

3.11.2. Air System Information

Air System Name **AHU & CW**
 Equipment Class **UNDEF**
 Air System Type **VAV**

Number of zones **4**
 Floor Area **1050.25** m²
 Location **Rabak, Sudan**

Sizing Calculation Information

Zone and Space Sizing Method:

Zone L/s **Peak zone sensible load**
 Space L/s **Zone L/(s-m²)**

Calculation Months **Jan to Dec**
 Sizing Data **Calculated**

Central Cooling Coil Sizing Data

Total coil load **483.0** kW
 Sensible coil load **353.4** kW
 Coil L/s at Dec 1700 **23550** L/s
 Max block L/s at Jan 1700 **26147** L/s
 Sum of peak zone L/s **26147** L/s
 Sensible heat ratio **0.732**
 m²/kW **2.1**
 W/m² **465.7**
 Water flow @ 5.6 °K rise **20.80** L/s

Load occurs at **Dec 1700**
 OA DB / WB **40.4 / 25.8** °C
 Entering DB / WB **25.8 / 18.5** °C
 Leaving DB / WB **12.8 / 12.1** °C
 Coil ADP **11.3** °C
 Bypass Factor **0.100**
 Resulting RH **52** %
 Design supply temp. **12.8** °C
 Zone T-stat Check **4 of 4** OK
 Max zone temperature deviation **0.0** °

Supply Fan Sizing Data

Calculation of Supply Fan and Outside Ventilation Air as Follows:

Actual max L/s at Jan 1700 **26147** L/s
 Standard L/s **25044** L/s
 Actual max L/(s-m²) **25.21** L/(s-m²)

Fan motor BHP **0.00** BHP
 Fan motor kW **0.00** kW
 Fan static **0** Pa

Return Fan Sizing Data

Actual max L/s at Jan 1700 **26147** L/s
 Standard L/s **25044** L/s
 Actual max L/(s-m²) **25.21** L/(s-m²)

Fan motor BHP **0.00** BHP
 Fan motor kW **0.00** kW
 Fan static **0** Pa

Outdoor Ventilation Air Data

Design airflow L/s **1702** L/s
 L/(s-m²) **1.64** L/(s-m²)

L/s/person **4.23** L/s/person

Air System Information

Air System Name AHU & CW
 Equipment Class UNDEF
 Air System Type VAV

Number of zones 4
 Floor Area 1050.25 m²
 Location Rabak, Sudan

Sizing Calculation Information

Zone and Space Sizing Method:

Zone L/s Peak zone sensible load
 Space L/s Zone L/(s-m²)

Calculation Months Jan to Dec
 Sizing Data Calculated

Zone Sizing Data

Table (3.1) illustrates Maximum Load and Flow rate of the Building.

| Zone Name | Maximum Cooling Sensible (kW) | Design Air Flow (L/s) | Minimum Air Flow (L/s) | Time of Peak Load | Maximum Heating Load (kW) | Zone Floor Area (m ²) | Zone L/(s-m ²) |
|-----------|-------------------------------|-----------------------|------------------------|-------------------|---------------------------|-----------------------------------|----------------------------|
| Zone 1 | 103.2 | 7953 | 866 | Jan 1700 | 0.0 | 328.8 | 24.19 |
| Zone 2 | 105.0 | 8092 | 671 | Jan 1700 | 0.0 | 300.0 | 26.97 |
| Zone 3 | 30.6 | 2355 | 73 | Jan 1700 | 0.0 | 102.0 | 23.09 |
| Zone 4 | 100.5 | 7747 | 92 | Jan 1700 | 0.0 | 306.3 | 25.29 |

Zone Terminal Sizing Data

Table (3.2) Illustrates Zone Terminal Sizing Data

| Zone Name | Reheat Coil Load (kW) | Reheat Coil Water L/s @ 11.1 °K | Zone Htg Coil Load (kW) | Zone Htg Water L/s @ 11.1 °K | Mixing Box Fan Airflow (L/s) |
|-----------|-----------------------|---------------------------------|-------------------------|------------------------------|------------------------------|
| Zone 1 | 9.2 | 0.20 | 0.0 | 0.00 | 0 |
| Zone 2 | 7.2 | 0.15 | 0.0 | 0.00 | 0 |
| Zone 3 | 0.8 | 0.02 | 0.0 | 0.00 | 0 |
| Zone 4 | 1.0 | 0.02 | 0.0 | 0.00 | 0 |

Space Loads and Airflows

Table (3.3) Illustrates the Cooling Load and the Time of Maximum Load and Flow Rate for Each Space.

| Zone Name / Space Name | Mult. | Cooling Sensible (kW) | Time of Load | Air Flow (L/s) | Heating Load (kW) | Floor Area (m ²) | Space L/(s-m ²) |
|------------------------|-------|-----------------------|--------------|----------------|-------------------|------------------------------|-----------------------------|
| Zone 1 | | | | | | | |
| Class 1 | 1 | 26.6 | Jan 1700 | 2032 | 0.0 | 84.0 | 24.19 |
| Class 2 | 1 | 26.6 | Jan 1700 | 2032 | 0.0 | 84.0 | 24.19 |
| Class 3 | 1 | 26.6 | Jan 1700 | 2032 | 0.0 | 84.0 | 24.19 |
| Deans office | 1 | 15.1 | Jan 1700 | 1161 | 0.0 | 48.0 | 24.19 |
| Electric Room | 1 | 8.4 | Jan 1700 | 697 | 0.0 | 28.8 | 24.19 |
| Zone 2 | | | | | | | |

| Zone Name / Space Name | Mult. | Cooling Sensible (kW) | Time of Load | Air Flow (L/s) | Heating Load (kW) | Floor Area (m²) | Space L/(s-m²) |
|-----------------------------------|--------------|--------------------------------------|-----------------------------|-------------------------------|----------------------------------|---|--------------------------------------|
| Lap 1 | 1 | 29.2 | Jan 1700 | 2266 | 0.0 | 84.0 | 26.97 |
| Lap 2 | 1 | 29.2 | Jan 1700 | 2266 | 0.0 | 84.0 | 26.97 |
| Lap 3 | 1 | 29.8 | Jan 1700 | 2266 | 0.0 | 84.0 | 26.97 |
| Registrar Office | 1 | 16.8 | Jan 1700 | 1295 | 0.0 | 48.0 | 26.97 |
| Zone 3 | | | | | | | |
| Food Manufacturing Office | 1 | 7.8 | Jan 1700 | 623 | 0.0 | 27.0 | 23.09 |
| Mechanical Office | 1 | 15.1 | Jan 1700 | 1108 | 0.0 | 48.0 | 23.09 |
| Chemical office | 1 | 7.6 | Jan 1700 | 623 | 0.0 | 27.0 | 23.09 |
| Zone 4 | | | | | | | |
| Corridor 1 | 1 | 38.8 | Jan 1700 | 3478 | 0.0 | 137.5 | 25.29 |
| Corridor 2 | 1 | 31.6 | Jan 1700 | 2309 | 0.0 | 91.3 | 25.29 |
| Reception | 1 | 30.1 | Jan 1700 | 1960 | 0.0 | 77.5 | 25.29 |

1. Summary

Ventilation Sizing Method **Sum of Space OA Airflows**

Design Ventilation Airflow Rate **1702 L/s**

2. Space Ventilation Analysis Table

Table (3.4) Illustrates Maximum Air Flow Rate Necessary for Each Space:

| Zone Name / Space Name | Mult. | Floor Area (m ²) | Maximum Occupants | Maximum Supply Air (L/s) | Required Outdoor Air (L/s/person) | Required Outdoor Air (L/(s-m ²)) | Required Outdoor Air (L/s) | Required Outdoor Air (% of supply) | Uncorrected Outdoor Air (L/s) |
|---|-------|------------------------------|-------------------|--------------------------|-----------------------------------|--|----------------------------|------------------------------------|-------------------------------|
| Zone 1 | | | | | | | | | |
| Class 1 | 1 | 84.0 | 66.0 | 2031.8 | 3.80 | 0.30 | 0.0 | 0.0 | 276.0 |
| Class 2 | 1 | 84.0 | 66.0 | 2031.8 | 3.80 | 0.30 | 0.0 | 0.0 | 276.0 |
| Class 3 | 1 | 84.0 | 66.0 | 2031.8 | 3.80 | 0.30 | 0.0 | 0.0 | 276.0 |
| Deans office | 1 | 48.0 | 6.0 | 1161.0 | 2.50 | 0.30 | 0.0 | 0.0 | 29.4 |
| Electric Room | 1 | 28.8 | 20.0 | 696.6 | 0.00 | 0.30 | 0.0 | 0.0 | 8.6 |
| Zone 2 | | | | | | | | | |
| Lap 1 | 1 | 84.0 | 32.0 | 2265.8 | 5.00 | 0.60 | 0.0 | 0.0 | 210.4 |
| Lap 2 | 1 | 84.0 | 32.0 | 2265.8 | 5.00 | 0.60 | 0.0 | 0.0 | 210.4 |
| Lap 3 | 1 | 84.0 | 32.0 | 2265.8 | 5.00 | 0.60 | 0.0 | 0.0 | 210.4 |
| Registrar Office | 1 | 48.0 | 10.0 | 1294.7 | 2.50 | 0.30 | 0.0 | 0.0 | 39.4 |
| Zone 3 | | | | | | | | | |
| Food Manufacturing Office | 1 | 27.0 | 5.0 | 623.4 | 2.50 | 0.30 | 0.0 | 0.0 | 20.6 |
| Mechanical Office | 1 | 27.0 | 6.0 | 1108.3 | 2.50 | 0.30 | 0.0 | 0.0 | 29.4 |
| Chemical office | 1 | 27.0 | 6.0 | 623.4 | 2.50 | 0.30 | 0.0 | 0.0 | 23.1 |
| Zone 4 | | | | | | | | | |
| Corridor 1 | 1 | 137.5 | 30.0 | 3477.6 | 0.00 | 0.30 | 0.0 | 0.0 | 41.3 |
| Corridor 2 | 1 | 105.25 | 15.0 | 2309.1 | 0.00 | 0.30 | 0.0 | 0.0 | 27.4 |
| Reception | 1 | 77.5 | 10.0 | 1960.1 | 0.00 | 0.30 | 0.0 | 0.0 | 23.3 |
| Totals (incl. Space Multipliers) | | | | 26147.2 | | | | | 1701.6 |

