|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **طرح نگهداشت و افزایش تولید 27 مخزن** | | | | | | | |
| **HVAC CALCULATION NOTE FOR GCS WAREHOUSE**  **نگهداشت و افزایش تولید میدان نفتی بینک** | | | | | | | |
|  | |  |  |  |  |  |  |
|  | |  |  |  |  |  |  |
|  | |  |  |  |  |  |  |
|  | |  |  |  |  |  |  |
|  | |  |  |  |  |  |  |
| D00 | | FEB. 2024 | IFC | K.Ahmadi | M.Fakharian | S.Faramarzpour |  |
| **Rev.** | | **Date** | **Purpose of Issue/Status** | **Prepared by:** | **Checked by:** | **Approved by:** | **CLIENT Approval** |
| **Class: 2** | | | **CLIENT Doc. Number:** **F0Z-709532** | | | | |
| **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**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **PAGE** | **D00** | **D01** | **D02** | **D03** | **D04** |  | **PAGE** | **D00** | **D01** | **D02** | **D03** | **D04** |
| 1 | X |  |  |  |  | 58 |  |  |  |  |  |
| 2 | X |  |  |  |  | 59 |  |  |  |  |  |
| 3 | X |  |  |  |  | 60 |  |  |  |  |  |
| 4 | X |  |  |  |  | 61 |  |  |  |  |  |
| 5 | X |  |  |  |  | 62 |  |  |  |  |  |
| 6 | X |  |  |  |  | 63 |  |  |  |  |  |
| 7 | X |  |  |  |  | 64 |  |  |  |  |  |
| 8 | X |  |  |  |  | 65 |  |  |  |  |  |
| 9 | X |  |  |  |  | 66 |  |  |  |  |  |
| 10 | X |  |  |  |  | 67 |  |  |  |  |  |
| 11 | X |  |  |  |  | 68 |  |  |  |  |  |
| 12 | X |  |  |  |  | 69 |  |  |  |  |  |
| 13 | X |  |  |  |  | 70 |  |  |  |  |  |
| 14 | X |  |  |  |  | 71 |  |  |  |  |  |
| 15 | X |  |  |  |  | 72 |  |  |  |  |  |
| 16 | X |  |  |  |  | 73 |  |  |  |  |  |
| 17 | X |  |  |  |  | 74 |  |  |  |  |  |
| 18 | X |  |  |  |  | 75 |  |  |  |  |  |
| 19 | X |  |  |  |  | 76 |  |  |  |  |  |
| 20 | X |  |  |  |  | 77 |  |  |  |  |  |
| 21 | X |  |  |  |  | 78 |  |  |  |  |  |
| 22 |  |  |  |  |  | 79 |  |  |  |  |  |
| 23 |  |  |  |  |  | 80 |  |  |  |  |  |
| 24 |  |  |  |  |  | 81 |  |  |  |  |  |
| 25 |  |  |  |  |  | 82 |  |  |  |  |  |
| 26 |  |  |  |  |  | 83 |  |  |  |  |  |
| 27 |  |  |  |  |  | 84 |  |  |  |  |  |
| 28 |  |  |  |  |  | 85 |  |  |  |  |  |
| 29 |  |  |  |  |  | 86 |  |  |  |  |  |
| 30 |  |  |  |  |  | 87 |  |  |  |  |  |
| 31 |  |  |  |  |  | 88 |  |  |  |  |  |
| 32 |  |  |  |  |  | 89 |  |  |  |  |  |
| 33 |  |  |  |  |  | 90 |  |  |  |  |  |
| 34 |  |  |  |  |  | 91 |  |  |  |  |  |
| 35 |  |  |  |  |  | 92 |  |  |  |  |  |
| 36 |  |  |  |  |  | 93 |  |  |  |  |  |
| 37 |  |  |  |  |  | 94 |  |  |  |  |  |
| 38 |  |  |  |  |  | 95 |  |  |  |  |  |
| 39 |  |  |  |  |  | 96 |  |  |  |  |  |
| 40 |  |  |  |  |  | 97 |  |  |  |  |  |
| 41 |  |  |  |  |  | 98 |  |  |  |  |  |
| 42 |  |  |  |  |  | 99 |  |  |  |  |  |
| 43 |  |  |  |  |  | 100 |  |  |  |  |  |
| 44 |  |  |  |  |  | 101 |  |  |  |  |  |
| 45 |  |  |  |  |  | 102 |  |  |  |  |  |
| 46 |  |  |  |  |  | 103 |  |  |  |  |  |
| 47 |  |  |  |  |  | 104 |  |  |  |  |  |
| 48 |  |  |  |  |  | 105 |  |  |  |  |  |
| 49 |  |  |  |  |  | 106 |  |  |  |  |  |
| 50 |  |  |  |  |  | 107 |  |  |  |  |  |
| 51 |  |  |  |  |  | 108 |  |  |  |  |  |
| 52 |  |  |  |  |  | 109 |  |  |  |  |  |
| 53 |  |  |  |  |  | 110 |  |  |  |  |  |
| 54 |  |  |  |  |  | 111 |  |  |  |  |  |
| 55 |  |  |  |  |  | 112 |  |  |  |  |  |
| 56 |  |  |  |  |  | 113 |  |  |  |  |  |
| 57 |  |  |  |  |  | 114 |  |  |  |  |  |

