Water storage loss: | | | | | | | | | | | | | | |
| a) If manufacturer's declared loss factor is known (kWh/day) | | | | | | | | | | | | | 1.30 | (48) |
| Temperature factor from Table 2b | | | | | | | | | | | | | 0.60 | (49) |
| Energy lost from water storage (kWh/day) (48) x (49) | | | | | | | | | | | | | 0.78 | (50) |
| Enter (50) or (54) in (55) | | | | | | | | | | | | | 0.78 | (55) |
| Water storage loss calculated for each month (55) x (41)m | 24.18 | 21.84 | 24.18 | 23.40 | 24.18 | 23.40 | 24.18 | 24.18 | 23.40 | 24.18 | 23.40 | 24.18 | | |
| If the vessel contains dedicated solar storage or dedicated WWHRS (56)m x [(47) - Vs] ÷ (47), else (56) | 24.18 | 21.84 | 24.18 | 23.40 | 24.18 | 23.40 | 24.18 | 24.18 | 23.40 | 24.18 | 23.40 | 24.18 | | |
| | | | | | | | | | | | | | (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 $0.85 \times (45)m + (46)m + (57)m + (59)m + (61)m$

| | | | | | | | | | | | | |
|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|------|
| 190.52 | 167.99 | 176.58 | 158.49 | 155.47 | 139.13 | 133.82 | 146.56 | 146.22 | 164.34 | 173.51 | 186.01 | (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

| | | | | | | | | | | | | |
|----------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|---------|------|
| 190.52 | 167.99 | 176.58 | 158.49 | 155.47 | 139.13 | 133.82 | 146.56 | 146.22 | 164.34 | 173.51 | 186.01 | |
| $\Sigma(64)1...12 =$ | | | | | | | | | | | 1938.65 | (64) |

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

| | | | | | | | | | | | | |
|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------|
| 85.53 | 75.89 | 80.89 | 74.16 | 73.87 | 67.72 | 66.68 | 70.91 | 70.08 | 76.82 | 79.16 | 84.03 | (65) |
|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------|

5. Internal gains

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

Metabolic gains (Table 5)

| | | | | | | | | | | | | |
|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|------|
| 112.66 | 112.66 | 112.66 | 112.66 | 112.66 | 112.66 | 112.66 | 112.66 | 112.66 | 112.66 | 112.66 | 112.66 | (66) |
|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|------|

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

| | | | | | | | | | | | | |
|-------|-------|-------|------|------|------|------|------|-------|-------|-------|-------|------|
| 17.65 | 15.68 | 12.75 | 9.65 | 7.21 | 6.09 | 6.58 | 8.55 | 11.48 | 14.58 | 17.02 | 18.14 | (67) |
|-------|-------|-------|------|------|------|------|------|-------|-------|-------|-------|------|

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

| | | | | | | | | | | | | |
|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|------|
| 197.97 | 200.03 | 194.85 | 183.83 | 169.92 | 156.84 | 148.11 | 146.05 | 151.23 | 162.25 | 176.16 | 189.24 | (68) |
|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|------|

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

| | | | | | | | | | | | | |
|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------|
| 34.27 | 34.27 | 34.27 | 34.27 | 34.27 | 34.27 | 34.27 | 34.27 | 34.27 | 34.27 | 34.27 | 34.27 | (69) |
|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------|

Pump and fan gains (Table 5a)

| | | | | | | | | | | | | |
|------|------|------|------|------|------|------|------|------|------|------|------|------|
| 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | (70) |
|------|------|------|------|------|------|------|------|------|------|------|------|------|

Losses e.g. evaporation (Table 5)

| | | | | | | | | | | | | |
|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|------|
| -90.13 | -90.13 | -90.13 | -90.13 | -90.13 | -90.13 | -90.13 | -90.13 | -90.13 | -90.13 | -90.13 | -90.13 | (71) |
|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|------|

Water heating gains (Table 5)

| | | | | | | | | | | | | |
|--------|--------|--------|--------|-------|-------|-------|-------|-------|--------|--------|--------|------|
| 114.96 | 112.93 | 108.72 | 103.00 | 99.29 | 94.06 | 89.62 | 95.31 | 97.34 | 103.26 | 109.94 | 112.94 | (72) |
|--------|--------|--------|--------|-------|-------|-------|-------|-------|--------|--------|--------|------|

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

| | | | | | | | | | | | | |
|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|------|
| 387.38 | 385.43 | 373.12 | 353.28 | 333.22 | 313.79 | 301.10 | 306.72 | 316.84 | 336.88 | 359.92 | 377.12 | (73) |
|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|------|

