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| --- |
| **طرح نگهداشت و افزایش تولید 27 مخزن** |
| **HVAC CALCULATION NOTE FOR SECURITY BUILDING – BK05** **نگهداشت و افزایش تولید میدان نفتی بینک** |
|  |  |  |  |  |  |  |
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|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
| D00 | OCT. 2023 | 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-708441** |
| **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** |  |  |  |  | **59** |  |  |  |  |  |
| **3** | **X** |  |  |  |  | **60** |  |  |  |  |  |
| **4** | **X** |  |  |  |  | **61** |  |  |  |  |  |
| **5** | **X** |  |  |  |  | **62** |  |  |  |  |  |
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| **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** |  |  |  |  |  | **78** |  |  |  |  |  |
| **22** |  |  |  |  |  | **79** |  |  |  |  |  |
| **23** |  |  |  |  |  | **80** |  |  |  |  |  |
| **24** | X |  |  |  |  | **81** |  |  |  |  |  |
| **25** | X |  |  |  |  | **82** |  |  |  |  |  |
| **26** | X |  |  |  |  | **83** |  |  |  |  |  |
| **27** | X |  |  |  |  | **84** |  |  |  |  |  |
| **28** | X |  |  |  |  | **85** |  |  |  |  |  |
| **29** | X |  |  |  |  | **86** |  |  |  |  |  |
| **30** |  X |  |  |  |  | **87** |  |  |  |  |  |
| **31** | X |  |  |  |  | **88** |  |  |  |  |  |
| **32** |  X |  |  |  |  | **89** |  |  |  |  |  |
| **33** |  |  |  |  |  | **90** |  |  |  |  |  |
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| **40** |  |  |  |  |  | **97** |  |  |  |  |  |
| **41** |  |  |  |  |  | **98** |  |  |  |  |  |
| **42** |  |  |  |  |  | **99** |  |  |  |  |  |
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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

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   **26.2** m

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

    Summer Coincident Wet-Bulb   **32.0** °C

    Summer Daily Range   **16.7** °K

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

    Winter Design Wet-Bulb   **6.0** °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.

**Design Temperature Profile**



## CONSTRUCTIONS U-VALUE:

**Wall**

**Wall Details**

    Outside Surface Color   **Medium**

    Absorptivity   **0.675**

    Overall U-Value   **0.199** 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 | 12.500 | 1200.0 | 1.09 | 0.02193 | 15.0 |
| cement plaster | 12.500 | 1600.0 | 0.80 | 0.01563 | 20.0 |
| wall brick | 200.000 | 2000.0 | 0.20 | 1.00000 | 400.0 |
| high density PU | 50.000 | 50.0 | 0.04 | 1.42857 | 2.5 |
| cement plaster | 30.000 | 1600.0 | 0.80 | 0.03750 | 48.0 |
| face brick | 70.000 | 2000.0 | 0.03 | 2.33330 | 140.0 |
| Outside surface resistance | 0.000 | 0.0 | 0.00 | 0.05864 | 0.0 |
| **Totals** | **375.000** | **-** |  | **5.01621** | **625.5** |

**Roof**

**Roof Details**

    Outside Surface Color   **Medium**

    Absorptivity   **0.675**

    Overall U-Value   **0.404** 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 |
| gypsum Board | 30.000 | 800.9 | 1.09 | 0.18638 | 24.0 |
| ceiling air space | 670.000 | 0.0 | 0.00 | 0.17611 | 0.0 |
| HW concrete | 300.000 | 2242.6 | 0.84 | 0.17368 | 672.8 |
| high density PU | 50.000 | 45.0 | 0.90 | 1.25000 | 2.3 |
| LW concrete | 90.000 | 608.7 | 0.84 | 0.23637 | 54.8 |
| Asphalt sheathing | 10.000 | 1121.3 | 1.47 | 0.19924 | 11.2 |
| sand cement mortar | 25.000 | 600.0 | 0.84 | 0.05500 | 15.0 |
| terrazzo tile | 25.000 | 4325.0 | 1.26 | 0.01734 | 108.1 |
| Outside surface resistance | 0.000 | 0.0 | 0.00 | 0.05864 | 0.0 |
| **Totals** | **1200.000** | **-** |  | **2.47340** | **888.2** |

