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| --- | --- | --- | --- | --- | --- | --- | --- |
| **طرح نگهداشت و افزایش تولید 27 مخزن** | | | | | | | |
| **HVAC CALCULATION NOTE FOR EXTENSION OF EXISTING ELECT. BUILDING**  **نگهداشت و افزایش تولید میدان نفتی بینک** | | | | | | | |
|  | |  |  |  |  |  |  |
| D04 | | MAY. 2024 | AFD | K.Ahmadi | M.Fakharian | S.Faramarzpour |  |
| D03 | | MAR. 2024 | IFA | K.Ahmadi | M.Fakharian | S.Faramarzpour |  |
| D02 | | JAN. 2023 | IFA | H.Adineh | M.Fakharian | M.Mehrshad |  |
| D01 | | SEP. 2022 | IFA | H.Adineh | M.Fakharian | M.Mehrshad |  |
| D00 | | JUN. 2022 | IFC | H.Adineh | M.Fakharian | M.Mehrshad |  |
| **Rev.** | | **Date** | **Purpose of Issue/Status** | **Prepared by:** | **Checked by:** | **Approved by:** | **CLIENT Approval** |
| **Class: 2** | | | **CLIENT Doc. Number:** **F0Z-708866** | | | | |
| **Status:** | | **IDC: Inter-Discipline Check**  **IFC: Issued For Comment**  **IFA: Issued For Approval**  **AFD: Approved For Design**  **AFC: Approved For Construction**  **AFP: Approved For Purchase**  **AFQ:** Approved For Quotation  **IFI: Issued For Information**  **AB-R: As-Built for CLIENT Review**  **AB-A: As-Built –Approved** | | | | | |

**REVISION RECORD SHEET**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
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| 2 | X | X | X | X | X | 59 |  |  |  |  |  |
| 3 | X | X |  | X |  | 60 |  |  |  |  |  |
| 4 | X | X |  | X |  | 61 |  |  |  |  |  |
| 5 | X | X |  | X |  | 62 |  |  |  |  |  |
| 6 | X | X |  | X |  | 63 |  |  |  |  |  |
| 7 | X | X |  | X |  | 64 |  |  |  |  |  |
| 8 | X | X |  | X |  | 65 |  |  |  |  |  |
| 9 | X | X |  | X |  | 66 |  |  |  |  |  |
| 10 | X | X |  | X |  | 67 |  |  |  |  |  |
| 11 | X | X |  | X |  | 68 |  |  |  |  |  |
| 12 | X | X |  | X |  | 69 |  |  |  |  |  |
| 13 | X | X |  | X |  | 70 |  |  |  |  |  |
| 14 | X | X |  | X |  | 71 |  |  |  |  |  |
| 15 | X | X |  | X |  | 72 |  |  |  |  |  |
| 16 | X | X |  | X |  | 73 |  |  |  |  |  |
| 17 | X | X |  | X |  | 74 |  |  |  |  |  |
| 18 | X | X |  | X |  | 75 |  |  |  |  |  |
| 19 | X | X |  | X |  | 76 |  |  |  |  |  |
| 20 | X | X |  | X |  | 77 |  |  |  |  |  |
| 21 | X | X |  | X |  | 78 |  |  |  |  |  |
| 22 | X | X |  | X |  | 79 |  |  |  |  |  |
| 23 | X | X | X | X |  | 80 |  |  |  |  |  |
| 24 | X | X |  | X |  | 81 |  |  |  |  |  |
| 25 |  | X |  | X |  | 82 |  |  |  |  |  |
| 26 |  | X |  | X |  | 83 |  |  |  |  |  |
| 27 |  | X | X | X |  | 84 |  |  |  |  |  |
| 28 |  |  |  | X |  | 85 |  |  |  |  |  |
| 29 |  |  |  | X |  | 86 |  |  |  |  |  |
| 30 |  |  |  | X |  | 87 |  |  |  |  |  |
| 31 |  |  |  |  |  | 88 |  |  |  |  |  |
| 32 |  |  |  |  |  | 89 |  |  |  |  |  |
| 33 |  |  |  |  |  | 90 |  |  |  |  |  |
| 34 |  |  |  |  |  | 91 |  |  |  |  |  |
| 35 |  |  |  |  |  | 92 |  |  |  |  |  |
| 36 |  |  |  |  |  | 93 |  |  |  |  |  |
| 37 |  |  |  |  |  | 94 |  |  |  |  |  |
| 38 |  |  |  |  |  | 95 |  |  |  |  |  |
| 39 |  |  |  |  |  | 96 |  |  |  |  |  |
| 40 |  |  |  |  |  | 97 |  |  |  |  |  |
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| 45 |  |  |  |  |  | 102 |  |  |  |  |  |
| 46 |  |  |  |  |  | 103 |  |  |  |  |  |
| 47 |  |  |  |  |  | 104 |  |  |  |  |  |
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1. **INTRODUCTION**

Binak oilfield in Bushehr province is a part of the southern oilfields of Iran, is located 20 km northwest of Genaveh city.

With the aim of increasing production of oil from Binak oilfield, an EPC/EPD Project has been defined by NIOC/NISOC and awarded to Petro Iran Development Company (PEDCO).Also PEDCO (as General Contractor) has assigned the EPC-packages of the Project to "Hirgan Energy - Design and Inspection" JV.

**GENERAL DEFINITION**

The following terms shall be used in this document.

|  |  |
| --- | --- |
| CLIENT: | National Iranian South Oilfields Company (NISOC) |
| PROJECT: | Binak Oilfield Development – General Facilities |
| GENERAL CONTRACTOR (GC): | Petro Iran Development Company (PEDCO) |
| EPC CONTRACTOR: | Joint Venture of :Hirgan Energy – Design & Inspection(D&I) Companies |
| VENDOR: | The firm or person who will fabricate the equipment or material. |
| EXECUTOR: | Executor is the party which carries out all or part of construction and/or commissioning for the project. |
| THIRD PARTY INSPECTOR (TPI): | The firm appointed by EPD/EPC CONTRACTOR (GC) and approved by CLIENT (in writing) for the inspection of goods. |
| SHALL: | Is used where a provision is mandatory. |
| SHOULD: | Is used where a provision is advisory only. |
| WILL: | Is normally used in connection with the action by CLIENT rather than by an EPC/EPD CONTRACTOR, supplier or VENDOR |
| MAY: | Is used where a provision is completely discretionary. |

1. **Scope**

The main purpose of this document is to define the HVAC system load calculation has been carried out by computer program (HAP software) as per ASHRAE method in order to evaluate cooling load (summer) and heating load (winter) and also to select HVAC equipment for the calculated cooling and heating load.

1. **NORMATIVE REFERENCES**

## Local Codes and Standards

* IPS Iranian petroleum standards
* INBC Iranian National Building Code

## International Codes and Standards

* ASTM American Society for Testing Materials Relevant Parts
* API 610 Centrifugal Pumps for General Refinery Service, 10th Edition
* ISO 15156 Petroleum and Natural Gas Industries. Materials for use in H2S Containing Environments in Oil and Gas

Production

* AMCA Air Movement and Control Association
* ANSI American National Standards Institute.
* ASHRAE American Society of Heating, Refrigeration and Air-conditioning Engineer
* ASTM American Society for Testing and Material
* BOCA Building Officials and Code Administrators international
* BS British Standards
* CIBSE Chartered Institute of Building Services Engineers.
* NFPA National fire protection association
* SBCCI Southern Building Code Congress International
* SMACNA Sheet Metal and Air Conditioning Contractors’ National Association
* AWWA [American Water Works Association](http://www.awwa.org/)
* ASME [The American Society of Mechanical Engineers](https://www.asme.org/)

Note: The latest issued or revised edition of all above mentioned codes and standards shall be considered as reference.

## ENVIRONMENTAL DATA

* Latitude 29° 73’ N
* Longitude 50° 35’ E
* Elevation 10 m
* Summer dry bulb temperature : 41° C
* Summer wet bulb temperature : 30.5° C
* Summer daily range temperature : 15.0° C
* Winter dry bulb temperature : 6° C
* Winter relative humidity : 78%

Refer to "Process Basis of Design; Doc. No BK-GNRAL-PEDCO-000-PR-DB-0001.

1. **HVAC CALCULATION**

## Design weather Parameters:

**Design Parameters:**

    City Name   **Binak**

    Location   **IRAN**

    Latitude   **29.7** Deg.

    Longitude   **-50.4** Deg.

    Elevation   **10.0** m

    Summer Design Dry-Bulb   **41.0** °C

    Summer Coincident Wet-Bulb   **30.5** °C

    Summer Daily Range   **15.0** °K

    Winter Design Dry-Bulb   **6.0** °C

    Winter Design Wet-Bulb   **4.4** °C

    Atmospheric Clearness Number   **1.00**

    Average Ground Reflectance   **0.20**

    Soil Conductivity   **1.385** W/(m-°K)

    Local Time Zone (GMT +/- N hours)   **-3.5** hours

    Consider Daylight Savings Time   **No**

    Simulation Weather Data   **noneN/A**

    Current Data is   **User Modified**

    Design Cooling Months   **January to December**

**Design Day Maximum Solar Heat Gains**

    (The MSHG values are expressed in W/m²)