**CONTENTS**

[1.0 INTRODUCTION 4](#_Toc157854379)

[2.0 Scope 4](#_Toc157854380)

[3.0 NORMATIVE REFERENCES 5](#_Toc157854381)

[3.1 Local Codes and Standards 5](#_Toc157854382)

[3.2 International Codes and Standards 5](#_Toc157854383)

[3.3 ENVIRONMENTAL DATA 6](#_Toc157854384)

[4.0 HVAC CALCULATION 6](#_Toc157854385)

[4.1 Design weather Parameters: 6](#_Toc157854386)

[4.2 CONSTRUCTIONS U-VALUE: 10](#_Toc157854387)

[4.3 SPACE INPUT DATA: 11](#_Toc157854388)

[4.4 SYSTEM INPUT DATA 13](#_Toc157854389)

[4.5 ZONE SIZING SUMMARY 14](#_Toc157854390)

[4.6 ventilation sizing summary 15](#_Toc157854391)

[4.7 air system design load summary: 16](#_Toc157854392)

[4.8 ZONE DESIGN LOAD SUMMARY: 17](#_Toc157854393)

[4.9 SPACE DESIGN LOAD SUMMARY: 18](#_Toc157854394)

[5.0 Equipment Selection 20](#_Toc157854395)

[5.1 Air Conditioning Unit (split unit) 20](#_Toc157854396)

[5.2 Exhaust fan selection 20](#_Toc157854397)

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   **0.419** 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 |
| face brick(P99-19NR) | 30.000 | 2000.0 | 1.09 | 1.00000 | 60.0 |
| cement plaster(P87-19NR) | 20.000 | 1600.0 | 0.80 | 0.02500 | 32.0 |
| concrete wall(P87-19NR) | 400.000 | 2400.0 | 0.84 | 0.16000 | 960.0 |
| cement plaster(P87-19NR) | 20.000 | 1600.0 | 0.80 | 0.02500 | 32.0 |
| face brick(P99-19NR) | 30.000 | 2000.0 | 0.03 | 1.00000 | 60.0 |
| Outside surface resistance | 0.000 | 0.0 | 0.00 | 0.05864 | 0.0 |
| **Totals** | **500.000** | **-** |  | **2.38928** | **1144.0** |

**Roof**

**Roof Details**

    Outside Surface Color   **Medium**

    Absorptivity   **0.675**

    Overall U-Value   **1.220** 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 wall(P87-19NR) | 400.000 | 2400.0 | 0.84 | 0.16000 | 960.0 |
| high density polyurethane(P8-19N | 50.000 | 1300.0 | 0.84 | 0.23810 | 65.0 |
| light weight concrete(P87-19NR) | 50.000 | 1800.0 | 0.84 | 0.03704 | 90.0 |
| waterproofing layer(P96-19NR) | 20.000 | 1100.0 | 1.67 | 0.08696 | 22.0 |
| sand cement mortar(P88-19NR) | 50.000 | 1600.0 | 0.80 | 0.09615 | 80.0 |
| terrazzo tile(P89-19NR) | 30.000 | 2000.0 | 1.35 | 0.02222 | 60.0 |
| Outside surface resistance | 0.000 | 0.0 | 0.00 | 0.05864 | 0.0 |
| **Totals** | **600.000** | **-** |  | **0.81975** | **1277.0** |