**U.W.-1**

**Window Details:**

    Detailed Input   **Yes**

    Height   **2.00** m

    Width   **1.20** m

    Frame Type   **Vinyl**

    Internal Shade Type   **None**

    Overall U-Value   **2.789** W/(m²-°K)

    Overall Shade Coefficient   **0.700**

**Glass Details:**

    Gap Type   **6mm Argon**

| **Glazing** | **Glass Type** | **Transmissivity** | **Reflectivity** | **Absorptivity** |
| --- | --- | --- | --- | --- |
| Outer Glazing | 6mm clear | 0.792 | 0.079 | 0.129 |
| Glazing #2 | 6mm clear | 0.792 | 0.079 | 0.129 |
| Glazing #3 | not used | 1.000 | 0.000 | 0.000 |

**U.W.-2**

**Window Details:**

    Detailed Input   **Yes**

    Height   **1.20** m

    Width   **1.20** m

    Frame Type   **Vinyl**

    Internal Shade Type   **None**

    Overall U-Value   **2.808** W/(m²-°K)

    Overall Shade Coefficient   **0.700**

**Glass Details:**

    Gap Type   **6mm Argon**

| **Glazing** | **Glass Type** | **Transmissivity** | **Reflectivity** | **Absorptivity** |
| --- | --- | --- | --- | --- |
| Outer Glazing | 6mm clear | 0.792 | 0.079 | 0.129 |
| Glazing #2 | 6mm clear | 0.792 | 0.079 | 0.129 |
| Glazing #3 | not used | 1.000 | 0.000 | 0.000 |

**M.D.-1**

**Door Details:**

    Gross Area   **2.2** m²

    Door U-Value   **5.800** 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:

**00-Security Guard Room**

**1. General Details:**

    Floor Area   **13.6** m²

    Avg. Ceiling Height   **3.0** 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   **11.90** W/m²

    Ballast Multiplier   **1.25**

    Schedule   **Lighting**

**2.2. Task Lighting:**

    Wattage   **0.00** W/m²

    Schedule   **None**

**2.3. Electrical Equipment:**

    Wattage   **250.0** Watts

    Schedule   **Electrical Eq.**

**2.4. People:**

    Occupancy   **3.0** People

    Activity Level   **Sedentary Work**

    Sensible   **82.1** W/person

    Latent   **79.1** 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.** |
| --- | --- | --- | --- | --- |
| NE | 9.3 | 1 | 0 | 1 |
| NW | 13.2 | 2 | 0 | 0 |
| SW | 9.3 | 1 | 0 | 1 |

**3.1. Construction Types for Exposure NE**

    Wall Type   **Wall**

    1st Window Type   **U.W.-1**

    Door Type   **M.D.-1**

**3.2. Construction Types for Exposure NW**

    Wall Type   **Wall**

    1st Window Type   **U.W.-1**

**3.3. Construction Types for Exposure SW**

    Wall Type   **Wall**

    1st Window Type   **U.W.-1**

    Door Type   **M.D.-1**

**4. Roofs, Skylights:**

| **Exp.** | **Roof Gross Area (m²)** | **Roof Slope (deg.)** | **Skylight Qty.** |
| --- | --- | --- | --- |
| H | 13.6 | 0 | 0 |

**4.1. Construction Types for Exposure H**

    Roof Type   **Roof**

**5. Infiltration:**

    Design Cooling   **3.00** ACH

    Design Heating   **3.00** ACH

    Energy Analysis   **3.00** ACH

    Infiltration occurs at all hours.

**6. Floors:**

    Type   **Slab Floor On Grade**

    Floor Area   **13.6** m²

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

    Exposed Perimeter   **10.6** m

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

**7. Partitions:**

**7.1. 1st Partition Details:**

    Partition Type   **Wall Partition**

    Area   **4.5** m²

    U-Value  **0.761** W/(m²-°K)

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

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

    Uncondit. Space Min Temp   **12.5** °C

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

**7.2. 2nd Partition Details:**

    **(No partition data).**

**01-Resting Area & Pantry**

**1. General Details:**

    Floor Area   **20.0** m²

    Avg. Ceiling Height   **3.0** 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   **11.90** W/m²