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Month** | **N** | **NNE** | **NE** | **ENE** | **E** | **ESE** | **SE** | **SSE** | **S** |
| January | 77.5 | 77.5 | 95.1 | 360.4 | 561.2 | 730.9 | 794.1 | 786.3 | 762.3 |
| February | 89.1 | 89.1 | 206.7 | 484.1 | 668.9 | 760.8 | 782.0 | 718.9 | 671.9 |
| March | 101.4 | 120.5 | 367.4 | 576.2 | 723.5 | 759.6 | 702.5 | 590.8 | 520.1 |
| April | 113.0 | 252.7 | 487.2 | 636.6 | 705.1 | 688.3 | 568.6 | 408.7 | 322.0 |
| May | 124.3 | 351.1 | 551.9 | 666.3 | 679.9 | 619.4 | 469.6 | 279.8 | 199.5 |
| June | 161.0 | 389.1 | 570.0 | 664.8 | 662.8 | 586.8 | 421.4 | 228.9 | 165.7 |
| July | 128.9 | 355.9 | 541.6 | 644.7 | 671.3 | 606.9 | 452.1 | 270.2 | 196.1 |
| August | 118.3 | 256.1 | 470.7 | 606.2 | 686.0 | 663.8 | 546.8 | 395.4 | 311.9 |
| September | 104.3 | 109.2 | 354.3 | 538.8 | 681.8 | 728.9 | 670.0 | 569.4 | 503.5 |
| October | 91.2 | 91.2 | 226.5 | 441.2 | 642.7 | 746.9 | 748.8 | 692.4 | 650.8 |
| November | 78.1 | 78.1 | 103.7 | 341.8 | 572.3 | 707.9 | 785.7 | 774.1 | 747.8 |
| December | 71.9 | 71.9 | 71.9 | 306.4 | 524.4 | 699.0 | 788.1 | 799.2 | 780.7 |
| **Month** | **SSW** | **SW** | **WSW** | **W** | **WNW** | **NW** | **NNW** | **HOR** | **Mult** |
| January | 779.8 | 791.7 | 733.2 | 577.4 | 337.4 | 108.2 | 77.5 | 591.4 | 1.00 |
| February | 716.3 | 777.2 | 772.2 | 650.4 | 482.8 | 225.6 | 89.1 | 714.5 | 1.00 |
| March | 590.5 | 703.8 | 755.6 | 713.7 | 589.1 | 369.6 | 114.3 | 816.8 | 1.00 |
| April | 413.5 | 574.6 | 682.6 | 707.6 | 645.8 | 485.9 | 241.4 | 863.3 | 1.00 |
| May | 282.1 | 471.6 | 614.4 | 688.4 | 669.7 | 550.4 | 343.5 | 875.1 | 1.00 |
| June | 233.1 | 424.2 | 577.0 | 674.2 | 670.6 | 567.0 | 376.4 | 872.9 | 1.00 |
| July | 274.2 | 458.7 | 596.0 | 677.5 | 657.5 | 539.9 | 345.0 | 865.3 | 1.00 |
| August | 398.9 | 554.0 | 657.3 | 682.8 | 624.7 | 473.1 | 240.3 | 846.4 | 1.00 |
| September | 569.0 | 669.3 | 728.9 | 681.0 | 540.4 | 354.6 | 108.6 | 783.8 | 1.00 |
| October | 697.0 | 755.4 | 737.2 | 647.9 | 457.7 | 216.5 | 91.2 | 696.8 | 1.00 |
| November | 775.6 | 786.0 | 708.0 | 568.2 | 351.0 | 91.0 | 78.1 | 582.8 | 1.00 |
| December | 798.2 | 790.7 | 685.6 | 536.9 | 295.2 | 71.9 | 71.9 | 533.5 | 1.00 |

    Mult. = User-defined solar multiplier factor.

**Cooling Design Temperature Profile**

**Location: Binak, IRAN**

    (Dry and Wet Bulb temperatures are expressed in °C)

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Hr** | **January** | | **February** | | **March** | | **April** | | **May** | | **June** | |
|  | **DB** | **WB** | **DB** | **WB** | **DB** | **WB** | **DB** | **WB** | **DB** | **WB** | **DB** | **WB** |
| 0000 | 19.4 | 19.1 | 20.5 | 20.2 | 23.0 | 22.8 | 24.5 | 24.2 | 26.7 | 26.4 | 28.1 | 27.8 |
| 0100 | 18.6 | 18.3 | 19.7 | 19.5 | 22.3 | 22.0 | 23.7 | 23.5 | 26.0 | 25.7 | 27.4 | 27.1 |
| 0200 | 17.9 | 17.6 | 19.0 | 18.7 | 21.5 | 21.3 | 23.0 | 22.7 | 25.2 | 24.9 | 26.6 | 26.4 |
| 0300 | 17.3 | 17.0 | 18.4 | 18.1 | 20.9 | 20.7 | 22.4 | 22.1 | 24.6 | 24.3 | 26.0 | 25.8 |
| 0400 | 16.8 | 16.5 | 17.9 | 17.7 | 20.5 | 20.2 | 21.9 | 21.7 | 24.2 | 23.9 | 25.6 | 25.3 |
| 0500 | 16.7 | 16.4 | 17.8 | 17.5 | 20.3 | 20.1 | 21.8 | 21.5 | 24.0 | 23.7 | 25.4 | 25.2 |
| 0600 | 17.0 | 16.7 | 18.1 | 17.8 | 20.6 | 20.4 | 22.1 | 21.8 | 24.3 | 24.0 | 25.7 | 25.5 |
| 0700 | 17.7 | 17.4 | 18.8 | 18.6 | 21.4 | 21.1 | 22.8 | 22.6 | 25.1 | 24.8 | 26.5 | 26.2 |
| 0800 | 19.1 | 18.8 | 20.2 | 19.9 | 22.7 | 22.5 | 24.2 | 23.9 | 26.4 | 26.1 | 27.8 | 27.6 |
| 0900 | 21.0 | 20.7 | 22.1 | 21.9 | 24.7 | 24.4 | 26.1 | 25.9 | 28.4 | 27.0 | 29.8 | 28.2 |
| 1000 | 23.3 | 22.2 | 24.4 | 23.2 | 26.9 | 25.6 | 28.4 | 26.6 | 30.6 | 27.5 | 32.0 | 28.7 |
| 1100 | 25.8 | 22.9 | 26.9 | 23.9 | 29.5 | 26.2 | 30.9 | 27.2 | 33.2 | 28.1 | 34.6 | 29.3 |
| 1200 | 28.2 | 23.6 | 29.3 | 24.5 | 31.9 | 26.8 | 33.3 | 27.7 | 35.6 | 28.6 | 37.0 | 29.8 |
| 1300 | 30.0 | 24.1 | 31.1 | 25.0 | 33.7 | 27.2 | 35.1 | 28.1 | 37.4 | 29.0 | 38.8 | 30.2 |
| 1400 | 31.2 | 24.4 | 32.3 | 25.3 | 34.9 | 27.5 | 36.3 | 28.4 | 38.6 | 29.3 | 40.0 | 30.4 |
| 1500 | 31.7 | 24.5 | 32.8 | 25.4 | 35.3 | 27.6 | 36.8 | 28.5 | 39.0 | 29.4 | 40.4 | 30.5 |
| 1600 | 31.2 | 24.4 | 32.3 | 25.3 | 34.9 | 27.5 | 36.3 | 28.4 | 38.6 | 29.3 | 40.0 | 30.4 |
| 1700 | 30.2 | 24.1 | 31.3 | 25.0 | 33.8 | 27.3 | 35.3 | 28.2 | 37.5 | 29.1 | 38.9 | 30.2 |
| 1800 | 28.5 | 23.7 | 29.6 | 24.6 | 32.2 | 26.9 | 33.6 | 27.8 | 35.9 | 28.7 | 37.3 | 29.8 |
| 1900 | 26.6 | 23.1 | 27.7 | 24.1 | 30.2 | 26.4 | 31.7 | 27.3 | 33.9 | 28.3 | 35.3 | 29.4 |
| 2000 | 24.6 | 22.6 | 25.7 | 23.5 | 28.3 | 25.9 | 29.7 | 26.9 | 32.0 | 27.8 | 33.4 | 29.0 |
| 2100 | 23.0 | 22.1 | 24.1 | 23.1 | 26.6 | 25.5 | 28.1 | 26.5 | 30.3 | 27.4 | 31.7 | 28.6 |
| 2200 | 21.5 | 21.2 | 22.6 | 22.3 | 25.1 | 24.9 | 26.6 | 26.1 | 28.8 | 27.1 | 30.2 | 28.3 |
| 2300 | 20.3 | 20.0 | 21.4 | 21.1 | 23.9 | 23.7 | 25.4 | 25.1 | 27.6 | 26.8 | 29.0 | 28.0 |