**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**

## SPACE INPUT DATA:

**01-Instrument Workshop**

**1. General Details:**

    Floor Area   **19.4** m²

    Avg. Ceiling Height   **3.4** m

    Building Weight   **634.7** 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   **2000.0** Watts

    Schedule   **Electrical Eq.**

**2.4. People:**

    Occupancy   **5.0** People

    Activity Level   **Heavy Work**

    Sensible   **153.9** W/person

    Latent   **271.1** W/person

    Schedule   **People**

**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 | 16.1 | 0 | 0 | 0 |
| SSE | 9.6 | 0 | 0 | 1 |

**3.1. Construction Types for Exposure NNW**

    Wall Type    **Wall**

**3.2. Construction Types for Exposure SSE**

    Wall Type    **Wall**

    Door Type   **B.P.D./T-1**

**4. Roofs, Skylights:**

| **Exp.** | **Roof Gross Area (m²)** | **Roof Slope (deg.)** | **Skylight Qty.** |
| --- | --- | --- | --- |
| H | 19.4 | 0 | 0 |

**4.1. Construction Types for Exposure H**

    Roof Type   **Roof**

**5. Infiltration:**

    Design Cooling   **131.20** L/s

    Design Heating   **131.20** L/s

    Energy Analysis   **131.20** L/s

    Infiltration occurs at all hours.

**6. Floors:**

    Type   **Slab Floor On Grade**

    Floor Area   **19.4** m²

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

    Exposed Perimeter   **7.7** m

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

**7. Partitions:**

**7.1. 1st Partition Details:**

    Partition Type   **Wall Partition**

    Area   **27.6** 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-Instrument Storage**

**1. General Details:**

    Floor Area   **17.6** m²

    Avg. Ceiling Height   **3.4** m

    Building Weight   **634.7** 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   **500.0** Watts

    Schedule   **Electrical Eq.**

**2.4. People:**

    Occupancy   **1.0** Person

    Activity Level   **Heavy Work**

    Sensible   **153.9** W/person

    Latent   **271.1** W/person

    Schedule   **People**

**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 | 12.6 | 0 | 0 | 0 |
| SSE | 12.6 | 0 | 0 | 0 |
| ENE | 15.7 | 0 | 0 | 0 |

**3.1. Construction Types for Exposure NNW**

    Wall Type    **Wall**

**3.2. Construction Types for Exposure SSE**

    Wall Type    **Wall**

**3.3. Construction Types for Exposure ENE**

    Wall Type    **Wall**

**4. Roofs, Skylights:**

| **Exp.** | **Roof Gross Area (m²)** | **Roof Slope (deg.)** | **Skylight Qty.** |
| --- | --- | --- | --- |
| H | 17.6 | 0 | 0 |

**4.1. Construction Types for Exposure H**

    Roof Type   **Roof**

**5. Infiltration:**

    Design Cooling   **65.60** L/s

    Design Heating   **65.60** L/s

    Energy Analysis   **65.60** L/s

    Infiltration occurs at all hours.

**6. Floors:**

    Type   **Slab Floor On Grade**

    Floor Area   **17.6** m²

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

    Exposed Perimeter   **12.2** m

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

**7. Partitions:**

**7.1. 1st Partition Details:**

    Partition Type   **Wall Partition**

    Area   **5.4** 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

**1. General Details:**

    Air System Name   **System**

    Equipment Type   **Terminal Units**

    Air System Type   **Packaged DX Fan Coil**

    Number of zones   **2**

    Ventilation   **Direct Ventilation**

**2. Ventilation System Components:**

(Common Ventilation System not used: no inputs)

