

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="87.04"/> (1a) | <input type="text" value="2.61"/> (2a) | <input type="text" value="227.17"/> (3a) |
| Total floor area | (1a) + (1b) + (1c) + (1d)...(1n) = <input type="text" value="87.04"/> (4) | | |
| Dwelling volume | | (3a) + (3b) + (3c) + (3d)...(3n) = <input type="text" value="227.17"/> (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) |
| Infiltration due to chimneys, flues, fans, PSVs | (6a) + (6b) + (7a) + (7b) + (7c) = <input type="text" value="0"/> | <input type="text" value="0.00"/> (8) |
| <i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i> | | |
| 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="1"/> (19) |
| Shelter factor | 1 - [0.075 x (19)] = | <input type="text" value="0.93"/> (20) |
| Infiltration rate incorporating shelter factor | (18) x (20) = | <input type="text" value="0.14"/> (21) |

| Monthly average wind speed from Table U2 | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|--|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|
| | <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 | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|-----------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|
| | <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 | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|
| | <input type="text" value="0.18"/> | <input type="text" value="0.17"/> | <input type="text" value="0.17"/> | <input type="text" value="0.15"/> | <input type="text" value="0.15"/> | <input type="text" value="0.13"/> | <input type="text" value="0.13"/> | <input type="text" value="0.13"/> | <input type="text" value="0.14"/> | <input type="text" value="0.15"/> | <input type="text" value="0.16"/> | <input type="text" value="0.16"/> |

| | |
|--|---|
| Calculate effective air change rate for the applicable case: | |
| If mechanical ventilation: air change rate through system | <input type="text" value="0.50"/> (23a) |
| If balanced with heat recovery: efficiency in % allowing for in-use factor from Table 4h | <input type="text" value="76.50"/> (23c) |
| a) If balanced mechanical ventilation with heat recovery (MVHR) (22b)m + (23b) x [1 - (23c) ÷ 100] | |
| | <input type="text" value="0.29"/> <input type="text" value="0.29"/> <input type="text" value="0.29"/> <input type="text" value="0.27"/> <input type="text" value="0.27"/> <input type="text" value="0.25"/> <input type="text" value="0.25"/> <input type="text" value="0.25"/> <input type="text" value="0.26"/> <input type="text" value="0.27"/> <input type="text" value="0.27"/> <input type="text" value="0.28"/> (24a) |

| Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in (25) | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|--|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|
| | <input type="text" value="0.29"/> | <input type="text" value="0.29"/> | <input type="text" value="0.29"/> | <input type="text" value="0.27"/> | <input type="text" value="0.27"/> | <input type="text" value="0.25"/> | <input type="text" value="0.25"/> | <input type="text" value="0.25"/> | <input type="text" value="0.26"/> | <input type="text" value="0.27"/> | <input type="text" value="0.27"/> | <input type="text" value="0.28"/> |

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 | | | 19.96 | 1.33 | 26.46 | | (27) | | | | | | |
| External wall | | | 39.20 | 0.15 | 5.88 | | (29a) | | | | | | |
| External wall | | | 26.65 | 0.01 | 0.27 | | (29a) | | | | | | |
| Party wall | | | 32.54 | 0.00 | 0.00 | | (32) | | | | | | |
| Roof | | | 87.04 | 0.16 | 13.93 | | (30) | | | | | | |
| Total area of external elements $\sum A$, m ² | | | 172.85 | | | | (31) | | | | | | |
| Fabric heat loss, W/K = $\sum(A \times U)$ | | | | | (26)...(30) + (32) = | 46.54 | (33) | | | | | | |
| Heat capacity Cm = $\sum(A \times \kappa)$ | | | | | (28)...(30) + (32) + (32a)...(32e) = | N/A | (34) | | | | | | |
| Thermal mass parameter (TMP) in kJ/m ² K | | | | | | 100.00 | (35) | | | | | | |
| Thermal bridges: $\sum(L \times \Psi)$ calculated using Appendix K | | | | | | 13.25 | (36) | | | | | | |
| Total fabric heat loss | | | | | | (33) + (36) = | 59.78 (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) | 22.07 | 21.81 | 21.55 | 20.25 | 19.99 | 18.69 | 18.69 | 18.43 | 19.21 | 19.99 | 20.51 | 21.03 | (38) |
| Heat transfer coefficient, W/K (37)m + (38)m | 81.85 | 81.59 | 81.33 | 80.03 | 79.77 | 78.47 | 78.47 | 78.21 | 78.99 | 79.77 | 80.29 | 80.81 | |
| | Average = $\sum(39)1...12/12 =$ | | | | | | | | | | | 79.97 (39) | |
| Heat loss parameter (HLP), W/m ² K (39)m ÷ (4) | 0.94 | 0.94 | 0.93 | 0.92 | 0.92 | 0.90 | 0.90 | 0.90 | 0.91 | 0.92 | 0.92 | 0.93 | |
| | Average = $\sum(40)1...12/12 =$ | | | | | | | | | | | 0.92 (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 | | | | | | | | | | | | | 2.58 | (42) | |
| Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 | | | | | | | | | | | | | | 95.55 | (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) | 105.10 | 101.28 | 97.46 | 93.64 | 89.81 | 85.99 | 85.99 | 89.81 | 93.64 | 97.46 | 101.28 | 105.10 | | | |
| | $\sum(44)1...12 =$ | | | | | | | | | | | 1146.55 | (44) | | |
| Energy content of hot water used = 4.18 x Vd,m x nm x Tm/3600 kWh/month (see Tables 1b, 1c 1d) | 155.86 | 136.32 | 140.67 | 122.64 | 117.67 | 101.54 | 94.09 | 107.98 | 109.26 | 127.34 | 139.00 | 150.94 | | | |
| | $\sum(45)1...12 =$ | | | | | | | | | | | 1503.31 | (45) | | |
| Distribution loss 0.15 x (45)m | 23.38 | 20.45 | 21.10 | 18.40 | 17.65 | 15.23 | 14.11 | 16.20 | 16.39 | 19.10 | 20.85 | 22.64 | | (46) | |
| 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 | | (56) | |
| 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 $0.85 \times (45)m + (46)m + (57)m + (59)m + (61)m$