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Hr** | **July** | | **August** | | **September** | | **October** | | **November** | | **December** | |
|  | **DB** | **WB** | **DB** | **WB** | **DB** | **WB** | **DB** | **WB** | **DB** | **WB** | **DB** | **WB** |
| 0000 | 28.7 | 27.8 | 28.7 | 27.8 | 27.6 | 27.2 | 25.6 | 25.3 | 22.5 | 22.2 | 19.9 | 19.6 |
| 0100 | 28.0 | 27.7 | 28.0 | 27.7 | 26.8 | 26.6 | 24.8 | 24.6 | 21.7 | 21.5 | 19.2 | 18.9 |
| 0200 | 27.2 | 26.9 | 27.2 | 26.9 | 26.1 | 25.8 | 24.1 | 23.8 | 21.0 | 20.7 | 18.4 | 18.1 |
| 0300 | 26.6 | 26.3 | 26.6 | 26.3 | 25.5 | 25.2 | 23.5 | 23.2 | 20.4 | 20.1 | 17.8 | 17.5 |
| 0400 | 26.2 | 25.9 | 26.2 | 25.9 | 25.0 | 24.8 | 23.0 | 22.8 | 19.9 | 19.7 | 17.4 | 17.1 |
| 0500 | 26.0 | 25.7 | 26.0 | 25.7 | 24.9 | 24.6 | 22.9 | 22.6 | 19.8 | 19.5 | 17.2 | 16.9 |
| 0600 | 26.3 | 26.0 | 26.3 | 26.0 | 25.2 | 24.9 | 23.2 | 22.9 | 20.1 | 19.8 | 17.5 | 17.2 |
| 0700 | 27.1 | 26.8 | 27.1 | 26.8 | 25.9 | 25.7 | 23.9 | 23.7 | 20.8 | 20.6 | 18.3 | 18.0 |
| 0800 | 28.4 | 27.8 | 28.4 | 27.8 | 27.3 | 27.0 | 25.3 | 25.0 | 22.2 | 21.9 | 19.6 | 19.3 |
| 0900 | 30.4 | 28.2 | 30.4 | 28.2 | 29.2 | 27.6 | 27.2 | 26.4 | 24.1 | 23.9 | 21.6 | 21.3 |
| 1000 | 32.6 | 28.7 | 32.6 | 28.7 | 31.5 | 28.1 | 29.5 | 26.9 | 26.4 | 25.4 | 23.8 | 23.4 |
| 1100 | 35.2 | 29.3 | 35.2 | 29.3 | 34.0 | 28.7 | 32.0 | 27.5 | 28.9 | 26.0 | 26.4 | 24.1 |
| 1200 | 37.6 | 29.8 | 37.6 | 29.8 | 36.4 | 29.2 | 34.4 | 28.1 | 31.3 | 26.6 | 28.8 | 24.7 |
| 1300 | 39.4 | 30.2 | 39.4 | 30.2 | 38.2 | 29.6 | 36.2 | 28.5 | 33.1 | 27.0 | 30.6 | 25.2 |
| 1400 | 40.6 | 30.4 | 40.6 | 30.4 | 39.4 | 29.8 | 37.4 | 28.7 | 34.3 | 27.3 | 31.8 | 25.5 |
| 1500 | 41.0 | 30.5 | 41.0 | 30.5 | 39.9 | 29.9 | 37.9 | 28.8 | 34.8 | 27.4 | 32.2 | 25.6 |
| 1600 | 40.6 | 30.4 | 40.6 | 30.4 | 39.4 | 29.8 | 37.4 | 28.7 | 34.3 | 27.3 | 31.8 | 25.5 |
| 1700 | 39.5 | 30.2 | 39.5 | 30.2 | 38.4 | 29.6 | 36.4 | 28.5 | 33.3 | 27.0 | 30.7 | 25.2 |
| 1800 | 37.9 | 29.9 | 37.9 | 29.9 | 36.7 | 29.3 | 34.7 | 28.1 | 31.6 | 26.6 | 29.1 | 24.8 |
| 1900 | 35.9 | 29.4 | 35.9 | 29.4 | 34.8 | 28.9 | 32.8 | 27.7 | 29.7 | 26.2 | 27.1 | 24.3 |
| 2000 | 34.0 | 29.0 | 34.0 | 29.0 | 32.8 | 28.4 | 30.8 | 27.2 | 27.7 | 25.7 | 25.2 | 23.8 |
| 2100 | 32.3 | 28.7 | 32.3 | 28.7 | 31.2 | 28.0 | 29.2 | 26.8 | 26.1 | 25.3 | 23.5 | 23.2 |
| 2200 | 30.8 | 28.3 | 30.8 | 28.3 | 29.7 | 27.7 | 27.7 | 26.5 | 24.6 | 24.3 | 22.0 | 21.7 |
| 2300 | 29.6 | 28.0 | 29.6 | 28.0 | 28.5 | 27.4 | 26.5 | 26.2 | 23.4 | 23.1 | 20.8 | 20.5 |

**Design Temperature Profile**



## CONSTRUCTIONS U-VALUE:

**Wall**

**Wall Details**

    Outside Surface Color   **Medium**

    Absorptivity   **0.675**

    Overall U-Value   **1.968** W/(m²-°K)

**Wall Layers Details (Inside to Outside)**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **Thickness** | **Density** | **Specific Ht.** | **R-Value** | **Weight** |
| **Layers** | **mm** | **kg/m³** | **kJ / (kg - °K)** | **(m²-°K)/W** | **kg/m²** |
| Inside surface resistance | 0.000 | 0.0 | 0.00 | 0.12064 | 0.0 |
| Gypsum plaster-P219-19 INBR | 20.000 | 1200.0 | 1.09 | 0.03509 | 24.0 |
| Cement plaster-P210-19 INBR | 20.000 | 750.0 | 0.80 | 0.06667 | 15.0 |
| Concrete wall-P210-19 INBR | 300.000 | 2300.0 | 0.84 | 0.13043 | 690.0 |
| Cement plaster-P210-19 INBR | 20.000 | 750.0 | 0.80 | 0.06667 | 15.0 |
| Face brick-P224-19 INBR | 30.000 | 2000.0 | 0.03 | 0.03000 | 60.0 |
| Outside surface resistance | 0.000 | 0.0 | 0.00 | 0.05864 | 0.0 |
| **Totals** | **390.000** | **-** |  | **0.50814** | **804.0** |

**Roof**

**Roof Details**

    Outside Surface Color   **Medium**

    Absorptivity   **0.675**

    Overall U-Value   **0.484** W/(m²-°K)

**Roof Layers Details (Inside to Outside)**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **Thickness** | **Density** | **Specific Ht.** | **R-Value** | **Weight** |
| **Layers** | **mm** | **kg/m³** | **kJ / (kg - °K)** | **(m²-°K)/W** | **kg/m²** |
| Inside surface resistance | 0.000 | 0.0 | 0.00 | 0.12064 | 0.0 |
| Concrete roof-P210-19 INBR | 300.000 | 2300.0 | 0.84 | 0.13043 | 690.0 |
| HDPU-P218-19 INBR | 50.000 | 50.0 | 0.84 | 1.21951 | 2.5 |
| Cement plaster-P210-19 INBR | 100.000 | 750.0 | 0.84 | 0.33333 | 75.0 |
| Waterproofing layer-P219-19 INBR | 4.000 | 1100.0 | 1.67 | 0.01739 | 4.4 |
| Cement plaster-P210-19 INBR | 50.000 | 750.0 | 0.80 | 0.16667 | 37.5 |
| Terrazzo tile-P212-19 INBR | 25.000 | 2000.0 | 0.84 | 0.01852 | 50.0 |
| Outside surface resistance | 0.000 | 0.0 | 0.00 | 0.05864 | 0.0 |
| **Totals** | **529.000** | **-** |  | **2.06513** | **859.4** |

**B.P.D./T-1**

**Door Details:**

    Gross Area   **2.6** m²

    Door U-Value   **3.000** W/(m²-°K)

**Glass Details:**

    Glass Area   **0.0** m²

    Glass U-Value   **3.293** W/(m²-°K)

    Glass Shade Coefficient   **0.880**

    Glass Shaded All Day?   **No**

**Ext. Dor W=1**

**Door Details:**

    Gross Area   **2.2** m²

    Door U-Value   **3.000** W/(m²-°K)

**Glass Details:**

    Glass Area   **0.0** m²

    Glass U-Value   **3.293** W/(m²-°K)

    Glass Shade Coefficient   **0.880**

    Glass Shaded All Day?   **No**

**Ext. Dor W=2**

**Door Details:**

    Gross Area   **4.4** m²

    Door U-Value   **3.000** W/(m²-°K)

**Glass Details:**

    Glass Area   **0.0** m²

    Glass U-Value   **3.293** W/(m²-°K)

    Glass Shade Coefficient   **0.880**

    Glass Shaded All Day?   **No**

## SPACE INPUT DATA:

**01-Capacitor Bank**

**1. General Details:**

    Floor Area   **24.7** m²

    Avg. Ceiling Height   **4.1** m

    Building Weight   **341.8** kg/m²

**1.1. OA Ventilation Requirements:**

    Space Usage   **User-Defined**

    OA Requirement 1   **0.0** L/s/person

    OA Requirement 2   **0.00** L/(s-m²)

    Space Usage Defaults   **ASHRAE Standard 62.1-2010**

**2. Internals:**

**2.1. Overhead Lighting:**

    Fixture Type   **Recessed (Unvented)**

    Wattage   **20.00** W/m²

    Ballast Multiplier   **1.00**

    Schedule   **Lighting**

**2.2. Task Lighting:**

    Wattage   **0.00** W/m²

    Schedule   **None**

**2.3. Electrical Equipment:**

    Wattage   **4920.0** Watts

    Schedule   **Electrical Eq.**

**2.4. People:**

    Occupancy   **0.0** Person

    Activity Level   **Office Work**

    Sensible   **71.8** W/person

    Latent   **60.1** W/person

    Schedule   **None**

**2.5. Miscellaneous Loads:**

    Sensible   **0** W

    Schedule   **None**

    Latent   **0** W

    Schedule   **None**

**3. Walls, Windows, Doors:**

| **Exp.** | **Wall Gross Area (m²)** | **Window 1 Qty.** | **Window 2 Qty.** | **Door 1 Qty.** |
| --- | --- | --- | --- | --- |
| NNW | 26.2 | 0 | 0 | 0 |
| ENE | 15.6 | 0 | 0 | 1 |

**3.1. Construction Types for Exposure NNW**

    Wall Type   **Wall**

**3.2. Construction Types for Exposure ENE**

    Wall Type   **Wall**

    Door Type   **B.P.D./T-1**

**4. Roofs, Skylights:**

| **Exp.** | **Roof Gross Area (m²)** | **Roof Slope (deg.)** | **Skylight Qty.** |
| --- | --- | --- | --- |
| H | 24.7 | 0 | 0 |

**4.1. Construction Types for Exposure H**

    Roof Type   **Roof**

**5. Infiltration:**

    Design Cooling   **1.00** ACH

    Design Heating   **1.00** ACH

    Energy Analysis   **1.00** ACH

    Infiltration occurs at all hours.