Table (3.5) Illustrates Calculation of Thermal Loads of the Building:

| | DESIGN COOLING | | | DESIGN HEATING | | |
|------------------------------------|---|---------------------|-------------------|---|---------------------|-------------------|
| | COOLING DATA AT Dec 1700 | | | HEATING DATA AT DES HTG | | |
| | COOLING OA DB / WB 40.4 °C / 25.8 °C | | | HEATING OA DB / WB 24.0 °C / 15.0 °C | | |
| ZONE LOADS | Details | Sensible (W) | Latent (W) | Details | Sensible (W) | Latent (W) |
| Window & Skylight Solar Loads | 102 m ² | 15110 | - | 102 m ² | - | - |
| Wall Transmission | 335 m ² | 17861 | - | 335 m ² | 0 | - |
| Roof Transmission | 1083 m ² | 103427 | - | 1083 m ² | 0 | - |
| Window Transmission | 102 m ² | 9082 | - | 102 m ² | 0 | - |
| Skylight Transmission | 0 m ² | 0 | - | 0 m ² | 0 | - |
| Door Loads | 48 m ² | 0 | - | 0 m ² | 0 | - |
| Floor Transmission | 1037 m ² | 0 | - | 1037 m ² | 0 | - |
| Partitions | 684 m ² | 10699 | - | 684 m ² | 0 | - |
| Ceiling | 0 m ² | 0 | - | 0 m ² | 0 | - |
| Overhead Lighting | 32000 W | 28023 | - | 0 | 0 | - |
| Task Lighting | 0 W | 0 | - | 0 | 0 | - |
| Electric Equipment | 21630 W | 19744 | - | 0 | 0 | - |
| People | 402 | 22628 | 20865 | 0 | 0 | 0 |
| Infiltration | - | 110575 | 86089 | - | 0 | 0 |
| Miscellaneous | - | 0 | 0 | - | 0 | 0 |
| Safety Factor | 0% / 0% | 0 | 0 | 0% | 0 | 0 |
| >> Total Zone Loads | - | 337149 | 106954 | - | 0 | 0 |
| Zone Conditioning | - | 325620 | 106954 | - | -5461 | 0 |
| Plenum Wall Load | 0% | 0 | - | 0 | 0 | - |
| Plenum Roof Load | 0% | 0 | - | 0 | 0 | - |
| Plenum Lighting Load | 0% | 0 | - | 0 | 0 | - |
| Return Fan Load | 23550 L/s | 0 | - | 1702 L/s | 0 | - |
| Ventilation Load | 1533 L/s | 27748 | 22618 | 111 L/s | -324 | 0 |
| Supply Fan Load | 23550 L/s | 0 | - | 1702 L/s | 0 | - |
| Space Fan Coil Fans | - | 0 | - | - | 0 | - |
| Duct Heat Gain / Loss | 0% | 0 | - | 0% | 0 | - |
| >> Total System Loads | - | 353369 | 129572 | - | -5785 | 0 |
| Central Cooling Coil | - | 353369 | 129587 | - | -17422 | 0 |
| Terminal Reheat Coils | - | 0 | - | - | 11637 | - |
| >> Total Conditioning | - | 353369 | 129587 | - | -5785 | 0 |
| Key: | Positive values are clg loads | | | Positive values are htg loads | | |
| | Negative values are htg loads | | | Negative values are clg loads | | |

| Zone 1 | DESIGN COOLING | | | DESIGN HEATING | | |
|----------------------------------|---|---------------------|-------------------|---|---------------------|-------------------|
| | COOLING DATA AT Jan 1700 | | | HEATING DATA AT DES HTG | | |
| | COOLING OA DB / WB 41.0 °C / 25.8 °C | | | HEATING OA DB / WB 24.0 °C / 15.0 °C | | |
| | OCCUPIED T-STAT 24.0 °C | | | OCCUPIED T-STAT 22.0 °C | | |
| ZONE LOADS | Details | Sensible (W) | Latent (W) | Details | Sensible (W) | Latent (W) |
| Window & Skylight Solar Loads | 23 m² | 2880 | - | 23 m² | - | - |
| Wall Transmission | 105 m² | 4655 | - | 105 m² | 0 | - |
| Roof Transmission | 329 m² | 31018 | - | 329 m² | 0 | - |
| Window Transmission | 23 m² | 2134 | - | 23 m² | 0 | - |
| Skylight Transmission | 0 m² | 0 | - | 0 m² | 0 | - |
| Door Loads | 15 m² | 0 | - | 0 m² | 0 | - |
| Floor Transmission | 329 m² | 0 | - | 329 m² | 0 | - |
| Partitions | 289 m² | 4555 | - | 289 m² | 0 | - |
| Ceiling | 0 m² | 0 | - | 0 m² | 0 | - |
| Overhead Lighting | 11500 W | 10252 | - | 0 | 0 | - |
| Task Lighting | 0 W | 0 | - | 0 | 0 | - |
| Electric Equipment | 2610 W | 2382 | - | 0 | 0 | - |
| People | 224 | 12124 | 8532 | 0 | 0 | 0 |
| Infiltration | - | 33200 | 24201 | - | 0 | 0 |
| Miscellaneous | - | 0 | 0 | - | 0 | 0 |
| Safety Factor | 0% / 0% | 0 | 0 | 0% | 0 | 0 |
| >> Total Zone Loads | - | 103200 | 32733 | - | 0 | 0 |

| Zone 2 | DESIGN COOLING | | | DESIGN HEATING | | |
|----------------------------------|---|---------------------|-------------------|---|---------------------|-------------------|
| | COOLING DATA AT Jan 1700 | | | HEATING DATA AT DES HTG | | |
| | COOLING OA DB / WB 41.0 °C / 25.8 °C | | | HEATING OA DB / WB 24.0 °C / 15.0 °C | | |
| | OCCUPIED T-STAT 24.0 °C | | | OCCUPIED T-STAT 22.0 °C | | |
| ZONE LOADS | Details | Sensible (W) | Latent (W) | Details | Sensible (W) | Latent (W) |
| Window & Skylight Solar Loads | 22 m² | 3262 | - | 22 m² | - | - |
| Wall Transmission | 113 m² | 6264 | - | 113 m² | 0 | - |
| Roof Transmission | 300 m² | 28301 | - | 300 m² | 0 | - |
| Window Transmission | 22 m² | 1996 | - | 22 m² | 0 | - |
| Skylight Transmission | 0 m² | 0 | - | 0 m² | 0 | - |
| Door Loads | 12 m² | 0 | - | 0 m² | 0 | - |
| Floor Transmission | 300 m² | 0 | - | 300 m² | 0 | - |
| Partitions | 270 m² | 4260 | - | 270 m² | 0 | - |
| Ceiling | 0 m² | 0 | - | 0 m² | 0 | - |
| Overhead Lighting | 10500 W | 9361 | - | 0 | 0 | - |
| Task Lighting | 0 W | 0 | - | 0 | 0 | - |
| Electric Equipment | 15640 W | 14275 | - | 0 | 0 | - |
| People | 106 | 5729 | 3980 | 0 | 0 | 0 |
| Infiltration | - | 31554 | 22988 | - | 0 | 0 |
| Miscellaneous | - | 0 | 0 | - | 0 | 0 |
| Safety Factor | 0% / 0% | 0 | 0 | 0% | 0 | 0 |
| >> Total Zone Loads | - | 105002 | 26968 | - | 0 | 0 |

| Zone 3 | DESIGN COOLING | | | DESIGN HEATING | | |
|----------------------------------|---|---------------------|-------------------|---|---------------------|-------------------|
| | COOLING DATA AT Jan 1700 | | | HEATING DATA AT DES HTG | | |
| | COOLING OA DB / WB 41.0 °C / 25.8 °C | | | HEATING OA DB / WB 24.0 °C / 15.0 °C | | |
| | OCCUPIED T-STAT 24.0 °C | | | OCCUPIED T-STAT 22.0 °C | | |
| ZONE LOADS | Details | Sensible (W) | Latent (W) | Details | Sensible (W) | Latent (W) |
| Window & Skylight Solar Loads | 16 m ² | 2547 | - | 16 m ² | - | - |
| Wall Transmission | 53 m ² | 2686 | - | 53 m ² | 0 | - |
| Roof Transmission | 102 m ² | 9622 | - | 102 m ² | 0 | - |
| Window Transmission | 16 m ² | 1470 | - | 16 m ² | 0 | - |
| Skylight Transmission | 0 m ² | 0 | - | 0 m ² | 0 | - |
| Door Loads | 7.5 m ² | 0 | - | 0 m ² | 0 | - |
| Floor Transmission | 102 m ² | 0 | - | 102 m ² | 0 | - |
| Partitions | 124 m ² | 1957 | - | 124 m ² | 0 | - |
| Ceiling | 0 m ² | 0 | - | 0 m ² | 0 | - |
| Overhead Lighting | 3500 W | 3120 | - | 0 | 0 | - |
| Task Lighting | 0 W | 0 | - | 0 | 0 | - |
| Electric Equipment | 2580 W | 2355 | - | 0 | 0 | - |
| People | 17 | 973 | 1021 | 0 | 0 | 0 |
| Infiltration | - | 5831 | 4246 | - | 0 | 0 |
| Miscellaneous | - | 0 | 0 | - | 0 | 0 |
| Safety Factor | 0% / 0% | 0 | 0 | 0% | 0 | 0 |
| >> Total Zone Loads | - | 30561 | 5267 | - | 0 | 0 |

| Zone 4 | DESIGN COOLING | | | DESIGN HEATING | | |
|----------------------------------|---|---------------------|-------------------|---|---------------------|-------------------|
| | COOLING DATA AT Jan 1700 | | | HEATING DATA AT DES HTG | | |
| | COOLING OA DB / WB 41.0 °C / 25.8 °C | | | HEATING OA DB / WB 24.0 °C / 15.0 °C | | |
| | OCCUPIED T-STAT 24.0 °C | | | OCCUPIED T-STAT 22.0 °C | | |
| ZONE LOADS | Details | Sensible (W) | Latent (W) | Details | Sensible (W) | Latent (W) |
| Window & Skylight Solar Loads | 41 m ² | 5868 | - | 41 m ² | - | - |
| Wall Transmission | 64 m ² | 4060 | - | 64 m ² | 0 | - |
| Roof Transmission | 353 m ² | 33216 | - | 353 m ² | 0 | - |
| Window Transmission | 41 m ² | 3816 | - | 41 m ² | 0 | - |
| Skylight Transmission | 0 m ² | 0 | - | 0 m ² | 0 | - |
| Door Loads | 13.5 m ² | 0 | - | 0 m ² | 0 | - |
| Floor Transmission | 306 m ² | 0 | - | 306 m ² | 0 | - |
| Partitions | 0 m ² | 0 | - | 0 m ² | 0 | - |
| Ceiling | 0 m ² | 0 | - | 0 m ² | 0 | - |
| Overhead Lighting | 6500 W | 5290 | - | 0 | 0 | - |
| Task Lighting | 0 W | 0 | - | 0 | 0 | - |
| Electric Equipment | 800 W | 731 | - | 0 | 0 | - |
| People | 55 | 3803 | 7332 | 0 | 0 | 0 |
| Infiltration | - | 43737 | 31851 | - | 0 | 0 |
| Miscellaneous | - | 0 | 0 | - | 0 | 0 |
| Safety Factor | 0% / 0% | 0 | 0 | 0% | 0 | 0 |
| >> Total Zone Loads | - | 100521 | 39182 | - | 0 | 0 |

TABLE 3.5.A. COMPONENT LOADS FOR SPACE " Class 1 " IN ZONE " Zone 1 "

| | DESIGN COOLING | | | DESIGN HEATING | | |
|----------------------------------|---|-----------------|---------------|---|-----------------|---------------|
| | COOLING DATA AT Jan 1700 | | | HEATING DATA AT DES HTG | | |
| | COOLING OA DB / WB 41.0 °C / 25.8 °C | | | HEATING OA DB / WB 24.0 °C / 15.0 °C | | |
| | OCCUPIED T-STAT 24.0 °C | | | OCCUPIED T-STAT 22.0 °C | | |
| | | Sensible | Latent | | Sensible | Latent |
| SPACE LOADS | Details | (W) | (W) | Details | (W) | (W) |
| Window & Skylight Solar Loads | 3 m ² | 219 | - | 3 m ² | - | - |
| Wall Transmission | 21 m ² | 830 | - | 21 m ² | 0 | - |
| Roof Transmission | 84 m ² | 7924 | - | 84 m ² | 0 | - |
| Window Transmission | 3 m ² | 295 | - | 3 m ² | 0 | - |
| Skylight Transmission | 0 m ² | 0 | - | 0 m ² | 0 | - |
| Door Loads | 3 m ² | 0 | - | 0 m ² | 0 | - |
| Floor Transmission | 84 m ² | 0 | - | 84 m ² | 0 | - |
| Partitions | 66 m ² | 1033 | - | 66 m ² | 0 | - |
| Ceiling | 0 m ² | 0 | - | 0 m ² | 0 | - |
| Overhead Lighting | 3000 W | 2675 | - | 0 | 0 | - |
| Task Lighting | 0 W | 0 | - | 0 | 0 | - |
| Electric Equipment | 480 W | 438 | - | 0 | 0 | - |
| People | 66 | 3545 | 2323 | 0 | 0 | 0 |
| Infiltration | - | 9603 | 7000 | - | 0 | 0 |
| Miscellaneous | - | 0 | 0 | - | 0 | 0 |
| Safety Factor | 0% / 0% | 0 | 0 | 0% | 0 | 0 |
| >> Total Zone Loads | - | 26564 | 9323 | - | 0 | 0 |