    Ballast Multiplier   **1.25**

    Schedule   **Lighting**

**2.2. Task Lighting:**

    Wattage   **0.00** W/m²

    Schedule   **None**

**2.3. Electrical Equipment:**

    Wattage   **600.0** Watts

    Schedule   **Electrical Eq.**

**2.4. People:**

    Occupancy   **3.0** People

    Activity Level   **Sedentary Work**

    Sensible   **82.1** W/person

    Latent   **79.1** W/person

    Schedule   **People**

**2.5. Miscellaneous Loads:**

    Sensible   **1000** W

    Schedule   **Electrical Eq.**

    Latent   **700** W

    Schedule   **Electrical Eq**

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

| **Exp.** | **Wall Gross Area (m²)** | **Window 1 Qty.** | **Window 2 Qty.** | **Door 1 Qty.** |
| --- | --- | --- | --- | --- |
| NE | 10.8 | 1 | 0 | 0 |
| SE | 13.2 | 1 | 0 | 0 |
| SW | 15.3 | 0 | 0 | 0 |

**3.1. Construction Types for Exposure NE**

    Wall Type   **Wall**

    1st Window Type   **U.W.-2**

**3.2. Construction Types for Exposure SE**

    Wall Type   **Wall**

    1st Window Type   **U.W.-2**

**3.3. Construction Types for Exposure SW**

    Wall Type   **Wall**

**4. Roofs, Skylights:**

| **Exp.** | **Roof Gross Area (m²)** | **Roof Slope (deg.)** | **Skylight Qty.** |
| --- | --- | --- | --- |
| H | 20.0 | 0 | 0 |

**4.1. Construction Types for Exposure H**

    Roof Type   **Roof**

**5. Infiltration:**

    Design Cooling   **2.00** ACH

    Design Heating   **2.00** ACH

    Energy Analysis   **2.00** ACH

    Infiltration occurs at all hours.

**6. Floors:**

    Type   **Slab Floor On Grade**

    Floor Area   **20.0** m²

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

    Exposed Perimeter   **13.1** m

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

**7. Partitions:**

**7.1. 1st Partition Details:**

    Partition Type   **Wall Partition**

    Area   **9.0** m²

    U-Value   **0.761** W/(m²-°K)

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

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

    Uncondit. Space Min Temp   **12.5** °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   **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** |   |
| 00-Security Guard Room | x1 |
| 01-Resting Area & Pantry | 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** | 24.0 | 27.0 | 22.0 | 18.0 | 0.83 |

    Thermostat Schedule   **Fan**

    Unoccupied Cooling is   **Available**

**Common Terminal Unit Data:**

    **Cooling Coil:**

    Design Supply Temperature   **14.4** °C

    Coil Bypass Factor   **0.100**

    Cooling Source   **Air-Cooled DX**

    Schedule   **JFMAMJJASOND**

    **Heating Coil:**

    Design Supply Temperature   **35.0** °C

    Heating Source   **Air Source Heat Pump**

    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   **14.4** °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** %

## AIR SYSTEM SIZING SUMMARY

**Air System Information**

   Air System Name  **System**

    Equipment Class   **TERM**

    Air System Type   **SPLT-FC**

Number of zones   **2**

Floor Area   **33.6** 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 | 7.2 | 626 | 626 | Jul 1600 | 3.2 | 33.6 | 18.62 |

**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 | 11.3 | 7.0 | 24.7 / 20.1 | 15.4 / 15.0 | - | 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 | 3.2 | 21.9 / 26.2 | - | 626 | 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*** |   |   |   |   |   |   |   |
|  00-Security Guard Room  | 1 | 3.7 | Jul 1600 | 320 | 1.9 | 13.6 | 23.54 |
|  01-Resting Area & Pantry | 1 | 3.5 | Jul 1500 | 305 | 1.3 | 20.0 | 15.27 |

## 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** |  |  |  |  |  |  |  |  |  |
| 00-Security Guard Room | 1 | 13.6 | 3.0 | 320.1 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| 01-Resting Area & Pantry | 1 | 20.0 | 3.0 | 305.5 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 |
| **Totals (incl. Space Multipliers)** |  |  |  | **625.6** |  |  |  |  | **0.0** |