**6. Floors:**

    Type   **Slab Floor On Grade**

    Floor Area   **24.7** m²

    Total Floor U-Value   **0.568** W/(m²-°K)

    Exposed Perimeter   **10.3** m

    Edge Insulation R-Value   **0.00** (m²-°K)/W

**7. Partitions:**

**7.1. 1st Partition Details:**

    Partition Type   **Wall Partition**

    Area   **41.8** m²

    U-Value   **1.260** W/(m²-°K)

    Uncondit. Space Max Temp   **35.0** °C

    Ambient at Space Max Temp   **41.0** °C

    Uncondit. Space Min Temp   **12.8** °C

    Ambient at Space Min Temp   **6.0** °C

**7.2. 2nd Partition Details:**

**(No partition data).**

**02-High Voltage Room**

**1. General Details:**

    Floor Area   **129.8** m²

    Avg. Ceiling Height   **4.1** m

    Building Weight   **341.8** kg/m²

**1.1. OA Ventilation Requirements:**

    Space Usage   **User-Defined**

    OA Requirement 1   **332.7** L/s

    OA Requirement 2   **0.00** L/(s-m²)

    Space Usage Defaults   **ASHRAE Standard 62.1-2010**

**2. Internals:**

**2.1. Overhead Lighting:**

    Fixture Type   **Recessed (Unvented)**

    Wattage   **20.00** W/m²

    Ballast Multiplier   **1.00**

    Schedule   **Lighting**

**2.2. Task Lighting:**

    Wattage   **0.00** W/m²

    Schedule   **None**

**2.3. Electrical Equipment:**

    Wattage   **20960.0** Watts

    Schedule   **Electrical Eq.**

**2.4. People:**

    Occupancy   **0.0** Person

    Activity Level   **Office Work**

    Sensible   **71.8** W/person

    Latent   **60.1** W/person

    Schedule   **None**

**2.5. Miscellaneous Loads:**

    Sensible   **0** W

    Schedule   **None**

    Latent   **0** W

    Schedule   **None**

**3. Walls, Windows, Doors:**

| **Exp.** | **Wall Gross Area (m²)** | **Window 1 Qty.** | **Window 2 Qty.** | **Door 1 Qty.** |
| --- | --- | --- | --- | --- |
| NNW | 51.1 | 0 | 0 | 0 |
| ENE | 21.4 | 0 | 0 | 1 |

**3.1. Construction Types for Exposure NNW**

    Wall Type   **Wall**

**3.2. Construction Types for Exposure ENE**

    Wall Type   **Wall**

    Door Type   **Ext. Dor W=2**

**4. Roofs, Skylights:**

| **Exp.** | **Roof Gross Area (m²)** | **Roof Slope (deg.)** | **Skylight Qty.** |
| --- | --- | --- | --- |
| H | 129.8 | 0 | 0 |

**4.1. Construction Types for Exposure H**

    Roof Type   **Roof**

**5. Infiltration:**

    Design Cooling   **0.00** ACH

    Design Heating   **0.00** ACH

    Energy Analysis   **0.00** ACH

    Infiltration occurs at all hours.

**6. Floors:**

    Type   **Floor Above Unconditioned Space**

    Floor Area   **129.8** m²

    Total Floor U-Value   **0.568** W/(m²-°K)

    Unconditioned Space Max Temp.   **35.0** °C

    Ambient at Space Max Temp.   **41.0** °C

    Unconditioned Space Min Temp.   **12.8** °C

    Ambient at Space Min Temp.   **6.0** °C

**7. Partitions:**

**7.1. 1st Partition Details:**

    Partition Type   **Wall Partition**

    Area   **43.4** m²

    U-Value   **1.260** W/(m²-°K)

    Uncondit. Space Max Temp   **35.0** °C

    Ambient at Space Max Temp   **41.0** °C

    Uncondit. Space Min Temp   **12.8** °C

    Ambient at Space Min Temp   **6.0** °C

**7.2. 2nd Partition Details:**

**(No partition data).**

**03-Low Voltage Room**

**1. General Details:**

    Floor Area   **156.6** m²

    Avg. Ceiling Height   **4.1** m

    Building Weight   **341.8** kg/m²

**1.1. OA Ventilation Requirements:**

    Space Usage   **User-Defined**

    OA Requirement 1   **389.4** L/s

    OA Requirement 2   **0.00** L/(s-m²)

    Space Usage Defaults   **ASHRAE Standard 62.1-2010**

**2. Internals:**

**2.1. Overhead Lighting:**

    Fixture Type   **Recessed (Unvented)**

    Wattage   **20.00** W/m²

    Ballast Multiplier   **1.00**

    Schedule   **Lighting**

**2.2. Task Lighting:**

    Wattage   **0.00** W/m²

    Schedule   **None**

**2.3. Electrical Equipment:**

    Wattage   **37361.0** Watts

    Schedule   **Electrical Eq.**

**2.4. People:**

    Occupancy   **0.0** Person

    Activity Level   **Office Work**

    Sensible   **71.8** W/person

    Latent   **60.1** W/person

    Schedule   **None**

**2.5. Miscellaneous Loads:**

    Sensible   **0** W

    Schedule   **None**

    Latent   **0** W

    Schedule   **None**

**3. Walls, Windows, Doors:**

| **Exp.** | **Wall Gross Area (m²)** | **Window 1 Qty.** | **Window 2 Qty.** | **Door 1 Qty.** |
| --- | --- | --- | --- | --- |
| WSW | 21.4 | 0 | 0 | 1 |
| SSE | 13.6 | 0 | 0 | 0 |
| ENE | 21.4 | 0 | 0 | 1 |

**3.1. Construction Types for Exposure WSW**

    Wall Type   **Wall**

    Door Type   **Ext. Dor W=1**

**3.2. Construction Types for Exposure SSE**

    Wall Type   **Wall**

**3.3. Construction Types for Exposure ENE**

    Wall Type   **Wall**

    Door Type   **Ext. Dor W=2**

**4. Roofs, Skylights:**

| **Exp.** | **Roof Gross Area (m²)** | **Roof Slope (deg.)** | **Skylight Qty.** |
| --- | --- | --- | --- |
| H | 156.6 | 0 | 0 |

**4.1. Construction Types for Exposure H**

    Roof Type   **Roof**

**5. Infiltration:**

    Design Cooling   **0.00** ACH

    Design Heating   **0.00** ACH

    Energy Analysis   **0.00** ACH

    Infiltration occurs at all hours.

**6. Floors:**

    Type   **Floor Above Unconditioned Space**

    Floor Area   **156.6** m²

    Total Floor U-Value   **0.568** W/(m²-°K)

    Unconditioned Space Max Temp.   **35.0** °C

    Ambient at Space Max Temp.   **41.0** °C

    Unconditioned Space Min Temp.   **12.8** °C

    Ambient at Space Min Temp.   **6.0** °C

**7. Partitions:**

**7.1. 1st Partition Details:**

    Partition Type   **Wall Partition**

    Area   **128.4** m²

    U-Value   **1.260** W/(m²-°K)

    Uncondit. Space Max Temp   **35.0** °C

    Ambient at Space Max Temp   **41.0** °C

    Uncondit. Space Min Temp   **12.8** °C

    Ambient at Space Min Temp   **6.0** °C

**7.2. 2nd Partition Details:**

**(No partition data).**

## SYSTEM INPUT DATA:

**Capacitor Bank System**

**1. General Details:**

    Air System Name   **Capacitor Bank System**

    Equipment Type   **Terminal Units**

    Air System Type   **Split DX Fan Coil**

    Number of zones   **1**

    Ventilation   **Direct Ventilation**

**2. Ventilation System Components:**

(Common Ventilation System not used: no inputs)

**3. Zone Components:**

**Space Assignments:**

|  |  |
| --- | --- |
| **Zone 1: Zone 1** |  |
| 01-Capacitor Bank | x1 |

**Thermostats and Zone Data:**

| **Zone** | **Cooling T-Stat Occ.** | **Cooling T-Stat Unocc.** | **Heating T-Stat Occ.** | **Heating T-Stat Unocc.** | **T-Stat Throttling Range** |
| --- | --- | --- | --- | --- | --- |
|  | **(°C)** | **(°C)** | **(°C)** | **(°C)** | **(°C)** |
| **1** | 30.0 | 31.0 | 10.0 | 8.0 | 0.83 |

    Thermostat Schedule   **Fan**

    Unoccupied Cooling is   **Available**

**Common Terminal Unit Data:**

**Cooling Coil:**

    Design Supply Temperature   **18.0** °C

    Coil Bypass Factor   **0.100**

    Cooling Source   **Air-Cooled DX**

    Schedule   **JFMAMJJASOND**

**Heating Coil:**

    Design Supply Temperature   **35.0** °C

    Heating Source   **Electric Resistance**

    Schedule   **JFMAMJJASOND**

    Fan Control   **Fan On**

    Ventilation Sizing Method   **ASHRAE Std 62.1-2010**

**Terminal Units Data:**

    Zone   **All**

    Terminal Type   **Fan Coil**

    Minimum Airflow   **0.00** L/s/person

    Fan Performance   **0** Pa

    Fan Overall Efficiency   **50** %

**4. Sizing Data (Computer-Generated):**

**System Sizing Data:**

**Sizing Data:**

**Hydronic Sizing Specifications:**

    Chilled Water Delta-T   **5.6** °K

    Hot Water Delta-T   **11.1** °K

**Safety Factors:**

    Cooling Sensible   **10** %

    Cooling Latent   **10** %

    Heating   **10** %

**Elec. Building System**

**1. General Details:**

    Air System Name   **Elec. Building**

    Equipment Type   **Packaged Rooftop Units**

    Air System Type   **Single Zone CAV**

    Number of zones   **1**

**2. Ventilation System Components:**

**Ventilation Air Data:**

    Airflow Control   **Constant Ventilation Airflow**

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

    Unocc. Damper Position   **Closed**

    Damper Leak Rate   **0** %

    Outdoor Air CO2 Level   **400** ppm

**Central Cooling Data:**

    Supply Air Temperature   **14.4** °C

    Coil Bypass Factor   **0.100**

    Cooling Source   **Air-Cooled DX**

    Schedule   **JFMAMJJASOND**

    Capacity Control   **Cycled or Staged Capacity - Fan On**

**Central Heating Data:**

    Supply Temperature   **35.0** °C

    Heating Source   **Electric Resistance**

    Schedule   **JFMAMJJASOND**

    Capacity Control   **Cycled or Staged Capacity - Fan On**

**Supply Fan Data:**

    Fan Type   **Forward Curved**

    Configuration   **Draw-thru**

    Fan Performance   **0** Pa

    Overall Efficiency   **54** %

    Fan Control   **1-speed fan, cooling and heating**

**Duct System Data:**

**Supply Duct Data:**

    Duct Heat Gain   **0** %

    Duct Leakage   **0** %

**Return Duct or Plenum Data:**

    Return Air Via   **Ducted Return**

**3. Zone Components:**

**Space Assignments:**

|  |  |
| --- | --- |
| **Zone 1: Zone 1** |  |
| 02-High Voltage Room | x1 |
| 03-Low Voltage Room | x1 |