6. Solar gains

| | Access factor Table 6d | Area m ² | Solar flux W/m ² | g specific data or Table 6b | FF specific data or Table 6c | Gains W | | |
|------|---------------------------|------------------------|--------------------------------|-----------------------------------|------------------------------------|------------|-------|------|
| East | 0.77 | 13.66 | 19.64 | 0.9 | 0.40 | 0.90 | 66.93 | (76) |

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

| | | | | | | | | | | | | |
|-------|--------|--------|--------|--------|--------|--------|--------|--------|--------|-------|-------|------|
| 66.93 | 130.93 | 215.63 | 314.48 | 385.41 | 394.53 | 375.61 | 322.65 | 250.78 | 155.36 | 83.46 | 55.04 | (83) |
|-------|--------|--------|--------|--------|--------|--------|--------|--------|--------|-------|-------|------|

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

| | | | | | | | | | | | | |
|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|------|
| 454.31 | 516.37 | 588.75 | 667.76 | 718.63 | 708.33 | 676.72 | 629.36 | 567.63 | 492.25 | 443.37 | 432.16 | (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)

| | | | | | | | | | | | | |
|------|------|------|------|------|------|------|------|------|------|------|------|------|
| 0.95 | 0.92 | 0.86 | 0.74 | 0.59 | 0.43 | 0.31 | 0.35 | 0.56 | 0.80 | 0.92 | 0.95 | (86) |
|------|------|------|------|------|------|------|------|------|------|------|------|------|

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

| | | | | | | | | | | | | |
|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------|
| 19.74 | 19.97 | 20.31 | 20.68 | 20.88 | 20.97 | 20.99 | 20.99 | 20.93 | 20.63 | 20.13 | 19.70 | (87) |
|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------|

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

| | | | | | | | | | | | | |
|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------|
| 20.32 | 20.32 | 20.32 | 20.33 | 20.33 | 20.35 | 20.35 | 20.35 | 20.34 | 20.33 | 20.33 | 20.33 | (88) |
|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------|

Utilisation factor for gains for rest of dwelling n2,m

| | | | | | | | | | | | | |
|------|------|------|------|------|------|------|------|------|------|------|------|------|
| 0.94 | 0.91 | 0.84 | 0.72 | 0.56 | 0.39 | 0.27 | 0.30 | 0.51 | 0.78 | 0.91 | 0.95 | (89) |
|------|------|------|------|------|------|------|------|------|------|------|------|------|

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

| | | | | | | | | | | | | |
|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------|
| 18.61 | 18.94 | 19.43 | 19.93 | 20.20 | 20.32 | 20.34 | 20.34 | 20.27 | 19.89 | 19.19 | 18.56 | (90) |
|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------|

Living area fraction

Living area ÷ (4) = (91)

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

| | | | | | | | | | | | | |
|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------|
| 19.11 | 19.40 | 19.82 | 20.26 | 20.51 | 20.61 | 20.63 | 20.63 | 20.57 | 20.22 | 19.61 | 19.07 | (92) |
|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------|

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

| | | | | | | | | | | | | |
|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------|
| 19.11 | 19.40 | 19.82 | 20.26 | 20.51 | 20.61 | 20.63 | 20.63 | 20.57 | 20.22 | 19.61 | 19.07 | (93) |
|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------|

8. Space heating requirement

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

Utilisation factor for gains, ηm

| | | | | | | | | | | | | |
|------|------|------|------|------|------|------|------|------|------|------|------|------|
| 0.93 | 0.90 | 0.83 | 0.71 | 0.57 | 0.40 | 0.29 | 0.32 | 0.53 | 0.77 | 0.89 | 0.94 | (94) |
|------|------|------|------|------|------|------|------|------|------|------|------|------|

Useful gains, ηmGm, W (94)m x (84)m

| | | | | | | | | | | | | |
|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|------|
| 421.40 | 462.25 | 489.56 | 477.39 | 406.12 | 286.58 | 195.33 | 203.50 | 299.82 | 380.02 | 396.45 | 404.49 | (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]

| | | | | | | | | | | | | |
|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|------|
| 757.24 | 738.60 | 676.24 | 566.83 | 437.80 | 293.49 | 196.85 | 205.78 | 317.93 | 478.19 | 626.28 | 749.56 | (97) |
|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|------|