TABLE 3.5.B. ENVELOPE LOADS FOR SPACE " Class 1 " IN ZONE " Zone 1 "

| | | | | COOLING | COOLING | HEATING |
|-------------------|------------------------|-------------------------------|---------------|----------------|----------------|----------------|
| | Area | U-Value | Shade | TRANS | SOLAR | TRANS |
| | (m²) | (W/(m²-°K)) | Coeff. | (W) | (W) | (W) |
| N EXPOSURE | | | | | | |
| WALL | 21 | 2.022 | - | 830 | - | 0 |
| WINDOW 1 | 3 | 5.900 | 0.940 | 295 | 219 | 0 |
| H EXPOSURE | | | | | | |
| ROOF | 84 | 3.105 | - | 7924 | - | 0 |

TABLE 3.6.A. COMPONENT LOADS FOR SPACE " Class 2 " IN ZONE " Zone 1 "

| | DESIGN COOLING | | | DESIGN HEATING | | |
|----------------------------------|---|-----------------|---------------|---|-----------------|---------------|
| | COOLING DATA AT Jan 1700 | | | HEATING DATA AT DES HTG | | |
| | COOLING OA DB / WB 41.0 °C / 25.8 °C | | | HEATING OA DB / WB 24.0 °C / 15.0 °C | | |
| | OCCUPIED T-STAT 24.0 °C | | | OCCUPIED T-STAT 22.0 °C | | |
| | | Sensible | Latent | | Sensible | Latent |
| SPACE LOADS | Details | (W) | (W) | Details | (W) | (W) |
| Window & Skylight Solar Loads | 3 m ² | 219 | - | 3 m ² | - | - |
| Wall Transmission | 21 m ² | 830 | - | 21 m ² | 0 | - |
| Roof Transmission | 84 m ² | 7924 | - | 84 m ² | 0 | - |
| Window Transmission | 3 m ² | 295 | - | 3 m ² | 0 | - |
| Skylight Transmission | 0 m ² | 0 | - | 0 m ² | 0 | - |
| Door Loads | 3 m ² | 0 | - | 0 m ² | 0 | - |
| Floor Transmission | 84 m ² | 0 | - | 84 m ² | 0 | - |
| Partitions | 66 m ² | 1033 | - | 66 m ² | 0 | - |
| Ceiling | 0 m ² | 0 | - | 0 m ² | 0 | - |
| Overhead Lighting | 3000 W | 2675 | - | 0 | 0 | - |
| Task Lighting | 0 W | 0 | - | 0 | 0 | - |
| Electric Equipment | 480 W | 438 | - | 0 | 0 | - |
| People | 66 | 3545 | 2323 | 0 | 0 | 0 |
| Infiltration | - | 9603 | 7000 | - | 0 | 0 |
| Miscellaneous | - | 0 | 0 | - | 0 | 0 |
| Safety Factor | 0% / 0% | 0 | 0 | 0% | 0 | 0 |
| >> Total Zone Loads | - | 26564 | 9323 | - | 0 | 0 |

TABLE 3.6.B. ENVELOPE LOADS FOR SPACE " Class 2 " IN ZONE " Zone 1 "

| | | | | COOLING | COOLING | HEATING |
|-------------------|------------------------|-------------------------------|---------------|----------------|----------------|----------------|
| | Area | U-Value | Shade | TRANS | SOLAR | TRANS |
| | (m²) | (W/(m²-°K)) | Coeff. | (W) | (W) | (W) |
| N EXPOSURE | | | | | | |
| WALL | 21 | 2.022 | - | 830 | - | 0 |
| WINDOW 1 | 3 | 5.900 | 0.940 | 295 | 219 | 0 |
| H EXPOSURE | | | | | | |
| ROOF | 84 | 3.105 | - | 7924 | - | 0 |

TABLE 3.7.A. COMPONENT LOADS FOR SPACE " Class 3 " IN ZONE " Zone 1 "

| | DESIGN COOLING | | | DESIGN HEATING | | |
|----------------------------------|---|-----------------|---------------|---|-----------------|---------------|
| | COOLING DATA AT Jan 1700 | | | HEATING DATA AT DES HTG | | |
| | COOLING OA DB / WB 41.0 °C / 25.8 °C | | | HEATING OA DB / WB 24.0 °C / 15.0 °C | | |
| | OCCUPIED T-STAT 24.0 °C | | | OCCUPIED T-STAT 22.0 °C | | |
| | | Sensible | Latent | | Sensible | Latent |
| SPACE LOADS | Details | (W) | (W) | Details | (W) | (W) |
| Window & Skylight Solar Loads | 3 m ² | 219 | - | 3 m ² | - | - |
| Wall Transmission | 21 m ² | 830 | - | 21 m ² | 0 | - |
| Roof Transmission | 84 m ² | 7924 | - | 84 m ² | 0 | - |
| Window Transmission | 3 m ² | 295 | - | 3 m ² | 0 | - |
| Skylight Transmission | 0 m ² | 0 | - | 0 m ² | 0 | - |
| Door Loads | 3 m ² | 0 | - | 0 m ² | 0 | - |
| Floor Transmission | 84 m ² | 0 | - | 84 m ² | 0 | - |
| Partitions | 70 m ² | 1101 | - | 70 m ² | 0 | - |
| Ceiling | 0 m ² | 0 | - | 0 m ² | 0 | - |
| Overhead Lighting | 3000 W | 2675 | - | 0 | 0 | - |
| Task Lighting | 0 W | 0 | - | 0 | 0 | - |
| Electric Equipment | 480 W | 438 | - | 0 | 0 | - |
| People | 66 | 3545 | 2323 | 0 | 0 | 0 |
| Infiltration | - | 9603 | 7000 | - | 0 | 0 |
| Miscellaneous | - | 0 | 0 | - | 0 | 0 |
| Safety Factor | 0% / 0% | 0 | 0 | 0% | 0 | 0 |
| >> Total Zone Loads | - | 26631 | 9323 | - | 0 | 0 |

TABLE 3.7.B. ENVELOPE LOADS FOR SPACE " Class 3 " IN ZONE " Zone 1 "

| | | | | COOLING | COOLING | HEATING |
|-------------------|------------------------|-------------------------------|---------------|----------------|----------------|----------------|
| | Area | U-Value | Shade | TRANS | SOLAR | TRANS |
| | (m²) | (W/(m²-°K)) | Coeff. | (W) | (W) | (W) |
| N EXPOSURE | | | | | | |
| WALL | 21 | 2.022 | - | 830 | - | 0 |
| WINDOW 1 | 3 | 5.900 | 0.940 | 295 | 219 | 0 |
| H EXPOSURE | | | | | | |
| ROOF | 84 | 3.105 | - | 7924 | - | 0 |

TABLE 3.8.A. COMPONENT LOADS FOR SPACE " Deans office " IN ZONE " Zone 1 "

| | DESIGN COOLING | | | DESIGN HEATING | | |
|----------------------------------|---|-----------------|---------------|---|-----------------|---------------|
| | COOLING DATA AT Jan 1700 | | | HEATING DATA AT DES HTG | | |
| | COOLING OA DB / WB 41.0 °C / 25.8 °C | | | HEATING OA DB / WB 24.0 °C / 15.0 °C | | |
| | OCCUPIED T-STAT 24.0 °C | | | OCCUPIED T-STAT 22.0 °C | | |
| | | Sensible | Latent | | Sensible | Latent |
| SPACE LOADS | Details | (W) | (W) | Details | (W) | (W) |
| Window & Skylight Solar Loads | 12 m ² | 2119 | - | 12 m ² | - | - |
| Wall Transmission | 26 m ² | 1540 | - | 26 m ² | 0 | - |
| Roof Transmission | 48 m ² | 4528 | - | 48 m ² | 0 | - |
| Window Transmission | 12 m ² | 1111 | - | 12 m ² | 0 | - |
| Skylight Transmission | 0 m ² | 0 | - | 0 m ² | 0 | - |
| Door Loads | 3 m ² | 0 | - | 0 m ² | 0 | - |
| Floor Transmission | 48 m ² | 0 | - | 48 m ² | 0 | - |
| Partitions | 31 m ² | 490 | - | 31 m ² | 0 | - |
| Ceiling | 0 m ² | 0 | - | 0 m ² | 0 | - |
| Overhead Lighting | 1500 W | 1337 | - | 0 | 0 | - |
| Task Lighting | 0 W | 0 | - | 0 | 0 | - |
| Electric Equipment | 940 W | 858 | - | 0 | 0 | - |
| People | 6 | 343 | 360 | 0 | 0 | 0 |
| Infiltration | - | 2744 | 2000 | - | 0 | 0 |
| Miscellaneous | - | 0 | 0 | - | 0 | 0 |
| Safety Factor | 0% / 0% | 0 | 0 | 0% | 0 | 0 |
| >> Total Zone Loads | - | 15070 | 2361 | - | 0 | 0 |

TABLE 3.8.B. ENVELOPE LOADS FOR SPACE " Deans office " IN ZONE " Zone 1 "

| | | | | COOLING | COOLING | HEATING |
|-------------------|------------------------|-------------------------------|---------------|----------------|----------------|----------------|
| | Area | U-Value | Shade | TRANS | SOLAR | TRANS |
| | (m²) | (W/(m²-°K)) | Coeff. | (W) | (W) | (W) |
| N EXPOSURE | | | | | | |
| WALL | 12 | 2.022 | - | 478 | - | 0 |
| WINDOW 1 | 2 | 5.900 | 0.940 | 157 | 117 | 0 |
| E EXPOSURE | | | | | | |
| WALL | 14 | 2.022 | - | 1062 | - | 0 |
| WINDOW 1 | 10 | 5.900 | 0.940 | 954 | 2002 | 0 |
| H EXPOSURE | | | | | | |
| ROOF | 48 | 3.105 | - | 4528 | - | 0 |

| TABLE 3.9.A. COMPONENT LOADS FOR SPACE " Electric Room " IN ZONE " Zone 1 " | | | | | | |
|--|---|-----------------|---------------|---|-----------------|---------------|
| | DESIGN COOLING | | | DESIGN HEATING | | |
| | COOLING DATA AT Jan 1700 | | | HEATING DATA AT DES HTG | | |
| | COOLING OA DB / WB 41.0 °C / 25.8 °C | | | HEATING OA DB / WB 24.0 °C / 15.0 °C | | |
| | OCCUPIED T-STAT 24.0 °C | | | OCCUPIED T-STAT 22.0 °C | | |
| | | Sensible | Latent | | Sensible | Latent |
| SPACE LOADS | Details | (W) | (W) | Details | (W) | (W) |
| Window & Skylight Solar Loads | 2 m ² | 103 | - | 2 m ² | - | - |
| Wall Transmission | 16 m ² | 625 | - | 16 m ² | 0 | - |
| Roof Transmission | 29 m ² | 2717 | - | 29 m ² | 0 | - |
| Window Transmission | 2 m ² | 138 | - | 2 m ² | 0 | - |
| Skylight Transmission | 0 m ² | 0 | - | 0 m ² | 0 | - |
| Door Loads | 3 m ² | 0 | - | 0 m ² | 0 | - |
| Floor Transmission | 29 m ² | 0 | - | 29 m ² | 0 | - |
| Partitions | 57 m ² | 896 | - | 57 m ² | 0 | - |
| Ceiling | 0 m ² | 0 | - | 0 m ² | 0 | - |
| Overhead Lighting | 1000 W | 892 | - | 0 | 0 | - |
| Task Lighting | 0 W | 0 | - | 0 | 0 | - |
| Electric Equipment | 230 W | 210 | - | 0 | 0 | - |
| People | 20 | 1145 | 1202 | 0 | 0 | 0 |
| Infiltration | - | 1646 | 1200 | - | 0 | 0 |
| Miscellaneous | - | 0 | 0 | - | 0 | 0 |
| Safety Factor | 0% / 0% | 0 | 0 | 0% | 0 | 0 |
| >> Total Zone Loads | - | 8371 | 2402 | - | 0 | 0 |

| TABLE 3.9.B. ENVELOPE LOADS FOR SPACE " Electric Room " IN ZONE " Zone 1 " | | | | | | |
|---|------------------------|-------------------------------|---------------|----------------|----------------|----------------|
| | | | | COOLING | COOLING | HEATING |
| | Area | U-Value | Shade | TRANS | SOLAR | TRANS |
| | (m²) | (W/(m²-°K)) | Coeff. | (W) | (W) | (W) |
| N EXPOSURE | | | | | | |
| WALL | 16 | 2.022 | - | 625 | - | 0 |
| WINDOW 1 | 2 | 5.900 | 0.940 | 138 | 103 | 0 |
| H EXPOSURE | | | | | | |
| ROOF | 29 | 3.105 | - | 2717 | - | 0 |