| | | | | | | | | | | | | |
|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|------|
| 203.30 | 179.17 | 188.11 | 168.55 | 165.12 | 147.46 | 141.54 | 155.42 | 155.18 | 174.78 | 184.91 | 198.39 | (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) $(62)m + (63)m$

| | | | | | | | | | | | | |
|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|------|
| 203.30 | 179.17 | 188.11 | 168.55 | 165.12 | 147.46 | 141.54 | 155.42 | 155.18 | 174.78 | 184.91 | 198.39 | (64) |
|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|------|

$\Sigma(64)1...12 = 2061.91$

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

| | | | | | | | | | | | | |
|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------|
| 89.78 | 79.61 | 84.73 | 77.51 | 77.08 | 70.49 | 69.24 | 73.86 | 73.06 | 80.29 | 82.95 | 88.14 | (65) |
|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------|

5. Internal gains

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

Metabolic gains (Table 5)

| | | | | | | | | | | | | |
|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|------|
| 129.15 | 129.15 | 129.15 | 129.15 | 129.15 | 129.15 | 129.15 | 129.15 | 129.15 | 129.15 | 129.15 | 129.15 | (66) |
|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|------|

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

| | | | | | | | | | | | | |
|-------|-------|-------|-------|------|------|------|-------|-------|-------|-------|-------|------|
| 20.82 | 18.49 | 15.04 | 11.38 | 8.51 | 7.18 | 7.76 | 10.09 | 13.54 | 17.20 | 20.07 | 21.40 | (67) |
|-------|-------|-------|-------|------|------|------|-------|-------|-------|-------|-------|------|

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

| | | | | | | | | | | | | |
|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|------|
| 233.53 | 235.95 | 229.84 | 216.84 | 200.43 | 185.01 | 174.70 | 172.28 | 178.39 | 191.39 | 207.80 | 223.22 | (68) |
|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|------|

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

| | | | | | | | | | | | | |
|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------|
| 35.91 | 35.91 | 35.91 | 35.91 | 35.91 | 35.91 | 35.91 | 35.91 | 35.91 | 35.91 | 35.91 | 35.91 | (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)

| | | | | | | | | | | | | |
|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|------|
| -103.32 | -103.32 | -103.32 | -103.32 | -103.32 | -103.32 | -103.32 | -103.32 | -103.32 | -103.32 | -103.32 | -103.32 | (71) |
|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|------|

Water heating gains (Table 5)

| | | | | | | | | | | | | |
|--------|--------|--------|--------|--------|-------|-------|-------|--------|--------|--------|--------|------|
| 120.67 | 118.46 | 113.88 | 107.65 | 103.60 | 97.91 | 93.07 | 99.27 | 101.47 | 107.92 | 115.20 | 118.47 | (72) |
|--------|--------|--------|--------|--------|-------|-------|-------|--------|--------|--------|--------|------|

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

| | | | | | | | | | | | | |
|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|------|
| 436.76 | 434.65 | 420.50 | 397.62 | 374.29 | 351.84 | 337.28 | 343.39 | 355.15 | 378.25 | 404.82 | 424.84 | (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 | |
|-------|---------------------------|------------------------|--------------------------------|-----------------------------------|------------------------------------|------------|------|
| West | 0.77 | 11.03 | 19.64 | 0.9 | 0.40 | 54.05 | (80) |
| South | 0.77 | 8.93 | 46.75 | 0.9 | 0.40 | 104.16 | (78) |