##  air system design load summary:

|  |  |  |
| --- | --- | --- |
|  | **DESIGN COOLING** | **DESIGN HEATING** |
|  | **COOLING DATA AT Jul 1600** | **HEATING DATA AT DES HTG** |
|  | **COOLING OA DB / WB 40.5 °C / 31.9 °C** | **HEATING OA DB / WB 6.0 °C / 6.0 °C** |
|  |  | **Sensible** | **Latent** |  | **Sensible** | **Latent** |
| **ZONE LOADS** | **Details** | **(W)** | **(W)** | **Details** | **(W)** | **(W)** |
| Window & Skylight Solar Loads | 12 m² | 1569 | - | 12 m² | - | - |
| Wall Transmission | 54 m² | 135 | - | 54 m² | 173 | - |
| Roof Transmission | 34 m² | 179 | - | 34 m² | 217 | - |
| Window Transmission | 12 m² | 483 | - | 12 m² | 558 | - |
| Skylight Transmission | 0 m² | 0 | - | 0 m² | 0 | - |
| Door Loads | 4 m² | 354 | - | 4 m² | 408 | - |
| Floor Transmission | 34 m² | 0 | - | 34 m² | 156 | - |
| Partitions | 14 m² | 92 | - | 14 m² | 98 | - |
| Ceiling | 0 m² | 0 | - | 0 m² | 0 | - |
| Overhead Lighting | 0 W | 11 | - | 0 | 0 | - |
| Task Lighting | 0 W | 0 | - | 0 | 0 | - |
| Electric Equipment | 850 W | 850 | - | 0 | 0 | - |
| People | 6 | 493 | 475 | 0 | 0 | 0 |
| Infiltration | - | 1337 | 2755 | - | 1297 | 0 |
| Miscellaneous | - | 1000 | 700 | - | 0 | 0 |
| Safety Factor | 10% / 10% | 650 | 393 | 10% | 291 | 0 |
| **>> Total Zone Loads** | **-** | **7154** | **4323** | **-** | **3197** | **0** |
| Zone Conditioning | - | 6983 | 4323 | - | 3223 | 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** | **-** | **6983** | **4323** | **-** | **3223** | **0** |
| Terminal Unit Cooling | - | 6983 | 4327 | - | 0 | 0 |
| Terminal Unit Heating | - | 0 | - | - | 3223 | - |
| **>> Total Conditioning** | **-** | **6983** | **4327** | **-** | **3223** | **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 1600** | **HEATING DATA AT DES HTG** |
|  | **COOLING OA DB / WB 40.5 °C / 31.9 °C** | **HEATING OA DB / WB 6.0 °C / 6.0 °C** |
|  | **OCCUPIED T-STAT 24.0 °C** | **OCCUPIED T-STAT 22.0 °C** |
|  |  | **Sensible** | **Latent** |  | **Sensible** | **Latent** |
| **ZONE LOADS** | **Details** | **(W)** | **(W)** | **Details** | **(W)** | **(W)** |
| Window & Skylight Solar Loads | 12 m² | 1569 | - | 12 m² | - | - |
| Wall Transmission | 54 m² | 135 | - | 54 m² | 173 | - |
| Roof Transmission | 34 m² | 179 | - | 34 m² | 217 | - |
| Window Transmission | 12 m² | 483 | - | 12 m² | 558 | - |
| Skylight Transmission | 0 m² | 0 | - | 0 m² | 0 | - |
| Door Loads | 4 m² | 354 | - | 4 m² | 408 | - |
| Floor Transmission | 34 m² | 0 | - | 34 m² | 156 | - |
| Partitions | 14 m² | 92 | - | 14 m² | 98 | - |
| Ceiling | 0 m² | 0 | - | 0 m² | 0 | - |
| Overhead Lighting | 0 W | 11 | - | 0 | 0 | - |
| Task Lighting | 0 W | 0 | - | 0 | 0 | - |
| Electric Equipment | 850 W | 850 | - | 0 | 0 | - |
| People | 6 | 493 | 475 | 0 | 0 | 0 |
| Infiltration | - | 1337 | 2755 | - | 1297 | 0 |
| Miscellaneous | - | 1000 | 700 | - | 0 | 0 |
| Safety Factor | 10% / 10% | 650 | 393 | 10% | 291 | 0 |
| **>> Total Zone Loads** | **-** | **7154** | **4323** | **-** | **3197** | **0** |