TABLE 3.10.A. COMPONENT LOADS FOR SPACE " Lap 1 " IN ZONE " Zone 2 "

| | DESIGN COOLING | | | DESIGN HEATING | | |
|----------------------------------|---|-----------------|---------------|---|-----------------|---------------|
| | COOLING DATA AT Jan 1700 | | | HEATING DATA AT DES HTG | | |
| | COOLING OA DB / WB 41.0 °C / 25.8 °C | | | HEATING OA DB / WB 24.0 °C / 15.0 °C | | |
| | OCCUPIED T-STAT 24.0 °C | | | OCCUPIED T-STAT 22.0 °C | | |
| | | Sensible | Latent | | Sensible | Latent |
| SPACE LOADS | Details | (W) | (W) | Details | (W) | (W) |
| Window & Skylight Solar Loads | 3 m ² | 357 | - | 3 m ² | - | - |
| Wall Transmission | 21 m ² | 1100 | - | 21 m ² | 0 | - |
| Roof Transmission | 84 m ² | 7924 | - | 84 m ² | 0 | - |
| Window Transmission | 3 m ² | 295 | - | 3 m ² | 0 | - |
| Skylight Transmission | 0 m ² | 0 | - | 0 m ² | 0 | - |
| Door Loads | 3 m ² | 0 | - | 0 m ² | 0 | - |
| Floor Transmission | 84 m ² | 0 | - | 84 m ² | 0 | - |
| Partitions | 66 m ² | 1033 | - | 66 m ² | 0 | - |
| Ceiling | 0 m ² | 0 | - | 0 m ² | 0 | - |
| Overhead Lighting | 3000 W | 2675 | - | 0 | 0 | - |
| Task Lighting | 0 W | 0 | - | 0 | 0 | - |
| Electric Equipment | 4900 W | 4472 | - | 0 | 0 | - |
| People | 32 | 1719 | 1126 | 0 | 0 | 0 |
| Infiltration | - | 9603 | 6996 | - | 0 | 0 |
| Miscellaneous | - | 0 | 0 | - | 0 | 0 |
| Safety Factor | 0% / 0% | 0 | 0 | 0% | 0 | 0 |
| >> Total Zone Loads | - | 29179 | 8123 | - | 0 | 0 |

TABLE 3.10.B. ENVELOPE LOADS FOR SPACE " Lap 1 " IN ZONE " Zone 2 "

| | | | | COOLING | COOLING | HEATING |
|-------------------|------------------------|-------------------------------|---------------|----------------|----------------|----------------|
| | Area | U-Value | Shade | TRANS | SOLAR | TRANS |
| | (m²) | (W/(m²-°K)) | Coeff. | (W) | (W) | (W) |
| S EXPOSURE | | | | | | |
| WALL | 21 | 2.022 | - | 1100 | - | 0 |
| WINDOW 1 | 3 | 5.900 | 0.940 | 295 | 357 | 0 |
| H EXPOSURE | | | | | | |
| ROOF | 84 | 3.105 | - | 7924 | - | 0 |

TABLE 3.11.A. COMPONENT LOADS FOR SPACE " Lap 2 " IN ZONE " Zone 2 "

| | DESIGN COOLING | | | DESIGN HEATING | | |
|----------------------------------|---|-----------------|---------------|---|-----------------|---------------|
| | COOLING DATA AT Jan 1700 | | | HEATING DATA AT DES HTG | | |
| | COOLING OA DB / WB 41.0 °C / 25.8 °C | | | HEATING OA DB / WB 24.0 °C / 15.0 °C | | |
| | OCCUPIED T-STAT 24.0 °C | | | OCCUPIED T-STAT 22.0 °C | | |
| | | Sensible | Latent | | Sensible | Latent |
| SPACE LOADS | Details | (W) | (W) | Details | (W) | (W) |
| Window & Skylight Solar Loads | 3 m ² | 357 | - | 3 m ² | - | - |
| Wall Transmission | 21 m ² | 1100 | - | 21 m ² | 0 | - |
| Roof Transmission | 84 m ² | 7924 | - | 84 m ² | 0 | - |
| Window Transmission | 3 m ² | 295 | - | 3 m ² | 0 | - |
| Skylight Transmission | 0 m ² | 0 | - | 0 m ² | 0 | - |
| Door Loads | 3 m ² | 0 | - | 0 m ² | 0 | - |
| Floor Transmission | 84 m ² | 0 | - | 84 m ² | 0 | - |
| Partitions | 66 m ² | 1033 | - | 66 m ² | 0 | - |
| Ceiling | 0 m ² | 0 | - | 0 m ² | 0 | - |
| Overhead Lighting | 3000 W | 2675 | - | 0 | 0 | - |
| Task Lighting | 0 W | 0 | - | 0 | 0 | - |
| Electric Equipment | 4900 W | 4472 | - | 0 | 0 | - |
| People | 32 | 1719 | 1126 | 0 | 0 | 0 |
| Infiltration | - | 9603 | 6996 | - | 0 | 0 |
| Miscellaneous | - | 0 | 0 | - | 0 | 0 |
| Safety Factor | 0% / 0% | 0 | 0 | 0% | 0 | 0 |
| >> Total Zone Loads | - | 29179 | 8123 | - | 0 | 0 |

TABLE 3.11.B. ENVELOPE LOADS FOR SPACE " Lap 2 " IN ZONE " Zone 2 "

| | | | | COOLING | COOLING | HEATING |
|-------------------|------------------------|-------------------------------|---------------|----------------|----------------|----------------|
| | Area | U-Value | Shade | TRANS | SOLAR | TRANS |
| | (m²) | (W/(m²-°K)) | Coeff. | (W) | (W) | (W) |
| S EXPOSURE | | | | | | |
| WALL | 21 | 2.022 | - | 1100 | - | 0 |
| WINDOW 1 | 3 | 5.900 | 0.940 | 295 | 357 | 0 |
| H EXPOSURE | | | | | | |
| ROOF | 84 | 3.105 | - | 7924 | - | 0 |

TABLE 3.12.A. COMPONENT LOADS FOR SPACE " Lap 3 " IN ZONE " Zone 2 "

| | DESIGN COOLING | | | DESIGN HEATING | | |
|----------------------------------|---|-----------------|---------------|---|-----------------|---------------|
| | COOLING DATA AT Jan 1700 | | | HEATING DATA AT DES HTG | | |
| | COOLING OA DB / WB 41.0 °C / 25.8 °C | | | HEATING OA DB / WB 24.0 °C / 15.0 °C | | |
| | OCCUPIED T-STAT 24.0 °C | | | OCCUPIED T-STAT 22.0 °C | | |
| | | Sensible | Latent | | Sensible | Latent |
| SPACE LOADS | Details | (W) | (W) | Details | (W) | (W) |
| Window & Skylight Solar Loads | 3 m ² | 357 | - | 3 m ² | - | - |
| Wall Transmission | 21 m ² | 1100 | - | 21 m ² | 0 | - |
| Roof Transmission | 84 m ² | 7924 | - | 84 m ² | 0 | - |
| Window Transmission | 3 m ² | 295 | - | 3 m ² | 0 | - |
| Skylight Transmission | 0 m ² | 0 | - | 0 m ² | 0 | - |
| Door Loads | 3 m ² | 0 | - | 0 m ² | 0 | - |
| Floor Transmission | 84 m ² | 0 | - | 84 m ² | 0 | - |
| Partitions | 108 m ² | 1703 | - | 108 m ² | 0 | - |
| Ceiling | 0 m ² | 0 | - | 0 m ² | 0 | - |
| Overhead Lighting | 3000 W | 2675 | - | 0 | 0 | - |
| Task Lighting | 0 W | 0 | - | 0 | 0 | - |
| Electric Equipment | 4900 W | 4472 | - | 0 | 0 | - |
| People | 32 | 1719 | 1126 | 0 | 0 | 0 |
| Infiltration | - | 9603 | 6996 | - | 0 | 0 |
| Miscellaneous | - | 0 | 0 | - | 0 | 0 |
| Safety Factor | 0% / 0% | 0 | 0 | 0% | 0 | 0 |
| >> Total Zone Loads | - | 29849 | 8123 | - | 0 | 0 |

TABLE 3.12.B. ENVELOPE LOADS FOR SPACE " Lap 3 " IN ZONE " Zone 2 "

| | | | | COOLING | COOLING | HEATING |
|-------------------|------------------------|-------------------------------|---------------|----------------|----------------|----------------|
| | Area | U-Value | Shade | TRANS | SOLAR | TRANS |
| | (m²) | (W/(m²-°K)) | Coeff. | (W) | (W) | (W) |
| S EXPOSURE | | | | | | |
| WALL | 21 | 2.022 | - | 1100 | - | 0 |
| WINDOW 1 | 3 | 5.900 | 0.940 | 295 | 357 | 0 |
| H EXPOSURE | | | | | | |
| ROOF | 84 | 3.105 | - | 7924 | - | 0 |

TABLE 3.13.A. COMPONENT LOADS FOR SPACE " Registrar Office " IN ZONE " Zone 2 "

| | DESIGN COOLING | | | DESIGN HEATING | | |
|----------------------------------|---|-----------------|---------------|---|-----------------|---------------|
| | COOLING DATA AT Dec 1700 | | | HEATING DATA AT DES HTG | | |
| | COOLING OA DB / WB 40.4 °C / 25.8 °C | | | HEATING OA DB / WB 24.0 °C / 15.0 °C | | |
| | OCCUPIED T-STAT 24.0 °C | | | OCCUPIED T-STAT 22.0 °C | | |
| | | Sensible | Latent | | Sensible | Latent |
| SPACE LOADS | Details | (W) | (W) | Details | (W) | (W) |
| Window & Skylight Solar Loads | 12 m ² | 2225 | - | 12 m ² | - | - |
| Wall Transmission | 50 m ² | 3072 | - | 50 m ² | 0 | - |
| Roof Transmission | 48 m ² | 4584 | - | 48 m ² | 0 | - |
| Window Transmission | 12 m ² | 1071 | - | 12 m ² | 0 | - |
| Skylight Transmission | 0 m ² | 0 | - | 0 m ² | 0 | - |
| Door Loads | 3 m ² | 0 | - | 0 m ² | 0 | - |
| Floor Transmission | 48 m ² | 0 | - | 48 m ² | 0 | - |
| Partitions | 31 m ² | 487 | - | 31 m ² | 0 | - |
| Ceiling | 0 m ² | 0 | - | 0 m ² | 0 | - |
| Overhead Lighting | 1500 W | 1337 | - | 0 | 0 | - |
| Task Lighting | 0 W | 0 | - | 0 | 0 | - |
| Electric Equipment | 940 W | 858 | - | 0 | 0 | - |
| People | 10 | 572 | 601 | 0 | 0 | 0 |
| Infiltration | - | 2654 | 2065 | - | 0 | 0 |
| Miscellaneous | - | 0 | 0 | - | 0 | 0 |
| Safety Factor | 0% / 0% | 0 | 0 | 0% | 0 | 0 |
| >> Total Zone Loads | - | 16861 | 2666 | - | 0 | 0 |