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

| | | | | | | | | | | | | |
|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|------|
| 158.20 | 276.31 | 391.40 | 499.52 | 567.12 | 564.86 | 543.93 | 494.22 | 429.49 | 309.44 | 190.85 | 134.45 | (83) |
|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|------|

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

| | | | | | | | | | | | | |
|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|------|
| 594.96 | 710.95 | 811.91 | 897.14 | 941.41 | 916.70 | 881.21 | 837.60 | 784.64 | 687.69 | 595.67 | 559.28 | (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 | 0.87 | 0.78 | 0.66 | 0.50 | 0.38 | 0.41 | 0.60 | 0.82 | 0.92 | 0.96 | (86) |
|------|------|------|------|------|------|------|------|------|------|------|------|------|

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

| | | | | | | | | | | | | |
|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------|
| 19.23 | 19.54 | 19.95 | 20.40 | 20.72 | 20.91 | 20.97 | 20.96 | 20.84 | 20.40 | 19.74 | 19.17 | (87) |
|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------|

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

| | | | | | | | | | | | | |
|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------|
| 20.13 | 20.14 | 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 n2,m

| | | | | | | | | | | | | |
|------|------|------|------|------|------|------|------|------|------|------|------|------|
| 0.94 | 0.91 | 0.85 | 0.75 | 0.62 | 0.45 | 0.31 | 0.34 | 0.55 | 0.79 | 0.91 | 0.95 | (89) |
|------|------|------|------|------|------|------|------|------|------|------|------|------|

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

| | | | | | | | | | | | | |
|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------|
| 17.75 | 18.20 | 18.78 | 19.41 | 19.84 | 20.08 | 20.15 | 20.14 | 20.00 | 19.43 | 18.50 | 17.68 | (90) |
|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------|

Living area fraction

Living area ÷ (4) = (91)

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

| | | | | | | | | | | | | |
|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------|
| 18.50 | 18.88 | 19.37 | 19.91 | 20.29 | 20.50 | 20.57 | 20.56 | 20.43 | 19.92 | 19.13 | 18.44 | (92) |
|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------|

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

| | | | | | | | | | | | | |
|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------|
| 18.50 | 18.88 | 19.37 | 19.91 | 20.29 | 20.50 | 20.57 | 20.56 | 20.43 | 19.92 | 19.13 | 18.44 | (93) |
|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------|

8. Space heating requirement

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

Utilisation factor for gains, ηm

| | | | | | | | | | | | | |
|------|------|------|------|------|------|------|------|------|------|------|------|------|
| 0.93 | 0.89 | 0.83 | 0.74 | 0.62 | 0.47 | 0.34 | 0.37 | 0.57 | 0.78 | 0.90 | 0.94 | (94) |
|------|------|------|------|------|------|------|------|------|------|------|------|------|

Useful gains, ηmGm, W (94)m x (84)m

| | | | | | | | | | | | | |
|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|------|
| 552.20 | 633.50 | 677.76 | 667.65 | 586.17 | 432.86 | 302.70 | 314.07 | 444.92 | 536.37 | 533.32 | 524.17 | (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]

| | | | | | | | | | | | | |
|---------|---------|---------|--------|--------|--------|--------|--------|--------|--------|--------|---------|------|
| 1162.33 | 1140.50 | 1046.94 | 881.44 | 685.24 | 463.27 | 311.21 | 325.32 | 499.86 | 743.89 | 965.88 | 1150.60 | (97) |
|---------|---------|---------|--------|--------|--------|--------|--------|--------|--------|--------|---------|------|

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

| | | | | | | | | | | | | |
|--------|--------|--------|--------|-------|------|------|------|------|--------|--------|--------|---|
| 453.94 | 340.70 | 274.67 | 153.93 | 73.71 | 0.00 | 0.00 | 0.00 | 0.00 | 154.39 | 311.44 | 466.06 | Σ(98)1...5, 10...12 = <input type="text" value="2228.84"/> (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 | 737.65 | 580.71 | 594.42 | 0.00 | 0.00 | 0.00 | 0.00 | (100) |
|------|------|------|------|------|--------|--------|--------|------|------|------|------|-------|

Utilisation factor for loss ηm

| | | | | | | | | | | | | |
|------|------|------|------|------|------|------|------|------|------|------|------|-------|
| 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.89 | 0.93 | 0.92 | 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 | 657.02 | 539.75 | 545.69 | 0.00 | 0.00 | 0.00 | 0.00 | (102) |
|------|------|------|------|------|--------|--------|--------|------|------|------|------|-------|