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

| | | | | | | | | | | | | |
|--------|--------|--------|-------|-------|------|------|------|------|-------|--------|--------|------|
| 249.87 | 185.71 | 138.89 | 64.40 | 23.57 | 0.00 | 0.00 | 0.00 | 0.00 | 73.04 | 165.47 | 256.73 | (98) |
|--------|--------|--------|-------|-------|------|------|------|------|-------|--------|--------|------|

Σ(98)1...5, 10...12 = (98)

Space heating requirement kWh/m²/year

(98) ÷ (4) = (99)

8c. Space cooling requirement

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

Heat loss rate Lm

| | | | | | | | | | | | | |
|------|------|------|------|------|--------|--------|--------|------|------|------|------|-------|
| 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 458.91 | 361.27 | 369.69 | 0.00 | 0.00 | 0.00 | 0.00 | (100) |
|------|------|------|------|------|--------|--------|--------|------|------|------|------|-------|

Utilisation factor for loss ηm

| | | | | | | | | | | | | |
|------|------|------|------|------|------|------|------|------|------|------|------|-------|
| 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.96 | 0.98 | 0.97 | 0.00 | 0.00 | 0.00 | 0.00 | (101) |
|------|------|------|------|------|------|------|------|------|------|------|------|-------|

Useful loss ηmLm (watts) (100)m x (101)m

| | | | | | | | | | | | | |
|------|------|------|------|------|--------|--------|--------|------|------|------|------|-------|
| 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 439.03 | 352.46 | 358.05 | 0.00 | 0.00 | 0.00 | 0.00 | (102) |
|------|------|------|------|------|--------|--------|--------|------|------|------|------|-------|

Gains

| | | | | | | | | | | | | |
|------|------|------|------|------|--------|--------|--------|------|------|------|------|-------|
| 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 900.36 | 861.99 | 807.64 | 0.00 | 0.00 | 0.00 | 0.00 | (103) |
|------|------|------|------|------|--------|--------|--------|------|------|------|------|-------|

Space cooling requirement, whole dwelling, continuous (kWh) 0.024 x [(103)m - (102)m] x (41)m

| | | | | | | | | | | | | |
|------|------|------|------|------|--------|--------|--------|------|------|------|------|-------|
| 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 332.15 | 379.09 | 334.50 | 0.00 | 0.00 | 0.00 | 0.00 | (104) |
|------|------|------|------|------|--------|--------|--------|------|------|------|------|-------|

Σ(104)6...8 = (104)

Cooled fraction

cooled area ÷ (4) = (105)

Intermittency factor (Table 10)

| | | | | | | | | | | | | |
|------|------|------|------|------|------|------|------|------|------|------|------|-------|
| 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.25 | 0.25 | 0.25 | 0.00 | 0.00 | 0.00 | 0.00 | (106) |
|------|------|------|------|------|------|------|------|------|------|------|------|-------|

Σ(106)6...8 = (106)

Space cooling requirement (104)m x (105) x (106)m

| | | | | | | | | | | | | |
|------|------|------|------|------|-------|-------|-------|------|------|------|------|-------|
| 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 37.07 | 42.31 | 37.33 | 0.00 | 0.00 | 0.00 | 0.00 | (107) |
|------|------|------|------|------|-------|-------|-------|------|------|------|------|-------|

Σ(107)6...8 = (107)

Space cooling requirement kWh/m²/year

(107) ÷ (4) = (108)

9b. Energy requirements - community heating scheme

| | | | |
|--|------------------|------|--------|
| Fraction of space heat from secondary/supplementary system (table 11) | '0' if none | 0.00 | (301) |
| Fraction of space heat from community system | 1 - (301) = | 1.00 | (302) |
| Fraction of community heat from boilers | | 1.00 | (303a) |
| Fraction of total space heat from community boilers | (302) x (303a) = | 1.00 | (304a) |
| Factor for control and charging method (Table 4c(3)) for community space heating | | 1.00 | (305) |
| Factor for charging method (Table 4c(3)) for community water heating | | 1.00 | (305a) |
| Distribution loss factor (Table 12c) for community heating system | | 1.05 | (306) |

Space heating

| | | | |
|----------------------------------|---------------------------------|---------|--------|
| Annual space heating requirement | 1157.68 | (98) | |
| Space heat from boilers | (98) x (304a) x (305) x (306) = | 1215.56 | (307a) |