TABLE 3.13.B. ENVELOPE LOADS FOR SPACE " Registrar Office " IN ZONE " Zone 2 "

| | | | | COOLING | COOLING | HEATING |
|-------------------|------------------------|-------------------------------|---------------|----------------|----------------|----------------|
| | Area | U-Value | Shade | TRANS | SOLAR | TRANS |
| | (m²) | (W/(m²-°K)) | Coeff. | (W) | (W) | (W) |
| S EXPOSURE | | | | | | |
| WALL | 36 | 2.022 | - | 2035 | - | 0 |
| WINDOW 1 | 2 | 5.900 | 0.940 | 151 | 239 | 0 |
| E EXPOSURE | | | | | | |
| WALL | 14 | 2.022 | - | 1037 | - | 0 |
| WINDOW 1 | 10 | 5.900 | 0.940 | 920 | 1986 | 0 |
| H EXPOSURE | | | | | | |
| ROOF | 48 | 3.105 | - | 4584 | - | 0 |

TABLE 3.14.A. COMPONENT LOADS FOR SPACE "Food Manufacturing Office "IN ZONE " Zone 3 "

| | DESIGN COOLING | | | DESIGN HEATING | | |
|----------------------------------|---|-----------------|---------------|---|-----------------|---------------|
| | COOLING DATA AT Jan 1700 | | | HEATING DATA AT DES HTG | | |
| | COOLING OA DB / WB 41.0 °C / 25.8 °C | | | HEATING OA DB / WB 24.0 °C / 15.0 °C | | |
| | OCCUPIED T-STAT 24.0 °C | | | OCCUPIED T-STAT 22.0 °C | | |
| | | Sensible | Latent | | Sensible | Latent |
| SPACE LOADS | Details | (W) | (W) | Details | (W) | (W) |
| Window & Skylight Solar Loads | 2 m ² | 214 | - | 2 m ² | - | - |
| Wall Transmission | 14 m ² | 573 | - | 14 m ² | 0 | - |
| Roof Transmission | 27 m ² | 2547 | - | 27 m ² | 0 | - |
| Window Transmission | 2 m ² | 180 | - | 2 m ² | 0 | - |
| Skylight Transmission | 0 m ² | 0 | - | 0 m ² | 0 | - |
| Door Loads | 2.5 m ² | 0 | - | 0 m ² | 0 | - |
| Floor Transmission | 27 m ² | 0 | - | 27 m ² | 0 | - |
| Partitions | 57 m ² | 896 | - | 57 m ² | 0 | - |
| Ceiling | 0 m ² | 0 | - | 0 m ² | 0 | - |
| Overhead Lighting | 1000 W | 892 | - | 0 | 0 | - |
| Task Lighting | 0 W | 0 | - | 0 | 0 | - |
| Electric Equipment | 780 W | 712 | - | 0 | 0 | - |
| People | 5 | 286 | 300 | 0 | 0 | 0 |
| Infiltration | - | 1543 | 1124 | - | 0 | 0 |
| Miscellaneous | - | 0 | 0 | - | 0 | 0 |
| Safety Factor | 0% / 0% | 0 | 0 | 0% | 0 | 0 |
| >> Total Zone Loads | - | 7843 | 1424 | - | 0 | 0 |

TABLE 3.14.B. ENVELOPE LOADS FOR SPACE " Food Manufacturing Office " IN ZONE " Zone 3 "

| | | | | COOLING | COOLING | HEATING |
|-------------------|------------------------|-------------------------------|---------------|----------------|----------------|----------------|
| | Area | U-Value | Shade | TRANS | SOLAR | TRANS |
| | (m²) | (W/(m²-°K)) | Coeff. | (W) | (W) | (W) |
| W EXPOSURE | | | | | | |
| WALL | 14 | 2.022 | - | 573 | - | 0 |
| WINDOW 1 | 2 | 5.900 | 0.940 | 180 | 214 | 0 |
| H EXPOSURE | | | | | | |
| ROOF | 27 | 3.105 | - | 2547 | - | 0 |

TABLE 3.15.A. COMPONENT LOADS FOR SPACE " Mechanical office " IN ZONE " Zone 3 "

| | DESIGN COOLING | | | DESIGN HEATING | | |
|----------------------------------|---|-----------------|---------------|---|-----------------|---------------|
| | COOLING DATA AT Jan 1700 | | | HEATING DATA AT DES HTG | | |
| | COOLING OA DB / WB 41.0 °C / 25.8 °C | | | HEATING OA DB / WB 24.0 °C / 15.0 °C | | |
| | OCCUPIED T-STAT 24.0 °C | | | OCCUPIED T-STAT 22.0 °C | | |
| | | Sensible | Latent | | Sensible | Latent |
| SPACE LOADS | Details | (W) | (W) | Details | (W) | (W) |
| Window & Skylight Solar Loads | 12 m ² | 2119 | - | 12 m ² | - | - |
| Wall Transmission | 26 m ² | 1540 | - | 26 m ² | 0 | - |
| Roof Transmission | 48 m ² | 4528 | - | 48 m ² | 0 | - |
| Window Transmission | 12 m ² | 1111 | - | 12 m ² | 0 | - |
| Skylight Transmission | 0 m ² | 0 | - | 0 m ² | 0 | - |
| Door Loads | 2.5 m ² | 0 | - | 0 m ² | 0 | - |
| Floor Transmission | 48 m ² | 0 | - | 48 m ² | 0 | - |
| Partitions | 31 m ² | 490 | - | 31 m ² | 0 | - |
| Ceiling | 0 m ² | 0 | - | 0 m ² | 0 | - |
| Overhead Lighting | 1500 W | 1337 | - | 0 | 0 | - |
| Task Lighting | 0 W | 0 | - | 0 | 0 | - |
| Electric Equipment | 940 W | 858 | - | 0 | 0 | - |
| People | 6 | 343 | 360 | 0 | 0 | 0 |
| Infiltration | - | 2744 | 1998 | - | 0 | 0 |
| Miscellaneous | - | 0 | 0 | - | 0 | 0 |
| Safety Factor | 0% / 0% | 0 | 0 | 0% | 0 | 0 |
| >> Total Zone Loads | - | 15070 | 2359 | - | 0 | 0 |

TABLE 3.15.B. ENVELOPE LOADS FOR SPACE " Mechanical office " IN ZONE " Zone 3 "

| | | | | COOLING | COOLING | HEATING |
|-------------------|------------------------|-------------------------------|---------------|----------------|----------------|----------------|
| | Area | U-Value | Shade | TRANS | SOLAR | TRANS |
| | (m²) | (W/(m²-°K)) | Coeff. | (W) | (W) | (W) |
| N EXPOSURE | | | | | | |
| WALL | 12 | 2.022 | - | 478 | - | 0 |
| WINDOW 1 | 2 | 5.900 | 0.940 | 157 | 117 | 0 |
| E EXPOSURE | | | | | | |
| WALL | 14 | 2.022 | - | 1062 | - | 0 |
| WINDOW 1 | 10 | 5.900 | 0.940 | 954 | 2002 | 0 |
| H EXPOSURE | | | | | | |
| ROOF | 48 | 3.105 | - | 4528 | - | 0 |

TABLE 3.16.A. COMPONENT LOADS FOR SPACE " Chemical office " IN ZONE " Zone 3 "

| | DESIGN COOLING | | | DESIGN HEATING | | |
|----------------------------------|---|-----------------|---------------|---|-----------------|---------------|
| | COOLING DATA AT Jan 1700 | | | HEATING DATA AT DES HTG | | |
| | COOLING OA DB / WB 41.0 °C / 25.8 °C | | | HEATING OA DB / WB 24.0 °C / 15.0 °C | | |
| | OCCUPIED T-STAT 24.0 °C | | | OCCUPIED T-STAT 22.0 °C | | |
| | | Sensible | Latent | | Sensible | Latent |
| SPACE LOADS | Details | (W) | (W) | Details | (W) | (W) |
| Window & Skylight Solar Loads | 2 m ² | 214 | - | 2 m ² | - | - |
| Wall Transmission | 14 m ² | 573 | - | 14 m ² | 0 | - |
| Roof Transmission | 27 m ² | 2547 | - | 27 m ² | 0 | - |
| Window Transmission | 2 m ² | 180 | - | 2 m ² | 0 | - |
| Skylight Transmission | 0 m ² | 0 | - | 0 m ² | 0 | - |
| Door Loads | 2.5 m ² | 0 | - | 0 m ² | 0 | - |
| Floor Transmission | 27 m ² | 0 | - | 27 m ² | 0 | - |
| Partitions | 36 m ² | 570 | - | 36 m ² | 0 | - |
| Ceiling | 0 m ² | 0 | - | 0 m ² | 0 | - |
| Overhead Lighting | 1000 W | 892 | - | 0 | 0 | - |
| Task Lighting | 0 W | 0 | - | 0 | 0 | - |
| Electric Equipment | 860 W | 785 | - | 0 | 0 | - |
| People | 6 | 343 | 360 | 0 | 0 | 0 |
| Infiltration | - | 1543 | 1124 | - | 0 | 0 |
| Miscellaneous | - | 0 | 0 | - | 0 | 0 |
| Safety Factor | 0% / 0% | 0 | 0 | 0% | 0 | 0 |
| >> Total Zone Loads | - | 7647 | 1484 | - | 0 | 0 |

TABLE 3.16.B. ENVELOPE LOADS FOR SPACE " Chemical office " IN ZONE " Zone 3 "

| | | | | COOLING | COOLING | HEATING |
|-------------------|------------------------|-------------------------------|---------------|----------------|----------------|----------------|
| | Area | U-Value | Shade | TRANS | SOLAR | TRANS |
| | (m²) | (W/(m²-°K)) | Coeff. | (W) | (W) | (W) |
| W EXPOSURE | | | | | | |
| WALL | 14 | 2.022 | - | 573 | - | 0 |
| WINDOW 1 | 2 | 5.900 | 0.940 | 180 | 214 | 0 |
| H EXPOSURE | | | | | | |
| ROOF | 27 | 3.105 | - | 2547 | - | 0 |

TABLE 3.17.A. COMPONENT LOADS FOR SPACE " Corridor 1 " IN ZONE " Zone 4 "

| | DESIGN COOLING | | | DESIGN HEATING | | |
|----------------------------------|---|-----------------|---------------|---|-----------------|---------------|
| | COOLING DATA AT Jan 1700 | | | HEATING DATA AT DES HTG | | |
| | COOLING OA DB / WB 41.0 °C / 25.8 °C | | | HEATING OA DB / WB 24.0 °C / 15.0 °C | | |
| | OCCUPIED T-STAT 24.0 °C | | | OCCUPIED T-STAT 22.0 °C | | |
| | | Sensible | Latent | | Sensible | Latent |
| SPACE LOADS | Details | (W) | (W) | Details | (W) | (W) |
| Window & Skylight Solar Loads | 0 m ² | 0 | - | 0 m ² | - | - |
| Wall Transmission | 0 m ² | 0 | - | 0 m ² | 0 | - |
| Roof Transmission | 138 m ² | 12953 | - | 138 m ² | 0 | - |
| Window Transmission | 0 m ² | 0 | - | 0 m ² | 0 | - |
| Skylight Transmission | 0 m ² | 0 | - | 0 m ² | 0 | - |
| Door Loads | 0 m ² | 0 | - | 0 m ² | 0 | - |
| Floor Transmission | 138 m ² | 0 | - | 138 m ² | 0 | - |
| Partitions | 0 m ² | 0 | - | 0 m ² | 0 | - |
| Ceiling | 0 m ² | 0 | - | 0 m ² | 0 | - |
| Overhead Lighting | 3000 W | 2422 | - | 0 | 0 | - |
| Task Lighting | 0 W | 0 | - | 0 | 0 | - |
| Electric Equipment | 400 W | 366 | - | 0 | 0 | - |
| People | 30 | 2076 | 3999 | 0 | 0 | 0 |
| Infiltration | - | 20960 | 15264 | - | 0 | 0 |
| Miscellaneous | - | 0 | 0 | - | 0 | 0 |
| Safety Factor | 0% / 0% | 0 | 0 | 0% | 0 | 0 |
| >> Total Zone Loads | - | 38775 | 19263 | - | 0 | 0 |