**Thermostats and Zone Data:**

    Zone   **All**

    Cooling T-stat: Occ.   **30.0** °C

    Cooling T-stat: Unocc.   **31.0** °C

    Heating T-stat: Occ.   **10.0** °C

    Heating T-stat: Unocc.   **8.0** °C

    T-stat Throttling Range   **0.83** °K

    Diversity Factor   **100** %

    Direct Exhaust Airflow   **0.0** L/s

    Direct Exhaust Fan kW   **0.0** kW

    Thermostat Schedule   **Fan**

    Unoccupied Cooling is   **Available**

**Supply Terminals Data:**

    Zone   **All**

    Terminal Type   **Diffuser**

    Minimum Airflow   **0.00** L/s/person

**Zone Heating Units:**

    Zone   **All**

    Zone Heating Unit Type   **None**

    Zone Unit Heat Source   **Electric Resistance**

    Zone Heating Unit Schedule   **JFMAMJJASOND**

**4. Sizing Data (Computer-Generated):**

**System Sizing Data:**

**Sizing Data:**

**Hydronic Sizing Specifications:**

    Chilled Water Delta-T   **5.6** °K

    Hot Water Delta-T   **11.1** °K

**Safety Factors:**

    Cooling Sensible   **10** %

    Cooling Latent   **10** %

    Heating   **10** %

## AIR SYSTEM SIZING SUMMARAIR

**Capacitor Bank System**

**Air System Information**

    Air System Name   **Capacitor Bank System**

    Equipment Class   **TERM**

    Air System Type   **SPLT-FC**

Number of zones   **1**

Floor Area   **24.7** m²

Location   **Binak, IRAN**

**Sizing Calculation Information**

    Calculation Months   **Jan to Dec**

    Sizing Data   **Calculated**

Zone L/s Sizing   **Sum of space airflow rates**

Space L/s Sizing   **Individual peak space loads**

|  | **Maximum** |  |  |  | **Maximum** | **Zone** |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Cooling** | **Design** | **Minimum** |  | **Heating** | **Floor** |  |
|  | **Sensible** | **Airflow** | **Airflow** | **Time of** | **Load** | **Area** | **Zone** |
| **Zone Name** | **(kW)** | **(L/s)** | **(L/s)** | **Peak Load** | **(kW)** | **(m²)** | **L/(s-m²)** |
| Zone 1 | 6.8 | 472 | 472 | Jul 1500 | 0.6 | 24.7 | 19.09 |

**Terminal Unit Sizing Data - Cooling**

|  | **Total** | **Sens** | **Coil** | **Coil** | **Water** | **Time** |
| --- | --- | --- | --- | --- | --- | --- |
|  | **Coil** | **Coil** | **Entering** | **Leaving** | **Flow** | **of** |
|  | **Load** | **Load** | **DB / WB** | **DB / WB** | **@ 5.6 °K** | **Peak** |
| **Zone Name** | **(kW)** | **(kW)** | **(°C)** | **(°C)** | **(L/s)** | **Load** |
| Zone 1 | 7.6 | 6.7 | 30.7 / 22.2 | 18.9 / 18.1 | - | Jul 1600 |

**Terminal Unit Sizing Data - Heating, Fan, Ventilation**

|  |  | **Heating** | **Htg Coil** |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Heating** | **Coil** | **Water** | **Fan** |  |  | **OA Vent** |
|  | **Coil** | **Ent/Lvg** | **Flow** | **Design** | **Fan** | **Fan** | **Design** |
|  | **Load** | **DB** | **@11.1 °K** | **Airflow** | **Motor** | **Motor** | **Airflow** |
| **Zone Name** | **(kW)** | **(°C)** | **(L/s)** | **(L/s)** | **(BHP)** | **(kW)** | **(L/s)** |
| Zone 1 | 0.6 | 9.9 / 10.9 | - | 472 | 0.000 | 0.000 | 0 |

**Space Loads and Airflows**

|  |  | **Cooling** | **Time** | **Air** | **Heating** | **Floor** |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Zone Name /** |  | **Sensible** | **of** | **Flow** | **Load** | **Area** | **Space** |
| **Space Name** | **Mult.** | **(kW)** | **Load** | **(L/s)** | **(kW)** | **(m²)** | **L/(s-m²)** |
| ***Zone 1*** |  |  |  |  |  |  |  |
| 01-Capacitor Bank | 1 | 6.8 | Jul 1500 | 472 | 0.6 | 24.7 | 19.09 |

**Elec. Building System**

**Air System Information**

    Air System Name   **Elec. Building**

    Equipment Class   **PKG ROOF**

    Air System Type   **SZCAV**

Number of zones   **1**

Floor Area   **286.4** m²

Location   **Binak, IRAN**

**Sizing Calculation Information**

    Calculation Months   **Jan to Dec**

    Sizing Data   **Calculated**

Zone L/s Sizing   **Sum of space airflow rates**

Space L/s Sizing   **Individual peak space loads**

**Central Cooling Coil Sizing Data**

    Total coil load   **106.9** kW

    Sensible coil load   **77.9** kW

    Coil L/s at Jul 1600   **3748** L/s

    Max block L/s   **3748** L/s

    Sum of peak zone L/s   **3748** L/s

    Sensible heat ratio   **0.729**

    m²/kW   **2.7**

    W/m²   **373.2**

    Water flow @ 5.6 °K rise   **N/A**

Load occurs at   **Jul 1600**

OA DB / WB   **40.6 / 30.4** °C

Entering DB / WB   **32.5 / 22.2** °C

Leaving DB / WB   **15.3 / 14.4** °C

Coil ADP   **13.4** °C

Bypass Factor   **0.100**

Resulting RH   **36** %

Design supply temp.   **14.4** °C

Zone T-stat Check   **1 of 1** OK

Max zone temperature deviation   **0.0** °K

**Central Heating Coil Sizing Data**

    Max coil load   **4.4** kW

    Coil L/s at Des Htg   **3748** L/s

    Max coil L/s   **3748** L/s

    Water flow @ 11.1 °K drop   **N/A**

Load occurs at   **Des Htg**

W/m²   **15.4**

Ent. DB / Lvg DB   **9.0 / 10.0** °C

**Supply Fan Sizing Data**

    Actual max L/s   **3748** L/s

    Standard L/s   **3744** L/s

    Actual max L/(s-m²)   **13.09** 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   **722** L/s

    L/(s-m²)   **2.52** L/(s-m²)

**Zone Sizing Data**

|  | **Maximum** |  |  |  | **Maximum** | **Zone** |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Cooling** | **Design** | **Minimum** |  | **Heating** | **Floor** |  |
|  | **Sensible** | **Airflow** | **Airflow** | **Time of** | **Load** | **Area** | **Zone** |
| **Zone Name** | **(kW)** | **(L/s)** | **(L/s)** | **Peak Load** | **(kW)** | **(m²)** | **L/(s-m²)** |
| Zone 1 | 70.3 | 3748 | 3748 | Jul 0800 | 1.8 | 286.4 | 13.09 |

**Zone Terminal Sizing Data**

No Zone Terminal Sizing Data required for this system.

**Space Loads and Airflows**

|  |  | **Cooling** | **Time** | **Air** | **Heating** | **Floor** |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Zone Name /** |  | **Sensible** | **of** | **Flow** | **Load** | **Area** | **Space** |
| **Space Name** | **Mult.** | **(kW)** | **Load** | **(L/s)** | **(kW)** | **(m²)** | **L/(s-m²)** |
| ***Zone 1*** |  |  |  |  |  |  |  |
| 02-High Voltage Room | 1 | 26.1 | Jul 0800 | 1393 | 0.9 | 129.8 | 10.73 |
| 03-Low Voltage Room | 1 | 44.2 | Jul 0800 | 2355 | 0.9 | 156.6 | 15.04 |

## ventilation sizing summary

**Capacitor Bank System**

**1. Summary**

    Ventilation Sizing Method   **ASHRAE Std 62.1-2010**

    Design Condition   **Cooling operation**

**2. Space Ventilation Analysis Table**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  | **Space** | **Area** | **Time** | **People** |  |  | **Breathing** |  |
|  |  |  | **Floor** | **Outdoor** | **Averaged** | **Outdoor** | **Air** | **Space** | **Zone** | **Space** |
|  |  | **Supply Air** | **Area** | **Air Rate** | **Occupancy** | **Air Rate** | **Distribution** | **Outdoor Air** | **Outdoor Air** | **Ventilation** |
|  |  | **(L/s)** | **(m²)** | **(L/(s-m²))** | **(Occupants)** | **(L/s/person)** | **Effectiveness** | **(L/s)** | **(L/s)** | **Efficiency** |
| **Zone Name / Space Name** | **Mult.** | **(Vpz)** | **(Az)** | **(Ra)** | **(Pz)** | **(Rp)** | **(Ez)** | **(Voz)** | **(Vbz)** | **(Evz)** |
| **Zone 1** |  |  |  |  |  |  |  |  |  |  |
| 01-Capacitor Bank | 1 | 472 | 24.7 | 0.00 | 0.0 | 0.00 | 1.00 | **0** | *0* | 1.000 |
| **Totals (incl. Space Multipliers)** |  | **472** |  |  |  |  |  |  | **0** | **1.000** |

**Elec. Building System**

**1. Summary**

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

    Design Ventilation Airflow Rate   **722** L/s

**2. Space Ventilation Analysis Table**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | **Floor** |  | **Maximum** | **Required** | **Required** | **Required** | **Required** | **Uncorrected** |
|  |  | **Area** | **Maximum** | **Supply Air** | **Outdoor Air** | **Outdoor Air** | **Outdoor Air** | **Outdoor Air** | **Outdoor Air** |
| **Zone Name / Space Name** | **Mult.** | **(m²)** | **Occupants** | **(L/s)** | **(L/s/person)** | **(L/(s-m²))** | **(L/s)** | **(% of supply)** | **(L/s)** |
| **Zone 1** |  |  |  |  |  |  |  |  |  |
| 02-High Voltage Room | 1 | 129.8 | 0.0 | 1392.8 | 0.00 | 0.00 | 332.7 | 0.0 | 332.7 |
| 03-Low Voltage Room | 1 | 156.6 | 0.0 | 2355.2 | 0.00 | 0.00 | 389.4 | 0.0 | 389.4 |
| **Totals (incl. Space Multipliers)** |  |  |  | **3748.0** |  |  |  |  | **722.1** |