**3. Zone Components:**

**Space Assignments:**

|  |  |
| --- | --- |
| **Zone 1: Zone 1** |  |
| 01-Instrument Workshop | x1 |
| **Zone 2: Zone 2** |  |
| 02-Instrument Storage | 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** | 23.9 | 26.7 | 21.1 | 18.3 | 0.83 |
| **2** | 30.0 | 35.0 | 15.0 | 10.0 | 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   **Sum of Space OA Airflows**

**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:**

    Cooling Supply Temperature   **18.0** °C

    Heating Supply Temperature   **35.0** °C

**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** %

## ZONE SIZING SUMMARY

**Air System Information**

    Air System Name   **System**

    Equipment Class   **TERM**

    Air System Type   **PKG-FC**

Number of zones   **2**

Floor Area   **37.0** 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**

**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 | 7.1 | 997 | 997 | Jul 1500 | 3.7 | 19.4 | 51.37 |
| Zone 2 | 2.1 | 144 | 144 | Jul 1500 | 1.2 | 17.6 | 8.21 |

**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 | 10.8 | 6.9 | 24.4 / 21.2 | 18.7 / 18.4 | - | Aug 1400 |
| Zone 2 | 4.0 | 1.9 | 30.6 / 25.8 | 19.6 / 19.3 | - | Jul 1500 |

**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 | 3.7 | 21.1 / 24.2 | - | 997 | 0.000 | 0.000 | 0 |
| Zone 2 | 1.2 | 15.1 / 22.2 | - | 144 | 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-Instrument Workshop | 1 | 7.1 | Jul 1500 | 997 | 3.7 | 19.4 | 51.37 |
| ***Zone 2*** |  |  |  |  |  |  |  |
| 02-Instrument Storage | 1 | 2.1 | Jul 1500 | 144 | 1.2 | 17.6 | 8.21 |

## ventilation sizing summary

**1. Summary**

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

**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** |  |  |  |  |  |  |  |  |  |
| 01-Instrument Workshop | 1 | 19.4 | 5.0 | 996.7 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| **Zone 2** |  |  |  |  |  |  |  |  |  |
| 02-Instrument Storage | 1 | 17.6 | 1.0 | 144.5 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| **Totals (incl. Space Multipliers)** |  |  |  | **1141.1** |  |  |  |  | **0.0** |