TABLE 3.17.B. ENVELOPE LOADS FOR SPACE " Corridor 1 " IN ZONE " Zone 4 "

| | | | | COOLING | COOLING | HEATING |
|-------------------|------------------------|-------------------------------|---------------|----------------|----------------|----------------|
| | Area | U-Value | Shade | TRANS | SOLAR | TRANS |
| | (m²) | (W/(m²-°K)) | Coeff. | (W) | (W) | (W) |
| H EXPOSURE | | | | | | |
| ROOF | 138 | 3.105 | - | 12953 | - | 0 |

| TABLE 3.18.A. COMPONENT LOADS FOR SPACE " Corridor 2 " IN ZONE " Zone 4 " | | | | | | |
|---|--------------------------------------|----------|--------|--------------------------------------|----------|--------|
| | DESIGN COOLING | | | DESIGN HEATING | | |
| | COOLING DATA AT Jan 1800 | | | HEATING DATA AT DES HTG | | |
| | COOLING OA DB / WB 39.8 °C / 25.5 °C | | | HEATING OA DB / WB 24.0 °C / 15.0 °C | | |
| | OCCUPIED T-STAT 24.0 °C | | | OCCUPIED T-STAT 22.0 °C | | |
| | | Sensible | Latent | | Sensible | Latent |
| SPACE LOADS | Details | (W) | (W) | Details | (W) | (W) |
| Window & Skylight Solar Loads | 0 m ² | 0 | - | 0 m ² | - | - |
| Wall Transmission | 17 m ² | 948 | - | 17 m ² | 0 | - |
| Roof Transmission | 138 m ² | 14884 | - | 138 m ² | 0 | - |
| Window Transmission | 0 m ² | 0 | - | 0 m ² | 0 | - |
| Skylight Transmission | 0 m ² | 0 | - | 0 m ² | 0 | - |
| Door Loads | 0 m ² | 0 | - | 0 m ² | 0 | - |
| Floor Transmission | 91 m ² | 0 | - | 91 m ² | 0 | - |
| Partitions | 0 m ² | 0 | - | 0 m ² | 0 | - |
| Ceiling | 0 m ² | 0 | - | 0 m ² | 0 | - |
| Overhead Lighting | 1500 W | 1635 | - | 0 | 0 | - |
| Task Lighting | 0 W | 0 | - | 0 | 0 | - |
| Electric Equipment | 200 W | 208 | - | 0 | 0 | - |
| People | 15 | 1055 | 2000 | 0 | 0 | 0 |
| Infiltration | - | 12969 | 10005 | - | 0 | 0 |
| Miscellaneous | - | 0 | 0 | - | 0 | 0 |
| Safety Factor | 0% / 0% | 0 | 0 | 0% | 0 | 0 |
| >> Total Zone Loads | - | 31698 | 12004 | - | 0 | 0 |

| TABLE 3.18.B. ENVELOPE LOADS FOR SPACE " Corridor 2 " IN ZONE " Zone 4 " | | | | | | |
|--|-------------------|--------------------------|--------|---------|---------|---------|
| | | | | COOLING | COOLING | HEATING |
| | Area | U-Value | Shade | TRANS | SOLAR | TRANS |
| | (m ²) | (W/(m ² -°K)) | Coeff. | (W) | (W) | (W) |
| S EXPOSURE | | | | | | |
| WALL | 17 | 2.022 | - | 948 | - | 0 |
| H EXPOSURE | | | | | | |
| ROOF | 138 | 3.105 | - | 14884 | - | 0 |

TABLE 3.19.A. COMPONENT LOADS FOR SPACE " Reception " IN ZONE " Zone 4 "

| | DESIGN COOLING | | | DESIGN HEATING | | |
|----------------------------------|---|-----------------|---------------|---|-----------------|---------------|
| | COOLING DATA AT Jan 1800 | | | HEATING DATA AT DES HTG | | |
| | COOLING OA DB / WB 39.8 °C / 25.5 °C | | | HEATING OA DB / WB 24.0 °C / 15.0 °C | | |
| | OCCUPIED T-STAT 24.0 °C | | | OCCUPIED T-STAT 22.0 °C | | |
| | | Sensible | Latent | | Sensible | Latent |
| SPACE LOADS | Details | (W) | (W) | Details | (W) | (W) |
| Window & Skylight Solar Loads | 41 m ² | 5831 | - | 41 m ² | - | - |
| Wall Transmission | 47 m ² | 3084 | - | 47 m ² | 0 | - |
| Roof Transmission | 78 m ² | 8397 | - | 78 m ² | 0 | - |
| Window Transmission | 41 m ² | 3645 | - | 41 m ² | 0 | - |
| Skylight Transmission | 0 m ² | 0 | - | 0 m ² | 0 | - |
| Door Loads | 13.5 m ² | 0 | - | 0 m ² | 0 | - |
| Floor Transmission | 78 m ² | 0 | - | 78 m ² | 0 | - |
| Partitions | 0 m ² | 0 | - | 0 m ² | 0 | - |
| Ceiling | 0 m ² | 0 | - | 0 m ² | 0 | - |
| Overhead Lighting | 250 W | 262 | - | 0 | 0 | - |
| Task Lighting | 0 W | 0 | - | 0 | 0 | - |
| Electric Equipment | 0 W | 0 | - | 0 | 0 | - |
| People | 10 | 701 | 1333 | 0 | 0 | 0 |
| Infiltration | - | 8257 | 6369 | - | 0 | 0 |
| Miscellaneous | - | 0 | 0 | - | 0 | 0 |
| Safety Factor | 0% / 0% | 0 | 0 | 0% | 0 | 0 |
| >> Total Zone Loads | - | 30175 | 7702 | - | 0 | 0 |

TABLE 3.19.B. ENVELOPE LOADS FOR SPACE " Reception " IN ZONE " Zone 4 "

| | | | | COOLING | COOLING | HEATING |
|-------------------|------------------------|-------------------------------|---------------|----------------|----------------|----------------|
| | Area | U-Value | Shade | TRANS | SOLAR | TRANS |
| | (m²) | (W/(m²-°K)) | Coeff. | (W) | (W) | (W) |
| N EXPOSURE | | | | | | |
| WALL | 7 | 2.022 | - | 291 | - | 0 |
| WINDOW 1 | 10 | 5.900 | 0.940 | 911 | 746 | 0 |
| S EXPOSURE | | | | | | |
| WALL | 7 | 2.022 | - | 381 | - | 0 |
| WINDOW 1 | 10 | 5.900 | 0.940 | 911 | 1204 | 0 |
| E EXPOSURE | | | | | | |
| WALL | 33 | 2.022 | - | 2412 | - | 0 |
| WINDOW 1 | 10 | 5.900 | 0.940 | 911 | 1940 | 0 |
| WINDOW 2 | 10 | 5.900 | 0.940 | 911 | 1940 | 0 |
| H EXPOSURE | | | | | | |
| ROOF | 78 | 3.105 | - | 8397 | - | 0 |

Table (3.20) Illustrates Calculation of Thermal Load of the Hours of the Day:

| DESIGN MONTH: JULY | | | | | | | | | | |
|--------------------|-------|--------|----------|---------|---------|--------|---------|---------|---------|---------|
| | OA | SUPPLY | CENTRAL | CENTRAL | CENTRAL | PRECOO | PREHEAT | TERMINA | TERMINA | ZONE |
| Hour | TEMP | AIRFLO | COOLING | COOLING | HEATING | L | COIL | L | L | HEATING |
| (°C) | (L/s) | W | SENSIBLE | TOTAL | COIL | COIL | COIL | COOLING | HEATING | UNIT |
| | | | (kW) | (kW) | (kW) | (kW) | (kW) | (kW) | (kW) | (kW) |
| 0000 | 27.8 | 10713 | 145.5 | 187.6 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 0100 | 27.3 | 9618 | 129.9 | 169.7 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 0200 | 26.8 | 8591 | 115.4 | 153.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 0300 | 26.4 | 7698 | 102.9 | 138.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 0400 | 26.0 | 6932 | 92.3 | 125.8 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 0500 | 25.9 | 6343 | 84.3 | 116.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 0600 | 26.2 | 5986 | 79.5 | 110.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 0700 | 26.7 | 5863 | 78.1 | 108.6 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 0800 | 27.6 | 8246 | 111.1 | 157.8 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 0900 | 29.0 | 10523 | 143.8 | 196.7 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 1000 | 30.6 | 10953 | 151.1 | 204.8 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 1100 | 32.3 | 11892 | 166.1 | 221.9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 1200 | 34.0 | 13233 | 187.1 | 245.7 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 1300 | 35.3 | 14699 | 210.0 | 271.7 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 1400 | 36.1 | 15430 | 221.8 | 284.5 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 1500 | 36.4 | 16407 | 236.9 | 301.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 1600 | 36.1 | 17159 | 247.8 | 313.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 1700 | 35.4 | 17769 | 256.0 | 322.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 1800 | 34.2 | 16776 | 239.7 | 304.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 1900 | 32.9 | 14694 | 207.3 | 256.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 2000 | 31.5 | 14354 | 200.8 | 249.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 2100 | 30.4 | 13811 | 191.8 | 239.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 2200 | 29.3 | 12930 | 178.1 | 224.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 2300 | 28.5 | 11850 | 162.0 | 206.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |

Table (3.21) Illustrates Calculation of Thermal Load of the Hours of the Day for Zone 1:

| ZONE: Zone 1 | | | | | | | | | |
|---------------------------|---------------------|-----------------------|---------------|---------------------------|-------------------------------|----------------------|----------------------------------|----------------------------------|------------------------------|
| DESIGN MONTH: JULY | | | | | | | | | |
| Hour | OA TEMP (°C) | ZONE TEMP (°C) | RH (%) | ZONE AIRFLOW (L/s) | ZONE SENSIBLE LOAD (W) | ZONE COND (W) | TERMINAL COOLING COIL (W) | TERMINAL HEATING COIL (W) | ZONE HEATING UNIT (W) |
| 0000 | 27.8 | 24.3 | 52 | 3518.9 | 47760.7 | 46869.8 | 0.0 | 0.0 | 0.0 |
| 0100 | 27.3 | 24.3 | 52 | 3163.6 | 42605.6 | 41987.5 | 0.0 | 0.0 | 0.0 |
| 0200 | 26.8 | 24.2 | 53 | 2833.4 | 37859.0 | 37483.0 | 0.0 | 0.0 | 0.0 |
| 0300 | 26.4 | 24.2 | 53 | 2547.6 | 33785.6 | 33607.0 | 0.0 | 0.0 | 0.0 |
| 0400 | 26.0 | 24.2 | 54 | 2303.0 | 30327.2 | 30306.6 | 0.0 | 0.0 | 0.0 |
| 0500 | 25.9 | 24.1 | 54 | 2113.6 | 27674.7 | 27763.1 | 0.0 | 0.0 | 0.0 |
| 0600 | 26.2 | 24.1 | 55 | 1995.2 | 26039.4 | 26177.3 | 0.0 | 0.0 | 0.0 |
| 0700 | 26.7 | 24.1 | 55 | 1947.8 | 25412.6 | 25543.2 | 0.0 | 0.0 | 0.0 |
| 0800 | 27.6 | 24.2 | 56 | 2788.3 | 37476.8 | 36869.3 | 0.0 | 0.0 | 0.0 |
| 0900 | 29.0 | 24.3 | 54 | 3396.4 | 46298.1 | 45181.9 | 0.0 | 0.0 | 0.0 |
| 1000 | 30.6 | 24.3 | 54 | 3556.6 | 48626.6 | 47388.5 | 0.0 | 0.0 | 0.0 |
| 1100 | 32.3 | 24.3 | 53 | 3839.7 | 52776.9 | 51305.8 | 0.0 | 0.0 | 0.0 |
| 1200 | 34.0 | 24.4 | 52 | 4223.0 | 58426.4 | 56645.1 | 0.0 | 0.0 | 0.0 |
| 1300 | 35.3 | 24.4 | 52 | 4633.4 | 64513.5 | 62407.8 | 0.0 | 0.0 | 0.0 |
| 1400 | 36.1 | 24.5 | 51 | 4899.6 | 68467.6 | 66170.5 | 0.0 | 0.0 | 0.0 |
| 1500 | 36.4 | 24.5 | 51 | 5226.9 | 73366.8 | 70825.3 | 0.0 | 0.0 | 0.0 |
| 1600 | 36.1 | 24.5 | 50 | 5498.3 | 77439.4 | 74708.5 | 0.0 | 0.0 | 0.0 |
| 1700 | 35.4 | 24.6 | 50 | 5724.2 | 80835.3 | 77957.3 | 0.0 | 0.0 | 0.0 |
| 1800 | 34.2 | 24.5 | 51 | 5506.9 | 77464.3 | 74832.4 | 0.0 | 0.0 | 0.0 |
| 1900 | 32.9 | 24.4 | 50 | 4783.4 | 66489.4 | 64524.5 | 0.0 | 0.0 | 0.0 |
| 2000 | 31.5 | 24.4 | 50 | 4683.4 | 64990.7 | 63112.4 | 0.0 | 0.0 | 0.0 |
| 2100 | 30.4 | 24.4 | 50 | 4513.8 | 62444.1 | 60723.4 | 0.0 | 0.0 | 0.0 |
| 2200 | 29.3 | 24.4 | 51 | 4234.5 | 58281.9 | 56805.5 | 0.0 | 0.0 | 0.0 |
| 2300 | 28.5 | 24.3 | 51 | 3888.0 | 53162.9 | 51976.2 | 0.0 | 0.0 | 0.0 |