Water heating

| | | | |
|--|--|---------|--------|
| Annual water heating requirement | 1938.65 | (64) | |
| Water heat from boilers | (64) x (303a) x (305a) x (306) = | 2035.58 | (310a) |
| Electricity used for heat distribution | 0.01 x [(307a)...(307e) + (310a)...(310e)] = | 32.51 | (313) |

| | | | |
|--|--|---------|-------|
| Cooling System Energy Efficiency Ratio | 4.05 | (314) | |
| Space cooling (if there is a fixed cooling system, if not enter 0) | (107) ÷ (314) | 28.82 | (315) |
| Electricity for pumps, fans and electric keep-hot (Table 4f) | | | |
| mechanical ventilation fans - balanced, extract or positive input from outside | 173.00 | (330a) | |
| Total electricity for the above, kWh/year | 173.00 | (331) | |
| Electricity for lighting (Appendix L) | 311.69 | (332) | |
| Total delivered energy for all uses | (307) + (309) + (310) + (312) + (315) + (331) + (332)...(337b) = | 3764.66 | (338) |

10b. Fuel costs - community heating scheme

| | Fuel kWh/year | | Fuel price | | Fuel cost £/year | |
|-----------------------------|---------------|---|------------|-----------------------------------|------------------|--------|
| Space heating from boilers | 1215.56 | x | 4.24 | x 0.01 = | 51.54 | (340a) |
| Water heating from boilers | 2035.58 | x | 4.24 | x 0.01 = | 86.31 | (342a) |
| Space cooling | 28.82 | x | 13.19 | x 0.01 = | 3.80 | (348) |
| Pumps and fans | 173.00 | x | 13.19 | x 0.01 = | 22.82 | (349) |
| Electricity for lighting | 311.69 | x | 13.19 | x 0.01 = | 41.11 | (350) |
| Additional standing charges | | | | | 120.00 | (351) |
| Total energy cost | | | | (340a)...(342e) + (345)...(354) = | 325.58 | (355) |

11b. SAP rating - community heating scheme

| | | |
|---------------------------------|-------|-------|
| Energy cost deflator (Table 12) | 0.42 | (356) |
| Energy cost factor (ECF) | 1.19 | (357) |
| SAP value | 83.45 | |
| SAP rating (section 13) | 83 | (358) |
| SAP band | B | |

12b. CO₂ emissions - community heating scheme

| | Energy kWh/year | Emission factor | Emissions (kg/year) |
|--|----------------------------------|-----------------|---------------------|
| Emissions from other sources (space heating) | | | |
| Efficiency of boilers | 89.50 | | (367a) |
| | [(307a)+(310a)] x 100 ÷ (367a) = | | |

| | | | | | | |
|---|---------|---|-------|----------------|---------|-------|
| CO2 emissions from boilers | 3632.56 | x | 0.216 | = | 784.63 | (367) |
| Electrical energy for community heat distribution | 32.51 | x | 0.519 | = | 16.87 | (372) |
| Total CO2 associated with community systems | | | | | 801.51 | (373) |
| Total CO2 associated with space and water heating | | | | | 801.51 | (376) |
| Space cooling | 28.82 | x | 0.519 | = | 14.96 | (377) |
| Pumps and fans | 173.00 | x | 0.519 | = | 89.79 | (378) |
| Electricity for lighting | 311.69 | x | 0.519 | = | 161.77 | (379) |
| Total CO ₂ , kg/year | | | | (376)..(382) = | 1068.02 | (383) |
| Dwelling CO ₂ emission rate | | | | (383) ÷ (4) = | 15.19 | (384) |
| EI value | | | | | 87.59 | |
| EI rating (section 14) | | | | | 88 | (385) |
| EI band | | | | | B | |

13b. Primary energy - community heating scheme

| | Energy kWh/year | | Primary factor | | Primary energy (kWh/year) | |
|--|----------------------------------|---------|----------------|------|---------------------------|---------------|
| Primary energy from other sources (space heating) | | | | | | |
| Efficiency of boilers | 89.50 | | | | | (367a) |
| Primary energy from boilers | [(307a)+(310a)] x 100 ÷ (367a) = | 3632.56 | x | 1.22 | = | 4431.73 (367) |
| Electrical energy for community heat distribution | 32.51 | x | 3.07 | = | 99.81 (372) | |
| Total primary energy associated with community systems | | | | | 4531.54 (373) | |
| Total primary energy associated with space and water heating | | | | | 4531.54 (376) | |
| Space cooling | 28.82 | x | 3.07 | = | 88.47 (377) | |
| Pumps and fans | 173.00 | x | 3.07 | = | 531.11 (378) | |
| Electricity for lighting | 311.69 | x | 3.07 | = | 956.90 (379) | |
| Primary energy kWh/year | | | | | 6108.02 (383) | |
| Dwelling primary energy rate kWh/m ² /year | | | | | 86.90 (384) | |