Gains

| | | | | | | | | | | | | |
|------|------|------|------|------|---------|---------|---------|------|------|------|------|-------|
| 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1156.96 | 1113.73 | 1064.03 | 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 | 359.96 | 427.04 | 385.64 | 0.00 | 0.00 | 0.00 | 0.00 | Σ(104)6...8 = <input type="text" value="1172.64"/> (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 | Σ(106)6...8 = <input type="text" value="0.75"/> (106) |
|------|------|------|------|------|------|------|------|------|------|------|------|---|

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

| | | | | | | | | | | | |
|------|------|------|------|------|-------|-------|-------|------|------|------|------|
| 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 45.66 | 54.17 | 48.91 | 0.00 | 0.00 | 0.00 | 0.00 |
|------|------|------|------|------|-------|-------|-------|------|------|------|------|

| | | | |
|--|---------------------|-------------------------------------|-------|
| | $\Sigma(107)6..8 =$ | <input type="text" value="148.74"/> | (107) |
| Space cooling requirement kWh/m ² /year | $(107) \div (4) =$ | <input type="text" value="1.71"/> | (108) |

9b. Energy requirements - community heating scheme

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

Space heating

| | | |
|----------------------------------|--|---|
| Annual space heating requirement | <input type="text" value="2228.84"/> | (98) |
| Space heat from boilers | $(98) \times (304a) \times (305) \times (306) =$ | <input type="text" value="2340.28"/> (307a) |

Water heating

| | | |
|--|---|---|
| Annual water heating requirement | <input type="text" value="2061.91"/> | (64) |
| Water heat from boilers | $(64) \times (303a) \times (305a) \times (306) =$ | <input type="text" value="2165.01"/> (310a) |
| Electricity used for heat distribution | $0.01 \times [(307a)...(307e) + (310a)...(310e)] =$ | <input type="text" value="45.05"/> (313) |

| | | |
|--|--|--|
| Cooling System Energy Efficiency Ratio | <input type="text" value="4.05"/> | (314) |
| Space cooling (if there is a fixed cooling system, if not enter 0) | $(107) \div (314) =$ | <input type="text" value="36.72"/> (315) |
| Electricity for pumps, fans and electric keep-hot (Table 4f) | | |
| mechanical ventilation fans - balanced, extract or positive input from outside | <input type="text" value="213.41"/> | (330a) |
| Total electricity for the above, kWh/year | <input type="text" value="213.41"/> | (331) |
| Electricity for lighting (Appendix L) | <input type="text" value="367.67"/> | (332) |
| Total delivered energy for all uses | $(307) + (309) + (310) + (312) + (315) + (331) + (332)...(337b) =$ | <input type="text" value="5123.09"/> (338) |

10b. Fuel costs - community heating scheme

| | Fuel kWh/year | | Fuel price | | Fuel cost £/year | |
|-----------------------------|--------------------------------------|---|------------------------------------|-------------------------------------|-------------------------------------|--------|
| Space heating from boilers | <input type="text" value="2340.28"/> | x | <input type="text" value="4.24"/> | x 0.01 = | <input type="text" value="99.23"/> | (340a) |
| Water heating from boilers | <input type="text" value="2165.01"/> | x | <input type="text" value="4.24"/> | x 0.01 = | <input type="text" value="91.80"/> | (342a) |
| Space cooling | <input type="text" value="36.72"/> | x | <input type="text" value="13.19"/> | x 0.01 = | <input type="text" value="4.84"/> | (348) |
| Pumps and fans | <input type="text" value="213.41"/> | x | <input type="text" value="13.19"/> | x 0.01 = | <input type="text" value="28.15"/> | (349) |
| Electricity for lighting | <input type="text" value="367.67"/> | x | <input type="text" value="13.19"/> | x 0.01 = | <input type="text" value="48.50"/> | (350) |
| Additional standing charges | | | | | <input type="text" value="120.00"/> | (351) |
| Total energy cost | | | | $(340a)...(342e) + (345)...(354) =$ | <input type="text" value="392.51"/> | (355) |

11b. SAP rating - community heating scheme

| | | |
|---------------------------------|------------------------------------|-------|
| Energy cost deflator (Table 12) | <input type="text" value="0.42"/> | (356) |
| Energy cost factor (ECF) | <input type="text" value="1.25"/> | (357) |
| SAP value | <input type="text" value="82.58"/> | |
| SAP rating (section 13) | <input type="text" value="83"/> | (358) |
| SAP band | <input type="text" value="B"/> | |

12b. CO₂ emissions - community heating scheme

| | Energy kWh/year | Emission factor | Emissions (kg/year) |
|--|-----------------|-----------------|---------------------|
|--|-----------------|-----------------|---------------------|