Table (3.22) Illustrates Calculation of Thermal Load of the Hours of the Day for Zone 2:

| ONE: Zone 2 | | | | | | | | | |
|---------------------------|---------------------|-----------------------|---------------|---------------------------|-------------------------------|----------------------|----------------------------------|----------------------------------|------------------------------|
| DESIGN MONTH: JULY | | | | | | | | | |
| Hour | OA TEMP (°C) | ZONE TEMP (°C) | RH (%) | ZONE AIRFLOW (L/s) | ZONE SENSIBLE LOAD (W) | ZONE COND (W) | TERMINAL COOLING COIL (W) | TERMINAL HEATING COIL (W) | ZONE HEATING UNIT (W) |
| 0000 | 27.8 | 24.2 | 52 | 2906.1 | 39085.0 | 38508.7 | 0.0 | 0.0 | 0.0 |
| 0100 | 27.3 | 24.2 | 52 | 2614.2 | 34931.9 | 34545.3 | 0.0 | 0.0 | 0.0 |
| 0200 | 26.8 | 24.2 | 53 | 2338.7 | 31039.0 | 30824.0 | 0.0 | 0.0 | 0.0 |
| 0300 | 26.4 | 24.2 | 53 | 2097.9 | 27661.7 | 27587.8 | 0.0 | 0.0 | 0.0 |
| 0400 | 26.0 | 24.1 | 54 | 1890.6 | 24773.1 | 24812.5 | 0.0 | 0.0 | 0.0 |
| 0500 | 25.9 | 24.1 | 54 | 1731.7 | 22579.0 | 22694.4 | 0.0 | 0.0 | 0.0 |
| 0600 | 26.2 | 24.1 | 55 | 1637.6 | 21298.0 | 21441.9 | 0.0 | 0.0 | 0.0 |
| 0700 | 26.7 | 24.1 | 55 | 1609.0 | 20934.7 | 21061.3 | 0.0 | 0.0 | 0.0 |
| 0800 | 27.6 | 24.2 | 56 | 2589.1 | 34831.2 | 34205.1 | 0.0 | 0.0 | 0.0 |
| 0900 | 29.0 | 24.3 | 54 | 3531.1 | 48388.8 | 47069.2 | 0.0 | 0.0 | 0.0 |
| 1000 | 30.6 | 24.3 | 54 | 3688.0 | 50641.5 | 49234.3 | 0.0 | 0.0 | 0.0 |
| 1100 | 32.3 | 24.4 | 53 | 3964.6 | 54664.7 | 53066.0 | 0.0 | 0.0 | 0.0 |
| 1200 | 34.0 | 24.4 | 52 | 4310.1 | 59718.0 | 57881.8 | 0.0 | 0.0 | 0.0 |
| 1300 | 35.3 | 24.4 | 52 | 4673.3 | 65060.9 | 62979.9 | 0.0 | 0.0 | 0.0 |
| 1400 | 36.1 | 24.5 | 51 | 4874.6 | 68015.0 | 65819.4 | 0.0 | 0.0 | 0.0 |
| 1500 | 36.4 | 24.5 | 51 | 5129.1 | 71780.7 | 69427.7 | 0.0 | 0.0 | 0.0 |
| 1600 | 36.1 | 24.5 | 50 | 5330.3 | 74756.9 | 72291.8 | 0.0 | 0.0 | 0.0 |
| 1700 | 35.4 | 24.5 | 50 | 5494.2 | 77180.6 | 74632.9 | 0.0 | 0.0 | 0.0 |
| 1800 | 34.2 | 24.5 | 51 | 4900.2 | 68222.9 | 66182.2 | 0.0 | 0.0 | 0.0 |
| 1900 | 32.9 | 24.4 | 50 | 4007.3 | 55004.1 | 53660.0 | 0.0 | 0.0 | 0.0 |
| 2000 | 31.5 | 24.3 | 50 | 3896.9 | 53402.5 | 52126.5 | 0.0 | 0.0 | 0.0 |
| 2100 | 30.4 | 24.3 | 50 | 3737.1 | 51070.1 | 49912.6 | 0.0 | 0.0 | 0.0 |
| 2200 | 29.3 | 24.3 | 51 | 3500.9 | 47639.0 | 46652.5 | 0.0 | 0.0 | 0.0 |
| 2300 | 28.5 | 24.3 | 51 | 3211.8 | 43465.3 | 42682.0 | 0.0 | 0.0 | 0.0 |

able (3.23) Illustrates Calculation of Thermal Load of the Hours of the Day for Zone 3:

| ZONE: Zone 3 | | | | | | | | | |
|---------------------------|---------------------|-----------------------|---------------|---------------------------|-------------------------------|----------------------|----------------------------------|----------------------------------|------------------------------|
| DESIGN MONTH: JULY | | | | | | | | | |
| Hour | OA TEMP (°C) | ZONE TEMP (°C) | RH (%) | ZONE AIRFLOW (L/s) | ZONE SENSIBLE LOAD (W) | ZONE COND (W) | TERMINAL COOLING COIL (W) | TERMINAL HEATING COIL (W) | ZONE HEATING UNIT (W) |
| 0000 | 27.8 | 24.4 | 52 | 1076.3 | 14732.8 | 14402.6 | 0.0 | 0.0 | 0.0 |
| 0100 | 27.3 | 24.3 | 52 | 964.3 | 13107.2 | 12858.3 | 0.0 | 0.0 | 0.0 |
| 0200 | 26.8 | 24.3 | 53 | 860.9 | 11619.8 | 11442.4 | 0.0 | 0.0 | 0.0 |
| 0300 | 26.4 | 24.2 | 53 | 771.4 | 10344.3 | 10225.2 | 0.0 | 0.0 | 0.0 |
| 0400 | 26.0 | 24.2 | 54 | 694.7 | 9258.8 | 9186.4 | 0.0 | 0.0 | 0.0 |
| 0500 | 25.9 | 24.2 | 54 | 633.3 | 8397.0 | 8358.5 | 0.0 | 0.0 | 0.0 |
| 0600 | 26.2 | 24.2 | 55 | 590.4 | 7801.2 | 7782.0 | 0.0 | 0.0 | 0.0 |
| 0700 | 26.7 | 24.2 | 55 | 565.9 | 7467.7 | 7453.7 | 0.0 | 0.0 | 0.0 |
| 0800 | 27.6 | 24.2 | 56 | 764.0 | 10303.7 | 10125.0 | 0.0 | 0.0 | 0.0 |
| 0900 | 29.0 | 24.4 | 54 | 1147.3 | 15865.4 | 15385.4 | 0.0 | 0.0 | 0.0 |
| 1000 | 30.6 | 24.3 | 54 | 998.0 | 13671.6 | 13321.2 | 0.0 | 0.0 | 0.0 |
| 1100 | 32.3 | 24.3 | 53 | 1057.7 | 14545.2 | 14144.3 | 0.0 | 0.0 | 0.0 |
| 1200 | 34.0 | 24.4 | 52 | 1190.9 | 16496.4 | 15992.8 | 0.0 | 0.0 | 0.0 |
| 1300 | 35.3 | 24.5 | 52 | 1488.9 | 20915.8 | 20181.4 | 0.0 | 0.0 | 0.0 |
| 1400 | 36.1 | 24.5 | 51 | 1394.6 | 19487.7 | 18847.9 | 0.0 | 0.0 | 0.0 |
| 1500 | 36.4 | 24.5 | 51 | 1483.9 | 20816.8 | 20111.6 | 0.0 | 0.0 | 0.0 |
| 1600 | 36.1 | 24.5 | 50 | 1555.3 | 21876.9 | 21126.4 | 0.0 | 0.0 | 0.0 |
| 1700 | 35.4 | 24.6 | 50 | 1622.7 | 22881.8 | 22089.6 | 0.0 | 0.0 | 0.0 |
| 1800 | 34.2 | 24.5 | 51 | 1523.4 | 21369.7 | 20672.1 | 0.0 | 0.0 | 0.0 |
| 1900 | 32.9 | 24.5 | 50 | 1366.4 | 19015.3 | 18450.8 | 0.0 | 0.0 | 0.0 |
| 2000 | 31.5 | 24.5 | 50 | 1372.0 | 19097.0 | 18528.7 | 0.0 | 0.0 | 0.0 |
| 2100 | 30.4 | 24.5 | 50 | 1353.5 | 18818.5 | 18269.1 | 0.0 | 0.0 | 0.0 |
| 2200 | 29.3 | 24.4 | 51 | 1285.5 | 17806.8 | 17314.7 | 0.0 | 0.0 | 0.0 |
| 2300 | 28.5 | 24.4 | 51 | 1186.8 | 16349.7 | 15935.9 | 0.0 | 0.0 | 0.0 |