## air system design load summary:

**Capacitor Bank System**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **DESIGN COOLING** | | | **DESIGN HEATING** | | |
|  | **COOLING DATA AT Jul 1600** | | | **HEATING DATA AT DES HTG** | | |
|  | **COOLING OA DB / WB 40.6 °C / 30.4 °C** | | | **HEATING OA DB / WB 6.0 °C / 4.4 °C** | | |
|  |  | **Sensible** | **Latent** |  | **Sensible** | **Latent** |
| **ZONE LOADS** | **Details** | **(W)** | **(W)** | **Details** | **(W)** | **(W)** |
| Window & Skylight Solar Loads | 0 m² | 0 | - | 0 m² | - | - |
| Wall Transmission | 39 m² | 549 | - | 39 m² | 309 | - |
| Roof Transmission | 25 m² | 131 | - | 25 m² | 48 | - |
| Window Transmission | 0 m² | 0 | - | 0 m² | 0 | - |
| Skylight Transmission | 0 m² | 0 | - | 0 m² | 0 | - |
| Door Loads | 3 m² | 64 | - | 3 m² | 31 | - |
| Floor Transmission | 25 m² | 0 | - | 25 m² | 23 | - |
| Partitions | 42 m² | 169 | - | 42 m² | 0 | - |
| Ceiling | 0 m² | 0 | - | 0 m² | 0 | - |
| Overhead Lighting | 0 W | 11 | - | 0 | 0 | - |
| Task Lighting | 0 W | 0 | - | 0 | 0 | - |
| Electric Equipment | 4920 W | 4920 | - | 0 | 0 | - |
| People | 0 | 0 | 0 | 0 | 0 | 0 |
| Infiltration | - | 358 | 844 | - | 136 | 0 |
| Miscellaneous | - | 0 | 0 | - | 0 | 0 |
| Safety Factor | 10% / 10% | 620 | 84 | 10% | 55 | 0 |
| **>> Total Zone Loads** | **-** | **6823** | **928** | **-** | **601** | **0** |
| Zone Conditioning | - | 6715 | 928 | - | 559 | 0 |
| Plenum Wall Load | 0% | 0 | - | 0 | 0 | - |
| Plenum Roof Load | 0% | 0 | - | 0 | 0 | - |
| Plenum Lighting Load | 0% | 0 | - | 0 | 0 | - |
| Exhaust Fan Load | 0 L/s | 0 | - | 0 L/s | 0 | - |
| Ventilation Load | 0 L/s | 0 | 0 | 0 L/s | 0 | 0 |
| Ventilation Fan Load | 0 L/s | 0 | - | 0 L/s | 0 | - |
| Space Fan Coil Fans | - | 0 | - | - | 0 | - |
| Duct Heat Gain / Loss | 0% | 0 | - | 0% | 0 | - |
| **>> Total System Loads** | **-** | **6715** | **928** | **-** | **559** | **0** |
| Terminal Unit Cooling | - | 6715 | 933 | - | 0 | 0 |
| Terminal Unit Heating | - | 0 | - | - | 559 | - |
| **>> Total Conditioning** | **-** | **6715** | **933** | **-** | **559** | **0** |
| **Key:** | **Positive values are clg loads** | | | **Positive values are htg loads** | | |
|  | **Negative values are htg loads** | | | **Negative values are clg loads** | | |

**Elec. Building System**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **DESIGN COOLING** | | | **DESIGN HEATING** | | |
|  | **COOLING DATA AT Jul 1600** | | | **HEATING DATA AT DES HTG** | | |
|  | **COOLING OA DB / WB 40.6 °C / 30.4 °C** | | | **HEATING OA DB / WB 6.0 °C / 4.4 °C** | | |
|  |  | **Sensible** | **Latent** |  | **Sensible** | **Latent** |
| **ZONE LOADS** | **Details** | **(W)** | **(W)** | **Details** | **(W)** | **(W)** |
| Window & Skylight Solar Loads | 0 m² | 0 | - | 0 m² | - | - |
| Wall Transmission | 118 m² | 1719 | - | 118 m² | 928 | - |
| Roof Transmission | 286 m² | 1522 | - | 286 m² | 555 | - |
| Window Transmission | 0 m² | 0 | - | 0 m² | 0 | - |
| Skylight Transmission | 0 m² | 0 | - | 0 m² | 0 | - |
| Door Loads | 11 m² | 270 | - | 11 m² | 132 | - |
| Floor Transmission | 286 m² | 523 | - | 286 m² | 0 | - |
| Partitions | 172 m² | 696 | - | 172 m² | 0 | - |
| Ceiling | 0 m² | 0 | - | 0 m² | 0 | - |
| Overhead Lighting | 0 W | 131 | - | 0 | 0 | - |
| Task Lighting | 0 W | 0 | - | 0 | 0 | - |
| Electric Equipment | 58321 W | 58318 | - | 0 | 0 | - |
| People | 0 | 0 | 0 | 0 | 0 | 0 |
| Infiltration | - | 0 | 0 | - | 0 | 0 |
| Miscellaneous | - | 0 | 0 | - | 0 | 0 |
| Safety Factor | 10% / 10% | 6318 | 0 | 10% | 161 | 0 |
| **>> Total Zone Loads** | **-** | **69496** | **0** | **-** | **1776** | **0** |
| Zone Conditioning | - | 69238 | 0 | - | 1150 | 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 | 3748 L/s | 0 | - | 3748 L/s | 0 | - |
| Ventilation Load | 722 L/s | 8642 | 28997 | 722 L/s | 3270 | 0 |
| Supply Fan Load | 3748 L/s | 0 | - | 3748 L/s | 0 | - |
| Space Fan Coil Fans | - | 0 | - | - | 0 | - |
| Duct Heat Gain / Loss | 0% | 0 | - | 0% | 0 | - |
| **>> Total System Loads** | **-** | **77881** | **28997** | **-** | **4420** | **0** |
| Central Cooling Coil | - | 77881 | 29003 | - | 0 | 0 |
| Central Heating Coil | - | 0 | - | - | 4420 | - |
| **>> Total Conditioning** | **-** | **77881** | **29003** | **-** | **4420** | **0** |
| **Key:** | **Positive values are clg loads** | | | **Positive values are htg loads** | | |
|  | **Negative values are htg loads** | | | **Negative values are clg loads** | | |

## ZONE DESIGN LOAD SUMMARY:

**Capacitor Bank System**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Zone 1** | **DESIGN COOLING** | | | **DESIGN HEATING** | | |
|  | **COOLING DATA AT Jul 1500** | | | **HEATING DATA AT DES HTG** | | |
|  | **COOLING OA DB / WB 41.0 °C / 30.5 °C** | | | **HEATING OA DB / WB 6.0 °C / 4.4 °C** | | |
|  | **OCCUPIED T-STAT 30.0 °C** | | | **OCCUPIED T-STAT 10.0 °C** | | |
|  |  | **Sensible** | **Latent** |  | **Sensible** | **Latent** |
| **ZONE LOADS** | **Details** | **(W)** | **(W)** | **Details** | **(W)** | **(W)** |
| Window & Skylight Solar Loads | 0 m² | 0 | - | 0 m² | - | - |
| Wall Transmission | 39 m² | 528 | - | 39 m² | 309 | - |
| Roof Transmission | 25 m² | 132 | - | 25 m² | 48 | - |
| Window Transmission | 0 m² | 0 | - | 0 m² | 0 | - |
| Skylight Transmission | 0 m² | 0 | - | 0 m² | 0 | - |
| Door Loads | 3 m² | 65 | - | 3 m² | 31 | - |
| Floor Transmission | 25 m² | 0 | - | 25 m² | 23 | - |
| Partitions | 42 m² | 174 | - | 42 m² | 0 | - |
| Ceiling | 0 m² | 0 | - | 0 m² | 0 | - |
| Overhead Lighting | 0 W | 12 | - | 0 | 0 | - |
| Task Lighting | 0 W | 0 | - | 0 | 0 | - |
| Electric Equipment | 4920 W | 4920 | - | 0 | 0 | - |
| People | 0 | 0 | 0 | 0 | 0 | 0 |
| Infiltration | - | 373 | 810 | - | 136 | 0 |
| Miscellaneous | - | 0 | 0 | - | 0 | 0 |
| Safety Factor | 10% / 10% | 620 | 81 | 10% | 55 | 0 |
| **>> Total Zone Loads** | **-** | **6823** | **891** | **-** | **601** | **0** |

**Elec. Building System**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Zone 1** | **DESIGN COOLING** | | | **DESIGN HEATING** | | |
|  | **COOLING DATA AT Jul 0800** | | | **HEATING DATA AT DES HTG** | | |
|  | **COOLING OA DB / WB 28.4 °C / 27.8 °C** | | | **HEATING OA DB / WB 6.0 °C / 4.4 °C** | | |
|  | **OCCUPIED T-STAT 30.0 °C** | | | **OCCUPIED T-STAT 10.0 °C** | | |
|  |  | **Sensible** | **Latent** |  | **Sensible** | **Latent** |
| **ZONE LOADS** | **Details** | **(W)** | **(W)** | **Details** | **(W)** | **(W)** |
| Window & Skylight Solar Loads | 0 m² | 0 | - | 0 m² | - | - |
| Wall Transmission | 118 m² | 1591 | - | 118 m² | 928 | - |
| Roof Transmission | 286 m² | 1778 | - | 286 m² | 555 | - |
| Window Transmission | 0 m² | 0 | - | 0 m² | 0 | - |
| Skylight Transmission | 0 m² | 0 | - | 0 m² | 0 | - |
| Door Loads | 11 m² | -27 | - | 11 m² | 132 | - |
| Floor Transmission | 286 m² | -406 | - | 286 m² | 0 | - |
| Partitions | 172 m² | -541 | - | 172 m² | 0 | - |
| Ceiling | 0 m² | 0 | - | 0 m² | 0 | - |
| Overhead Lighting | 5728 W | 3194 | - | 0 | 0 | - |
| Task Lighting | 0 W | 0 | - | 0 | 0 | - |
| Electric Equipment | 58321 W | 58318 | - | 0 | 0 | - |
| People | 0 | 0 | 0 | 0 | 0 | 0 |
| Infiltration | - | 0 | 0 | - | 0 | 0 |
| Miscellaneous | - | 0 | 0 | - | 0 | 0 |
| Safety Factor | 10% / 10% | 6391 | 0 | 10% | 161 | 0 |
| **>> Total Zone Loads** | **-** | **70299** | **0** | **-** | **1776** | **0** |