## air system design load summary:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **DESIGN COOLING** | | | **DESIGN HEATING** | | |
|  | **COOLING DATA AT Aug 1400** | | | **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 | 64 m² | 195 | - | 64 m² | 300 | - |
| Roof Transmission | 37 m² | 625 | - | 37 m² | 551 | - |
| Window Transmission | 0 m² | 0 | - | 0 m² | 0 | - |
| Skylight Transmission | 0 m² | 0 | - | 0 m² | 0 | - |
| Door Loads | 3 m² | 109 | - | 3 m² | 118 | - |
| Floor Transmission | 37 m² | 0 | - | 37 m² | 114 | - |
| Partitions | 33 m² | 337 | - | 33 m² | 304 | - |
| Ceiling | 0 m² | 0 | - | 0 m² | 0 | - |
| Overhead Lighting | 0 W | 17 | - | 0 | 0 | - |
| Task Lighting | 0 W | 0 | - | 0 | 0 | - |
| Electric Equipment | 2500 W | 2500 | - | 0 | 0 | - |
| People | 6 | 923 | 1627 | 0 | 0 | 0 |
| Infiltration | - | 3470 | 4360 | - | 3102 | 0 |
| Miscellaneous | - | 0 | 0 | - | 0 | 0 |
| Safety Factor | 10% / 10% | 817 | 599 | 10% | 449 | 0 |
| **>> Total Zone Loads** | **-** | **8992** | **6586** | **-** | **4938** | **0** |
| Zone Conditioning | - | 8753 | 6586 | - | 4953 | 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** | **-** | **8753** | **6586** | **-** | **4953** | **0** |
| Terminal Unit Cooling | - | 8753 | 6186 | - | 0 | 0 |
| Terminal Unit Heating | - | 0 | - | - | 4953 | - |
| **>> Total Conditioning** | **-** | **8753** | **6186** | **-** | **4953** | **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:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **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 23.9 °C** | | | **OCCUPIED T-STAT 21.1 °C** | | |
|  |  | **Sensible** | **Latent** |  | **Sensible** | **Latent** |
| **ZONE LOADS** | **Details** | **(W)** | **(W)** | **Details** | **(W)** | **(W)** |
| Window & Skylight Solar Loads | 0 m² | 0 | - | 0 m² | - | - |
| Wall Transmission | 23 m² | 98 | - | 23 m² | 146 | - |
| Roof Transmission | 19 m² | 413 | - | 19 m² | 358 | - |
| Window Transmission | 0 m² | 0 | - | 0 m² | 0 | - |
| Skylight Transmission | 0 m² | 0 | - | 0 m² | 0 | - |
| Door Loads | 3 m² | 112 | - | 3 m² | 118 | - |
| Floor Transmission | 19 m² | 0 | - | 19 m² | 68 | - |
| Partitions | 28 m² | 325 | - | 28 m² | 289 | - |
| Ceiling | 0 m² | 0 | - | 0 m² | 0 | - |
| Overhead Lighting | 0 W | 9 | - | 0 | 0 | - |
| Task Lighting | 0 W | 0 | - | 0 | 0 | - |
| Electric Equipment | 2000 W | 2000 | - | 0 | 0 | - |
| People | 5 | 769 | 1356 | 0 | 0 | 0 |
| Infiltration | - | 2707 | 3394 | - | 2391 | 0 |
| Miscellaneous | - | 0 | 0 | - | 0 | 0 |
| Safety Factor | 10% / 10% | 643 | 475 | 10% | 337 | 0 |
| **>> Total Zone Loads** | **-** | **7077** | **5224** | **-** | **3706** | **0** |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Zone 2** | **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 15.0 °C** | | |
|  |  | **Sensible** | **Latent** |  | **Sensible** | **Latent** |
| **ZONE LOADS** | **Details** | **(W)** | **(W)** | **Details** | **(W)** | **(W)** |
| Window & Skylight Solar Loads | 0 m² | 0 | - | 0 m² | - | - |
| Wall Transmission | 41 m² | 103 | - | 41 m² | 154 | - |
| Roof Transmission | 18 m² | 243 | - | 18 m² | 193 | - |
| Window Transmission | 0 m² | 0 | - | 0 m² | 0 | - |
| Skylight Transmission | 0 m² | 0 | - | 0 m² | 0 | - |
| Door Loads | 0 m² | 0 | - | 0 m² | 0 | - |
| Floor Transmission | 18 m² | 0 | - | 18 m² | 46 | - |
| Partitions | 5 m² | 22 | - | 5 m² | 15 | - |
| Ceiling | 0 m² | 0 | - | 0 m² | 0 | - |
| Overhead Lighting | 0 W | 8 | - | 0 | 0 | - |
| Task Lighting | 0 W | 0 | - | 0 | 0 | - |
| Electric Equipment | 500 W | 500 | - | 0 | 0 | - |
| People | 1 | 154 | 271 | 0 | 0 | 0 |
| Infiltration | - | 870 | 863 | - | 712 | 0 |
| Miscellaneous | - | 0 | 0 | - | 0 | 0 |
| Safety Factor | 10% / 10% | 190 | 113 | 10% | 112 | 0 |
| **>> Total Zone Loads** | **-** | **2090** | **1247** | **-** | **1232** | **0** |