## SPACE DESIGN LOAD SUMMARY:

|  |
| --- |
| **TABLE 1.1.A. COMPONENT LOADS FOR SPACE '' 00-Security Guard Room '' IN ZONE '' Zone 1 ''** |
|  | **DESIGN COOLING** | **DESIGN HEATING** |
|  | **COOLING DATA AT Jul 1600** | **HEATING DATA AT DES HTG** |
|  | **COOLING OA DB / WB 40.5 °C / 31.9 °C** | **HEATING OA DB / WB 6.0 °C / 6.0 °C** |
|  | **OCCUPIED T-STAT 24.0 °C** | **OCCUPIED T-STAT 22.0 °C** |
|  |  | **Sensible** | **Latent** |  | **Sensible** | **Latent** |
| **SPACE LOADS** | **Details** | **(W)** | **(W)** | **Details** | **(W)** | **(W)** |
| Window & Skylight Solar Loads | 10 m² | 1298 | - | 10 m² | - | - |
| Wall Transmission | 18 m² | 44 | - | 18 m² | 57 | - |
| Roof Transmission | 14 m² | 73 | - | 14 m² | 88 | - |
| Window Transmission | 10 m² | 371 | - | 10 m² | 428 | - |
| Skylight Transmission | 0 m² | 0 | - | 0 m² | 0 | - |
| Door Loads | 4 m² | 354 | - | 4 m² | 408 | - |
| Floor Transmission | 14 m² | 0 | - | 14 m² | 65 | - |
| Partitions | 5 m² | 31 | - | 5 m² | 33 | - |
| Ceiling | 0 m² | 0 | - | 0 m² | 0 | - |
| Overhead Lighting | 0 W | 5 | - | 0 | 0 | - |
| Task Lighting | 0 W | 0 | - | 0 | 0 | - |
| Electric Equipment | 250 W | 250 | - | 0 | 0 | - |
| People | 3 | 246 | 237 | 0 | 0 | 0 |
| Infiltration | - | 675 | 1391 | - | 655 | 0 |
| Miscellaneous | - | 0 | 0 | - | 0 | 0 |
| Safety Factor | 10% / 10% | 335 | 163 | 10% | 173 | 0 |
| **>> Total Zone Loads** | **-** | **3681** | **1792** | **-** | **1908** | **0** |

|  |
| --- |
| **TABLE 1.1.B. ENVELOPE LOADS FOR SPACE '' 00-Security Guard Room '' IN ZONE '' Zone 1 ''** |
|  |  |  |  | **COOLING** | **COOLING** | **HEATING** |
|  | **Area** | **U-Value** | **Shade** | **TRANS** | **SOLAR** | **TRANS** |
|  | **(m²)** | **(W/(m²-°K))** | **Coeff.** | **(W)** | **(W)** | **(W)** |
| **NE EXPOSURE** |   |   |   |   |   |   |
|  WALL | 5 | 0.199 | - | 12 | - | 15 |
|  WINDOW 1 | 2 | 2.789 | 0.700 | 93 | 224 | 107 |
|  DOOR | 2 | 5.800 | - | 177 | - | 204 |
| **NW EXPOSURE** |   |   |   |   |   |   |
|  WALL | 8 | 0.199 | - | 21 | - | 27 |
|  WINDOW 1 | 5 | 2.789 | 0.700 | 186 | 728 | 214 |
| **SW EXPOSURE** |   |   |   |   |   |   |
|  WALL | 5 | 0.199 | - | 11 | - | 15 |
|  WINDOW 1 | 2 | 2.789 | 0.700 | 93 | 347 | 107 |
|  DOOR | 2 | 5.800 | - | 177 | - | 204 |
| **H EXPOSURE** |   |   |   |   |   |   |
|  ROOF | 14 | 0.404 | - | 73 | - | 88 |