Table (3.24) Illustrates Calculation of Thermal Load of the Hours of the Day for Zone 4:

| ZONE: Zone 4 | | | | | | | | | |
|--------------------|--------------|----------------|--------|--------------------|------------------------|---------------|---------------------------|---------------------------|-----------------------|
| DESIGN MONTH: JULY | | | | | | | | | |
| Hour | OA TEMP (°C) | ZONE TEMP (°C) | RH (%) | ZONE AIRFLOW (L/s) | ZONE SENSIBLE LOAD (W) | ZONE COND (W) | TERMINAL COOLING COIL (W) | TERMINAL HEATING COIL (W) | ZONE HEATING UNIT (W) |
| 0000 | 27.8 | 24.3 | 52 | 3211.3 | 44011.9 | 42872.2 | 0.0 | 0.0 | 0.0 |
| 0100 | 27.3 | 24.3 | 52 | 2875.6 | 39170.8 | 38272.4 | 0.0 | 0.0 | 0.0 |
| 0200 | 26.8 | 24.3 | 53 | 2558.1 | 34625.5 | 33946.4 | 0.0 | 0.0 | 0.0 |
| 0300 | 26.4 | 24.2 | 53 | 2281.2 | 30693.6 | 30195.9 | 0.0 | 0.0 | 0.0 |
| 0400 | 26.0 | 24.2 | 54 | 2043.8 | 27344.6 | 26993.7 | 0.0 | 0.0 | 0.0 |
| 0500 | 25.9 | 24.2 | 54 | 1864.5 | 24836.6 | 24585.2 | 0.0 | 0.0 | 0.0 |
| 0600 | 26.2 | 24.2 | 55 | 1763.2 | 23440.2 | 23228.2 | 0.0 | 0.0 | 0.0 |
| 0700 | 26.7 | 24.2 | 55 | 1740.5 | 23155.0 | 22924.6 | 0.0 | 0.0 | 0.0 |
| 0800 | 27.6 | 24.2 | 56 | 2104.4 | 28348.0 | 27809.5 | 0.0 | 0.0 | 0.0 |
| 0900 | 29.0 | 24.2 | 54 | 2448.6 | 33277.2 | 32461.5 | 0.0 | 0.0 | 0.0 |
| 1000 | 30.6 | 24.3 | 54 | 2710.3 | 37038.7 | 36016.7 | 0.0 | 0.0 | 0.0 |
| 1100 | 32.3 | 24.3 | 53 | 3030.4 | 41659.6 | 40390.2 | 0.0 | 0.0 | 0.0 |
| 1200 | 34.0 | 24.4 | 52 | 3509.3 | 48614.7 | 46981.3 | 0.0 | 0.0 | 0.0 |
| 1300 | 35.3 | 24.4 | 52 | 3903.0 | 54362.3 | 52442.8 | 0.0 | 0.0 | 0.0 |
| 1400 | 36.1 | 24.4 | 51 | 4261.3 | 59623.4 | 57449.9 | 0.0 | 0.0 | 0.0 |
| 1500 | 36.4 | 24.5 | 51 | 4567.4 | 64133.6 | 61752.0 | 0.0 | 0.0 | 0.0 |
| 1600 | 36.1 | 24.5 | 50 | 4775.3 | 67198.1 | 64689.6 | 0.0 | 0.0 | 0.0 |
| 1700 | 35.4 | 24.5 | 50 | 4927.4 | 69435.4 | 66844.9 | 0.0 | 0.0 | 0.0 |
| 1800 | 34.2 | 24.5 | 51 | 4845.9 | 68174.6 | 65688.9 | 0.0 | 0.0 | 0.0 |
| 1900 | 32.9 | 24.5 | 50 | 4537.1 | 63534.4 | 61325.6 | 0.0 | 0.0 | 0.0 |
| 2000 | 31.5 | 24.5 | 50 | 4401.5 | 61502.1 | 59417.3 | 0.0 | 0.0 | 0.0 |
| 2100 | 30.4 | 24.4 | 50 | 4206.1 | 58591.1 | 56676.2 | 0.0 | 0.0 | 0.0 |
| 2200 | 29.3 | 24.4 | 51 | 3909.4 | 54205.4 | 52532.7 | 0.0 | 0.0 | 0.0 |
| 2300 | 28.5 | 24.4 | 51 | 3563.4 | 49131.9 | 47728.9 | 0.0 | 0.0 | 0.0 |

December DESIGN COOLING DAY, 1700

TABLE 1: SYSTEM DATA

Table (3.25) Illustrates Psychrometric Process.

| Component | Location | Dry-Bulb Temp (°C) | Specific Humidity (kg/kg) | Airflow (L/s) | CO2 Level (ppm) | Sensible Heat (W) | Latent Heat (W) |
|----------------------|----------|--------------------|---------------------------|---------------|-----------------|-------------------|-----------------|
| Ventilation Air | Inlet | 40.4 | 0.01577 | 1533 | 400 | 27748 | 22618 |
| Vent - Return Mixing | Outlet | 25.8 | 0.01088 | 23550 | 693 | - | - |
| Central Cooling Coil | Outlet | 12.8 | 0.00893 | 23550 | 693 | 353369 | 129587 |
| Supply Fan | Outlet | 12.8 | 0.00893 | 23550 | 693 | 0 | - |
| Cold Supply Duct | Outlet | 12.8 | 0.00893 | 23550 | 693 | - | - |
| Zone Air | - | 24.7 | 0.01054 | 23550 | 714 | 325620 | 106954 |
| Return Plenum | Outlet | 24.7 | 0.01054 | 23550 | 714 | 0 | - |
| Return Fan | Outlet | 24.7 | 0.01054 | 23550 | 714 | 0 | - |

Air Density x Heat Capacity x Conversion Factor: At sea level = 1.207; At site altitude = 1.156 W/(L/s-K)

Air Density x Heat of Vaporization x Conversion Factor: At sea level = 2947.6; At site altitude = 2823.2 W/(L/s)

Site Altitude = 362.0 m

TABLE (3. 26) ZONE DATA

| Zone Name | Zone Sensible Load (W) | T-stat Mode | Zone Cond (W) | Zone Temp (°C) | Zone Airflow (L/s) | CO2 Level (ppm) | Terminal Heating Coil (W) | Zone Heating Unit (W) |
|-----------|------------------------|-------------|---------------|----------------|--------------------|-----------------|---------------------------|-----------------------|
| Zone 1 | 102259 | Cooling | 98710 | 24.7 | 7143 | 759 | 0 | 0 |
| Zone 2 | 104869 | Cooling | 101469 | 24.7 | 7336 | 700 | 0 | 0 |
| Zone 3 | 30368 | Cooling | 29357 | 24.7 | 2123 | 704 | 0 | 0 |
| Zone 4 | 99653 | Cooling | 96083 | 24.7 | 6948 | 684 | 0 | 0 |

WINTER DESIGN HEATING

TABLE (3.27) SYSTEM DATA

| Component | Location | Dry-Bulb Temp (°C) | Specific Humidity (kg/kg) | Airflow (L/s) | CO2 Level (ppm) | Sensible Heat (W) | Latent Heat (W) |
|----------------------|----------|--------------------|---------------------------|---------------|-----------------|-------------------|-----------------|
| Ventilation Air | Inlet | 24.0 | 0.00740 | 111 | 400 | 324 | 0 |
| Vent - Return Mixing | Outlet | 21.6 | 0.00740 | 1702 | 536 | - | - |
| Central Cooling Coil | Outlet | 12.8 | 0.00740 | 1702 | 536 | 17422 | 0 |
| Supply Fan | Outlet | 12.8 | 0.00740 | 1702 | 536 | 0 | - |
| Cold Supply Duct | Outlet | 12.8 | 0.00740 | 1702 | 536 | - | - |
| Zone Air | - | 21.5 | 0.00740 | 1702 | 546 | 5461 | 0 |
| Return Plenum | Outlet | 21.5 | 0.00740 | 1702 | 546 | 0 | - |
| Return Fan | Outlet | 21.5 | 0.00740 | 1702 | 546 | 0 | - |

Air Density x Heat Capacity x Conversion Factor: At sea level = 1.207; At site altitude = 1.156 W/(L/s-K)

Air Density x Heat of Vaporization x Conversion Factor: At sea level = 2947.6; At site altitude = 2823.2 W/(L/s)

Site Altitude = 362.0 m

TABLE (3.28) ZONE DATA

| Zone Name | Zone Sensible Load (W) | T-stat Mode | Zone Cond (W) | Zone Temp (°C) | Zone Airflow (L/s) | CO2 Level (ppm) | Terminal Heating Coil (W) | Zone Heating Unit (W) |
|-----------|------------------------|-------------|---------------|----------------|--------------------|-----------------|---------------------------|-----------------------|
| Zone 1 | 0 | Heating | 2269 | 21.4 | 866 | 546 | 6390 | 0 |
| Zone 2 | 0 | Heating | 2034 | 21.5 | 671 | 546 | 4694 | 0 |
| Zone 3 | 0 | Heating | 410 | 21.6 | 73 | 546 | 339 | 0 |
| Zone 4 | 0 | Heating | 747 | 21.8 | 92 | 546 | 214 | 0 |

Location: Rabak, Sudan

Altitude: 362.0 m.

Data for: December DESIGN COOLING DAY, 1700

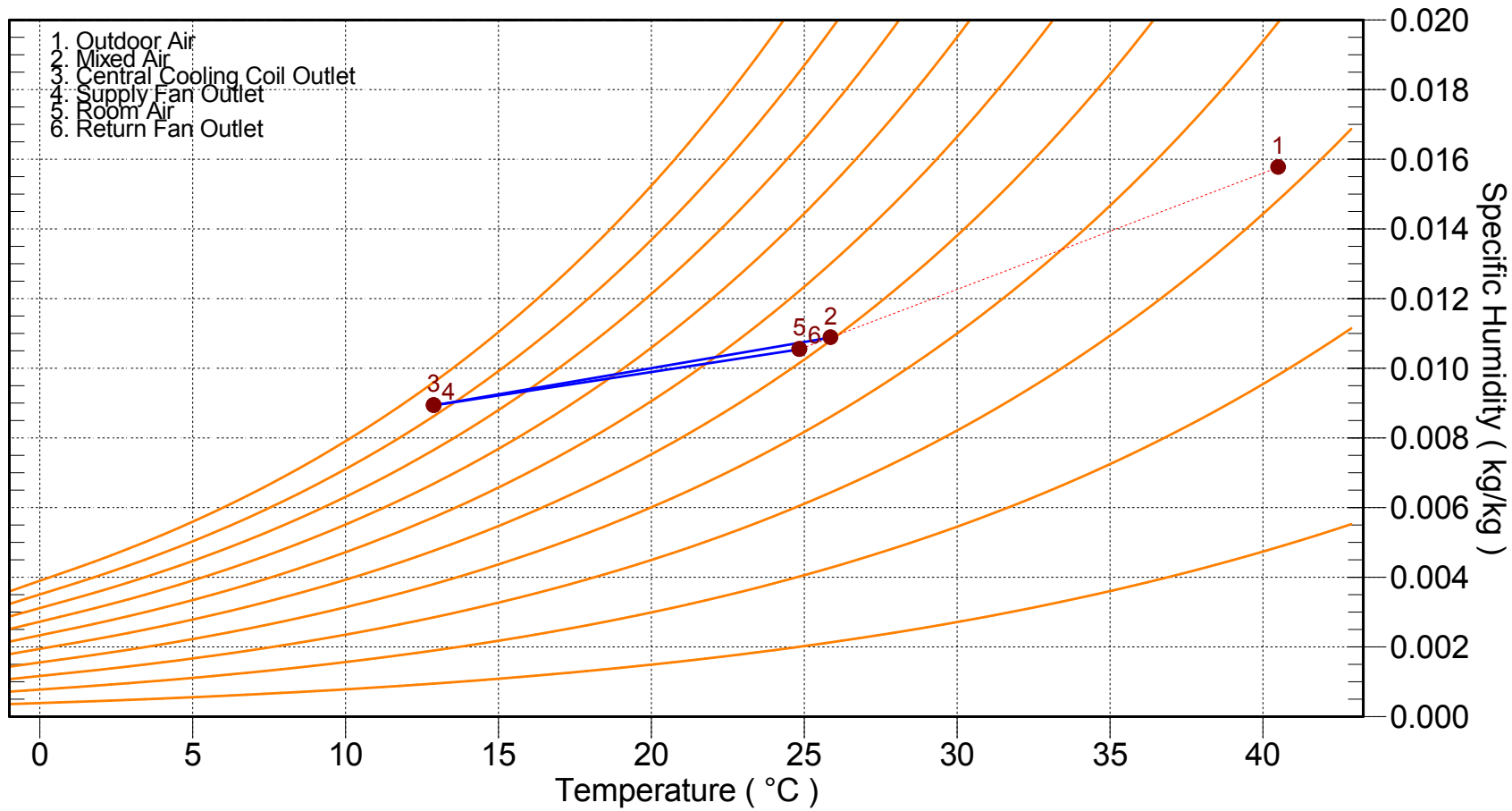


Figure (3.12) Illustrates Psychrometric Process