## SPACE DESIGN LOAD SUMMARY:

**Capacitor Bank System**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **TABLE 1.1.A. COMPONENT LOADS FOR SPACE '' 01-Capacitor Bank '' IN ZONE '' Zone 1 ''** | | | | | | |
|  | **DESIGN COOLING** | | | **DESIGN HEATING** | | |
|  | **COOLING DATA AT Jul 1500** | | | **HEATING DATA AT DES HTG** | | |
|  | **COOLING OA DB / WB 41.0 °C / 30.5 °C** | | | **HEATING OA DB / WB 6.0 °C / 4.4 °C** | | |
|  | **OCCUPIED T-STAT 30.0 °C** | | | **OCCUPIED T-STAT 10.0 °C** | | |
|  |  | **Sensible** | **Latent** |  | **Sensible** | **Latent** |
| **SPACE LOADS** | **Details** | **(W)** | **(W)** | **Details** | **(W)** | **(W)** |
| Window & Skylight Solar Loads | 0 m² | 0 | - | 0 m² | - | - |
| Wall Transmission | 39 m² | 528 | - | 39 m² | 309 | - |
| Roof Transmission | 25 m² | 132 | - | 25 m² | 48 | - |
| Window Transmission | 0 m² | 0 | - | 0 m² | 0 | - |
| Skylight Transmission | 0 m² | 0 | - | 0 m² | 0 | - |
| Door Loads | 3 m² | 65 | - | 3 m² | 31 | - |
| Floor Transmission | 25 m² | 0 | - | 25 m² | 23 | - |
| Partitions | 42 m² | 174 | - | 42 m² | 0 | - |
| Ceiling | 0 m² | 0 | - | 0 m² | 0 | - |
| Overhead Lighting | 0 W | 12 | - | 0 | 0 | - |
| Task Lighting | 0 W | 0 | - | 0 | 0 | - |
| Electric Equipment | 4920 W | 4920 | - | 0 | 0 | - |
| People | 0 | 0 | 0 | 0 | 0 | 0 |
| Infiltration | - | 373 | 810 | - | 136 | 0 |
| Miscellaneous | - | 0 | 0 | - | 0 | 0 |
| Safety Factor | 10% / 10% | 620 | 81 | 10% | 55 | 0 |
| **>> Total Zone Loads** | **-** | **6823** | **891** | **-** | **601** | **0** |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **TABLE 1.1.B. ENVELOPE LOADS FOR SPACE '' 01-Capacitor Bank '' IN ZONE '' Zone 1 ''** | | | | | | |
|  |  |  |  | **COOLING** | **COOLING** | **HEATING** |
|  | **Area** | **U-Value** | **Shade** | **TRANS** | **SOLAR** | **TRANS** |
|  | **(m²)** | **(W/(m²-°K))** | **Coeff.** | **(W)** | **(W)** | **(W)** |
| **NNW EXPOSURE** |  |  |  |  |  |  |
| WALL | 26 | 1.968 | - | 281 | - | 206 |
| **ENE EXPOSURE** |  |  |  |  |  |  |
| WALL | 13 | 1.968 | - | 247 | - | 102 |
| DOOR | 3 | 3.000 | - | 65 | - | 31 |
| **H EXPOSURE** |  |  |  |  |  |  |
| ROOF | 25 | 0.484 | - | 132 | - | 48 |

**Elec. Building System**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **TABLE 1.1.A. COMPONENT LOADS FOR SPACE '' 02-High Voltage Room '' IN ZONE '' Zone 1 ''** | | | | | | |
|  | **DESIGN COOLING** | | | **DESIGN HEATING** | | |
|  | **COOLING DATA AT Jul 0800** | | | **HEATING DATA AT DES HTG** | | |
|  | **COOLING OA DB / WB 28.4 °C / 27.8 °C** | | | **HEATING OA DB / WB 6.0 °C / 4.4 °C** | | |
|  | **OCCUPIED T-STAT 30.0 °C** | | | **OCCUPIED T-STAT 10.0 °C** | | |
|  |  | **Sensible** | **Latent** |  | **Sensible** | **Latent** |
| **SPACE LOADS** | **Details** | **(W)** | **(W)** | **Details** | **(W)** | **(W)** |
| Window & Skylight Solar Loads | 0 m² | 0 | - | 0 m² | - | - |
| Wall Transmission | 68 m² | 868 | - | 68 m² | 536 | - |
| Roof Transmission | 130 m² | 806 | - | 130 m² | 251 | - |
| Window Transmission | 0 m² | 0 | - | 0 m² | 0 | - |
| Skylight Transmission | 0 m² | 0 | - | 0 m² | 0 | - |
| Door Loads | 4 m² | -11 | - | 4 m² | 53 | - |
| Floor Transmission | 130 m² | -184 | - | 130 m² | 0 | - |
| Partitions | 43 m² | -137 | - | 43 m² | 0 | - |
| Ceiling | 0 m² | 0 | - | 0 m² | 0 | - |
| Overhead Lighting | 2596 W | 1448 | - | 0 | 0 | - |
| Task Lighting | 0 W | 0 | - | 0 | 0 | - |
| Electric Equipment | 20960 W | 20959 | - | 0 | 0 | - |
| People | 0 | 0 | 0 | 0 | 0 | 0 |
| Infiltration | - | 0 | 0 | - | 0 | 0 |
| Miscellaneous | - | 0 | 0 | - | 0 | 0 |
| Safety Factor | 10% / 10% | 2375 | 0 | 10% | 84 | 0 |
| **>> Total Zone Loads** | **-** | **26124** | **0** | **-** | **924** | **0** |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **TABLE 1.1.B. ENVELOPE LOADS FOR SPACE '' 02-High Voltage Room '' IN ZONE '' Zone 1 ''** | | | | | | |
|  |  |  |  | **COOLING** | **COOLING** | **HEATING** |
|  | **Area** | **U-Value** | **Shade** | **TRANS** | **SOLAR** | **TRANS** |
|  | **(m²)** | **(W/(m²-°K))** | **Coeff.** | **(W)** | **(W)** | **(W)** |
| **NNW EXPOSURE** |  |  |  |  |  |  |
| WALL | 51 | 1.968 | - | 619 | - | 402 |
| **ENE EXPOSURE** |  |  |  |  |  |  |
| WALL | 17 | 1.968 | - | 249 | - | 134 |
| DOOR | 4 | 3.000 | - | -11 | - | 53 |
| **H EXPOSURE** |  |  |  |  |  |  |
| ROOF | 130 | 0.484 | - | 806 | - | 251 |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **TABLE 1.2.A. COMPONENT LOADS FOR SPACE '' 03-Low Voltage Room '' IN ZONE '' Zone 1 ''** | | | | | | |
|  | **DESIGN COOLING** | | | **DESIGN HEATING** | | |
|  | **COOLING DATA AT Jul 0800** | | | **HEATING DATA AT DES HTG** | | |
|  | **COOLING OA DB / WB 28.4 °C / 27.8 °C** | | | **HEATING OA DB / WB 6.0 °C / 4.4 °C** | | |
|  | **OCCUPIED T-STAT 30.0 °C** | | | **OCCUPIED T-STAT 10.0 °C** | | |
|  |  | **Sensible** | **Latent** |  | **Sensible** | **Latent** |
| **SPACE LOADS** | **Details** | **(W)** | **(W)** | **Details** | **(W)** | **(W)** |
| Window & Skylight Solar Loads | 0 m² | 0 | - | 0 m² | - | - |
| Wall Transmission | 50 m² | 723 | - | 50 m² | 392 | - |
| Roof Transmission | 157 m² | 972 | - | 157 m² | 303 | - |
| Window Transmission | 0 m² | 0 | - | 0 m² | 0 | - |
| Skylight Transmission | 0 m² | 0 | - | 0 m² | 0 | - |
| Door Loads | 7 m² | -16 | - | 7 m² | 79 | - |
| Floor Transmission | 157 m² | -222 | - | 157 m² | 0 | - |
| Partitions | 128 m² | -404 | - | 128 m² | 0 | - |
| Ceiling | 0 m² | 0 | - | 0 m² | 0 | - |
| Overhead Lighting | 3132 W | 1747 | - | 0 | 0 | - |
| Task Lighting | 0 W | 0 | - | 0 | 0 | - |
| Electric Equipment | 37361 W | 37359 | - | 0 | 0 | - |
| People | 0 | 0 | 0 | 0 | 0 | 0 |
| Infiltration | - | 0 | 0 | - | 0 | 0 |
| Miscellaneous | - | 0 | 0 | - | 0 | 0 |
| Safety Factor | 10% / 10% | 4016 | 0 | 10% | 77 | 0 |
| **>> Total Zone Loads** | **-** | **44175** | **0** | **-** | **852** | **0** |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **TABLE 1.2.B. ENVELOPE LOADS FOR SPACE '' 03-Low Voltage Room '' IN ZONE '' Zone 1 ''** | | | | | | |
|  |  |  |  | **COOLING** | **COOLING** | **HEATING** |
|  | **Area** | **U-Value** | **Shade** | **TRANS** | **SOLAR** | **TRANS** |
|  | **(m²)** | **(W/(m²-°K))** | **Coeff.** | **(W)** | **(W)** | **(W)** |
| **WSW EXPOSURE** |  |  |  |  |  |  |
| WALL | 19 | 1.968 | - | 320 | - | 151 |
| DOOR | 2 | 3.000 | - | -5 | - | 26 |
| **SSE EXPOSURE** |  |  |  |  |  |  |
| WALL | 14 | 1.968 | - | 155 | - | 107 |
| **ENE EXPOSURE** |  |  |  |  |  |  |
| WALL | 17 | 1.968 | - | 249 | - | 134 |
| DOOR | 4 | 3.000 | - | -11 | - | 53 |
| **H EXPOSURE** |  |  |  |  |  |  |
| ROOF | 157 | 0.484 | - | 972 | - | 303 |