## SPACE DESIGN LOAD SUMMARY:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **TABLE 1.1.A. COMPONENT LOADS FOR SPACE '' 01-Instrument Workshop '' 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 23.9 °C** | | | **OCCUPIED T-STAT 21.1 °C** | | |
|  |  | **Sensible** | **Latent** |  | **Sensible** | **Latent** |
| **SPACE LOADS** | **Details** | **(W)** | **(W)** | **Details** | **(W)** | **(W)** |
| Window & Skylight Solar Loads | 0 m² | 0 | - | 0 m² | - | - |
| Wall Transmission | 23 m² | 98 | - | 23 m² | 146 | - |
| Roof Transmission | 19 m² | 413 | - | 19 m² | 358 | - |
| Window Transmission | 0 m² | 0 | - | 0 m² | 0 | - |
| Skylight Transmission | 0 m² | 0 | - | 0 m² | 0 | - |
| Door Loads | 3 m² | 112 | - | 3 m² | 118 | - |
| Floor Transmission | 19 m² | 0 | - | 19 m² | 68 | - |
| Partitions | 28 m² | 325 | - | 28 m² | 289 | - |
| Ceiling | 0 m² | 0 | - | 0 m² | 0 | - |
| Overhead Lighting | 0 W | 9 | - | 0 | 0 | - |
| Task Lighting | 0 W | 0 | - | 0 | 0 | - |
| Electric Equipment | 2000 W | 2000 | - | 0 | 0 | - |
| People | 5 | 769 | 1356 | 0 | 0 | 0 |
| Infiltration | - | 2707 | 3394 | - | 2391 | 0 |
| Miscellaneous | - | 0 | 0 | - | 0 | 0 |
| Safety Factor | 10% / 10% | 643 | 475 | 10% | 337 | 0 |
| **>> Total Zone Loads** | **-** | **7077** | **5224** | **-** | **3706** | **0** |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **TABLE 1.1.B. ENVELOPE LOADS FOR SPACE '' 01-Instrument Workshop '' 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 | 16 | 0.419 | - | 68 | - | 102 |
| **SSE EXPOSURE** |  |  |  |  |  |  |
| WALL | 7 | 0.419 | - | 30 | - | 44 |
| DOOR | 3 | 3.000 | - | 112 | - | 118 |
| **H EXPOSURE** |  |  |  |  |  |  |
| ROOF | 19 | 1.220 | - | 413 | - | 358 |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **TABLE 2.1.A. COMPONENT LOADS FOR SPACE '' 02-Instrument Storage '' IN ZONE '' Zone 2 ''** | | | | | | |
|  | **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 15.0 °C** | | |
|  |  | **Sensible** | **Latent** |  | **Sensible** | **Latent** |
| **SPACE LOADS** | **Details** | **(W)** | **(W)** | **Details** | **(W)** | **(W)** |
| Window & Skylight Solar Loads | 0 m² | 0 | - | 0 m² | - | - |
| Wall Transmission | 41 m² | 103 | - | 41 m² | 154 | - |
| Roof Transmission | 18 m² | 243 | - | 18 m² | 193 | - |
| Window Transmission | 0 m² | 0 | - | 0 m² | 0 | - |
| Skylight Transmission | 0 m² | 0 | - | 0 m² | 0 | - |
| Door Loads | 0 m² | 0 | - | 0 m² | 0 | - |
| Floor Transmission | 18 m² | 0 | - | 18 m² | 46 | - |
| Partitions | 5 m² | 22 | - | 5 m² | 15 | - |
| Ceiling | 0 m² | 0 | - | 0 m² | 0 | - |
| Overhead Lighting | 0 W | 8 | - | 0 | 0 | - |
| Task Lighting | 0 W | 0 | - | 0 | 0 | - |
| Electric Equipment | 500 W | 500 | - | 0 | 0 | - |
| People | 1 | 154 | 271 | 0 | 0 | 0 |
| Infiltration | - | 870 | 863 | - | 712 | 0 |
| Miscellaneous | - | 0 | 0 | - | 0 | 0 |
| Safety Factor | 10% / 10% | 190 | 113 | 10% | 112 | 0 |
| **>> Total Zone Loads** | **-** | **2090** | **1247** | **-** | **1232** | **0** |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **TABLE 2.1.B. ENVELOPE LOADS FOR SPACE '' 02-Instrument Storage '' IN ZONE '' Zone 2 ''** | | | | | | |
|  |  |  |  | **COOLING** | **COOLING** | **HEATING** |
|  | **Area** | **U-Value** | **Shade** | **TRANS** | **SOLAR** | **TRANS** |
|  | **(m²)** | **(W/(m²-°K))** | **Coeff.** | **(W)** | **(W)** | **(W)** |
| **NNW EXPOSURE** |  |  |  |  |  |  |
| WALL | 13 | 0.419 | - | 28 | - | 47 |
| **SSE EXPOSURE** |  |  |  |  |  |  |
| WALL | 13 | 0.419 | - | 28 | - | 47 |
| **ENE EXPOSURE** |  |  |  |  |  |  |
| WALL | 16 | 0.419 | - | 47 | - | 59 |
| **H EXPOSURE** |  |  |  |  |  |  |
| ROOF | 18 | 1.220 | - | 243 | - | 193 |