1. **Equipment Selection**

## Air Conditioning Unit (split unit)

**Capacitor Bank System**

|  |  |
| --- | --- |
| **Item** | **Service Area** |
| **Capacitor Bank** |
| Calculated Sensible Cooling Load(w) | 6823 |
| Calculated Latent Cooling Load(w) | 891 |
| Calculated Total Cooling Load(w) | 7714 |
| Calculated Total Cooling Load (btu/hr) | 26345 |
| Calculated Sensible Heating Load(w) | 601 |
| Calculated Sensible Heating Load (btu/hr) | 2053 |
| Eq. ID (1202-SUI/SUO-GCSEB-XX ) | 01 |
| Equipment QTY. | 1 duty / 1 standby |
| Equipment Type | W.M.\* |
| Eq. Calculated Cooling Load+ 10% Over Cap. (btu/hr) | 28980 |
| Eq. Calculated Heating Load+ 10% Over Cap. (btu/hr) | 2258 |
| Selected Eq. Nominal Cooling Cap. (btu/hr) | B.V.\*\* |
| Selected Eq. Actual Cooling Cap. (btu/hr) | B.V.\*\* |
| Selected Eq. Actual Heating Cap. (btu/hr) | B.V.\*\* |
| Power Supply (V/PH/Hz) | 230/1/50 |
| Max. Power Consumption (w) Eq. (Cooling/Heating) | B.V.\*\* |
| REMARKE \*\*\* | Cooling & Heating (Heat Pump) |

\*Wall Mounted Split unit

\*\*By Vendor

\*\*\*Indoor & Outdoor Unit-T3, With Thermostat and All Standard Accessory

**Elec. Building System**

**Existing Package Unit:**

|  |  |  |
| --- | --- | --- |
| **PACKAGE UNIT SCHEDULE** | | |
| Performance | Tag No. : PU-02-01 , PU-02-02 | |
| Cooling Capacity: 53400 KCAL/HR | |
| Nominal Tonnage: 25 TON | |
| Supply Air:12000 CMH – Fresh Air :2550 CMH | |
| SUMMER | Air Inlet Temp. :80.5/68.8  Leaving Temp. :57.7/56.6 |
| Elec. Data | 400-3-50 | |
| Physical Data | Dimensions:5200×2000×174 mm | |
| Operating Weight=1970 kg | |
| Designation & Quantity | P.U-2 QTY=1 | |
| MAX. Ambient Temp.= 125 | |
| Com. Data | Elec. Power =25 HP 400-3-50 | |
| Thermal =75450 Kcal/Hr | |
| Condenser Data | QTY=2 | |
| HP=3 HP | |
| Fan Data | Elec.-400-3-50 | |
| RPM=1450 | |
| Model | Similar to SARAN P.U. Model SPAR 25-1 Roof Top | |
| Quantity | QTY.=2 One as Standby | |

**High Voltage and Low Voltage Room:**

**Central Cooling Coil Sizing Data (From Hap 4.9)**

Total coil load   106.9 kW

    Sensible coil load   **77.9** kW

    Coil L/s at Jul 1600   **3748** L/s

    Max block L/s   **3748** L/s

    Sum of peak zone L/s   **3748** L/s

    Sensible heat ratio   **0.729**

    m²/kW   **2.7**

    W/m²   **373.2**

Existing Package Unit Actual Total Cooling Capacity = 53400 kcal/hr = 17.8 ton = 62.6 kW

Total Cooling Load – Package Unit Cooling Capacity = 106.9 – 62.6 = 44.3 kW

LV & HV Rooms Split units new loads = 44.3 kW

|  |  | **Cooling** | **Cooling** | **Heating** |
| --- | --- | --- | --- | --- |
| **Zone Name /** |  | **Sensible** | **Latent** |  |
| **Space Name** | **Mult.** | **(kW)** | **(kW)** | **(kW)** |
| 02-High Voltage Room | 1 | 26.124 | 0 | 0.924 |
| 03-Low Voltage Room | 1 | 44.175 | 0 | 0.852 |

Low Voltage Room load Ratio= = = 0.628

Low Voltage Room load = 0.628 × 44.3 kW = 27.820 kW

High Voltage Room load = 0.372 × 44.3 kW = 16.480 kW

|  |  |  |
| --- | --- | --- |
| **Item** | **Service Area** | |
| **High Voltage Room** | **Low Voltage Room** |
| Calculated Sensible Cooling Load(w) | 16480 | 27820 |
| Calculated Latent Cooling Load(w) | 0 | 0 |
| Calculated Total Cooling Load(w) | 16480 | 27820 |
| Calculated Total Cooling Load (btu/hr) | 56282 | 95010 |
| Calculated Sensible Heating Load(w) | 924 | 852 |
| Calculated Sensible Heating Load (btu/hr) | 3156 | 2910 |
| Eq. ID (1202-SUI/SUO-GCSEB-XX ) | 02 | 03 |
| Equipment QTY. | 2 duty / 2 standby | 2 duty / 2 standby |
| Equipment Type | C.T. | C.T. |
| Eq. Calculated Cooling Load+ 10% Over Cap. (btu/hr) | 30955 | 52256 |
| Eq. Calculated Heating Load+ 10% Over Cap. (btu/hr) | 1736 | 1601 |
| Selected Eq. Nominal Cooling Cap. (btu/hr) | B.V.\*\* | B.V.\*\* |
| Selected Eq. Actual Cooling Cap. (btu/hr) | B.V.\*\* | B.V.\*\* |
| Selected Eq. Actual Heating Cap. (btu/hr) | B.V.\*\* | B.V.\*\* |
| Power Supply (V/PH/Hz) | 400/3/50 | 400/3/50 |
| Max. Power Consumption (w) Eq. (Cooling/Heating) | B.V.\*\* | B.V.\*\* |
| REMARKE \*\*\* | Cooling & Heating (Heat Pump) | Cooling & Heating (Heat Pump) |

\* Ceiling Mounted Cassette Split unit

\*\*By Vendor

\*\*\*Indoor & Outdoor Unit-T3, With Thermostat, Control and All Standard Accessory

## FAN FILTER UNIT selection

**1202-FFU-GCSEB-01 (Capacitor Bank + CO2 Room)**

**Capacitor Bank**

Air Flow = 24.73 (area, m²) × 4.07 (height, m) × 1 ACH ÷ 60 min = 1.68 m³/min = 28 L/S = 59.33 cfm

**CO2 Room**

Air Flow = 20.13 (area, m²) × 4.57 (height, m) × 6 ACH ÷ 60 min = 9.2 m³/min = 153.3 L/S = 324.9 cfm

|  |  |  |
| --- | --- | --- |
| Item | | **1202-FFU-GCSEB-01** |
| Service Area | | Capacitor Bank + CO2 Room |
| Equipment QTY. | | 1 |
| Air Flow(L/S) | | 181.3 |
| Air Flow(CFM) | | 384.23 |
| Internal Pressure Drop (In.WG.) | Sand Tarp Louver | By Vendor |
| V-Type Aluminium Filter | By Vendor |
| Bag Filter (95% Efficiency) | By Vendor |
| Component Pressure Drop  (External)  (In.WG.) | Blast Proof Valve-01(300×250) | 0.420 |
| Fire Damper-01(300×250) | 0.030 |
| Intake Air Duct | 0.050 |
| Intake Air Duct Volume Damper  (300×200) | 0.080 |
| Intake Air Diffuser(300×300) | 0.028 |
| Total External Pressure Drop \*  + 10% Over S.F. | (In.WG.) | 0.669 |
| (Pa) | 166.474 |
| Fan type | | Centrifugal |
| Power Supply (V/PH/Hz) | | 230/1/50 |
| Power Consumption (w) Each Eq. | | By Vendor |
| REMARKE | | Equipped With Bird Mesh, Sand Tarp Louver, V-Type Aluminium Filter and Bag Filter (95% Efficiency). |

\* Total Pressure Drop (External + Internal) Shall Be Specified By Vendor.

## Exhaust fan selection

**1202-EF-GCSEB-01 (Capacitor Bank + CO2 Room)**

**Capacitor Bank**

Air Flow = 24.73 (area, m²) × 4.07 (height, m) × 1 ACH ÷ 60 min = 1.68 m³/min = 28 L/S = 59.33 cfm

**CO2 Room**

Air Flow = 20.13 (area, m²) × 4.57 (height, m) × 6 ACH ÷ 60 min = 9.2 m³/min = 153.3 L/S = 324.9 cfm

|  |  |  |
| --- | --- | --- |
| Item | | **1202-EF-GCSEB-01** |
| Service Area | | Capacitor Bank + CO2 Room |
| Equipment QTY. | | 1 |
| Air Flow(L/S) | | 181.3 |
| Air Flow(CFM) | | 384.23 |
| Component Pressure Drop  (External)  (In.WG.) | Exhaust Air Diffuser/Register(150×150) | 0.028 |
| Exhaust Air Duct Volume Damper(150×100) | 0.090 |
| Exhaust Air Duct | 0.031 |
| Blast Proof Valve-02(400×150) | 0.510 |
| Fire Damper-02(400×150) | 0.032 |
| Total Pressure Drop \*  + 10% Over S.F. | (In.WG.) | 0.760 |
| (Pa) | 189.118 |
| Exhaust Fan type | | Utility Ex. Fan (Centrifugal) |
| Power Supply (V/PH/Hz) | | 230/1/50 |
| Power Consumption (w) Each Eq. | | By Vendor |
| REMARKE | | Equipped With Bird Mesh and Gravity Damper |

\* Total Pressure Drop (External + Internal) Shall Be Specified By Vendor.

**Battery Room Exhaust Fan:**

Air Flow = 25.64 (area, m²) × 4.07 (height, m) × 10 ACH ÷ 60 min = 17.39 m³/min = 289.83 L/S = 614.12 cfm = 1043 m³/hr

Wall Mounted Exhaust Fan Pressure Drop: 15 Pa

**“This Fan is Existing and Battery Room Air Exhaust Directly from Inside Battery Room”**