1. **Equipment Selection**

## Air Conditioning Unit (split unit)

|  |  |  |
| --- | --- | --- |
| Item | **Service Area** | |
| Instrument Workshop | Instrument Storage |
| Calculated Sensible Cooling Load(w) | 7077 | 2090 |
| Calculated Latent Cooling Load(w) | 5224 | 1247 |
| Calculated Total Cooling Load(w) | 12301 | 3337 |
| Calculated Total Cooling Load (btu/hr) | 42010 | 11396 |
| Calculated Sensible Heating Load(w) | 3706 | 1232 |
| Calculated Sensible Heating Load (btu/hr) | 12657 | 4208 |
| Eq. ID (1202-SUI/SUO-GCSWH-XX ) | 01,02 | 03 |
| Equipment QTY. | 2 | 1 |
| Equipment Type | W.M.\* | W.M.\* |
| Calculated Cooling Load+ 10% Over Cap. (btu/hr) (each) | 23106 | 12536 |
| Calculated Heating Load+ 10% Over Cap. (btu/hr) | 13923 | 4629 |
| 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) | 230/1/50 | 230/1/50 |
| Max. Power Consumption (w) Eq. (Cooling/Heating) | B.V.\*\* | B.V.\*\* |
| REMARKE \*\*\* | Cooling & Heating (Heat Pump) | Cooling & Heating (Heat Pump) |

\*Wall Mounted

\*\*By Vendor

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

## Exhaust fan selection

**1202-EF-GCSWH-01 (Storage, Instrument Workshop, Toilet and Instrument Storage)**

**Storage**

Air Flow = 22.28 (area, m²) × 3.35 (height, m) × 4 ACH ÷ 60 min = 4.98 m³/min = 83 L/S = 176 cfm

**Instrument Workshop**

Air Flow = 19.39 (area, m²) × 3.35 (height, m) × 6 ACH ÷ 60 min = 6.50 m³/min = 108.33 L/S = 229.54 cfm

**Toilet**

Air Flow = 2.44 (area, m²) × 3.35 (height, m) × 10 ACH ÷ 60 min = 1.36 m³/min = 22.67 L/S = 48 cfm

**Instrument Storage**

Air Flow = 17.58 (area, m²) × 3.35 (height, m) × 4 ACH ÷ 60 min = 3.93 m³/min = 65.5 L/S = 139 cfm

|  |  |  |
| --- | --- | --- |
| Item | | **1202-EF-GCSWH-01** |
| Service Area | | Storage, Instrument Workshop, Toilet and Instrument Storage |
| Equipment QTY. | | 1 |
| Air Flow(L/S) | | 279.4 |
| Air Flow(CFM) | | 592 |
| Component Pressure Drop  (External)  (In.WG.) | Sand Tarp Louver | 0.03 |
| Blast Proof Valve-01 | 0.08 |
| Fire Damper-01 | 0.01 |
| Intake Air Duct | 0.032 |
| Intake Air Duct Volume Damper | 0.04 |
| Intake Air Diffuser | 0.062 |
| Exhaust Air Diffuser/Register | 0.065 |
| Exhaust Air Duct Volume Damper | 0.04 |
| Exhaust Air Duct | 0.029 |
| Blast Proof Valve-02 | 0.08 |
| Fire Damper-02 | 0.01 |
| Total Pressure Drop \*  + 10% Over S.F. | (In.WG.) | 0.478 |
| (Pa) | 118.95 |
| Exhaust Fan type | | Utility Ex. Fan |
| Power Supply (V/PH/Hz) | | 230/1/50 |
| Power Consumption (w) Each Eq. | | By Vendor |
| REMARKE | | Equipped With Bird Mesh and Gravity Damper – Standard Type |

\*Total Pressure Drop Should Be Specified By Vendor.