|  |
| --- |
| **TABLE 1.2.A. COMPONENT LOADS FOR SPACE '' 01-Resting Area & Pantry '' 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 / 32.0 °C** | **HEATING OA DB / WB 6.0 °C / 6.0 °C** |
|  | **OCCUPIED T-STAT 24.0 °C** | **OCCUPIED T-STAT 22.0 °C** |
|  |  | **Sensible** | **Latent** |  | **Sensible** | **Latent** |
| **SPACE LOADS** | **Details** | **(W)** | **(W)** | **Details** | **(W)** | **(W)** |
| Window & Skylight Solar Loads | 3 m² | 284 | - | 3 m² | - | - |
| Wall Transmission | 36 m² | 91 | - | 36 m² | 116 | - |
| Roof Transmission | 20 m² | 107 | - | 20 m² | 129 | - |
| Window Transmission | 3 m² | 113 | - | 3 m² | 129 | - |
| Skylight Transmission | 0 m² | 0 | - | 0 m² | 0 | - |
| Door Loads | 0 m² | 0 | - | 0 m² | 0 | - |
| Floor Transmission | 20 m² | 0 | - | 20 m² | 91 | - |
| Partitions | 9 m² | 62 | - | 9 m² | 65 | - |
| Ceiling | 0 m² | 0 | - | 0 m² | 0 | - |
| Overhead Lighting | 0 W | 7 | - | 0 | 0 | - |
| Task Lighting | 0 W | 0 | - | 0 | 0 | - |
| Electric Equipment | 600 W | 600 | - | 0 | 0 | - |
| People | 3 | 246 | 237 | 0 | 0 | 0 |
| Infiltration | - | 682 | 1336 | - | 642 | 0 |
| Miscellaneous | - | 1000 | 700 | - | 0 | 0 |
| Safety Factor | 10% / 10% | 319 | 227 | 10% | 117 | 0 |
| **>> Total Zone Loads** | **-** | **3513** | **2500** | **-** | **1290** | **0** |

|  |
| --- |
| **TABLE 1.2.B. ENVELOPE LOADS FOR SPACE '' 01-Resting Area & Pantry '' IN ZONE '' Zone 1 ''** |
|  |  |  |  | **COOLING** | **COOLING** | **HEATING** |
|  | **Area** | **U-Value** | **Shade** | **TRANS** | **SOLAR** | **TRANS** |
|  | **(m²)** | **(W/(m²-°K))** | **Coeff.** | **(W)** | **(W)** | **(W)** |
| **NE EXPOSURE** |   |   |   |   |   |   |
|  WALL | 9 | 0.199 | - | 24 | - | 30 |
|  WINDOW 1 | 1 | 2.808 | 0.700 | 57 | 141 | 65 |
| **SE EXPOSURE** |   |   |   |   |   |   |
|  WALL | 12 | 0.199 | - | 30 | - | 38 |
|  WINDOW 1 | 1 | 2.808 | 0.700 | 57 | 143 | 65 |
| **SW EXPOSURE** |   |   |   |   |   |   |
|  WALL | 15 | 0.199 | - | 38 | - | 49 |
| **H EXPOSURE** |   |   |   |   |   |   |
|  ROOF | 20 | 0.404 | - | 107 | - | 129 |

1. **Equipment Selection**

## Air Conditioning Unit

|  |  |
| --- | --- |
| Item | Service Area |
| Security Guard Room | Resting Area & Pantry |
| Calculated Sensible Cooling Load(w) | 3681 | 3513 |
| Calculated Latent Cooling Load(w) | 1792 | 2500 |
| Calculated Total Cooling Load(w) | 5473 | 6013 |
| Calculated Total Cooling Load (btu/hr) | 18691 | 20535 |
| Calculated Sensible Heating Load(w) | 1908 | 1290 |
| Calculated Sensible Heating Load (btu/hr) | 6516 | 4406 |
| Split Unit ID Indoor Unit ID | 1101-SUI-BK05-01 | 1101-SUI-BK05-02 |
| Split Unit Outdoor Unit ID | 1101-SUO-BK05-01 | 1101-SUO-BK05-02 |
| Equipment QTY. | 1 | 1 |
| Equipment Type | Wall Mounted Split Unit | Wall Mounted Split Unit |
| Calculated Cooling Load+ 10% Over Cap. (btu/hr) Each | 20560 | 22589 |
| Calculated Heating Load+ 10% Over Cap. (btu/hr) Each | 7168 | 4847 |
| Selected Eq. Nominal Cooling Cap. (btu/hr) Each | By Vendor | By Vendor |
| Selected Eq. Actual Cooling Cap. (btu/hr) Each | By Vendor | By Vendor |
| Selected Eq. Actual Heating Cap. (btu/hr) Each | By Vendor | By Vendor |
| Power Supply (V/PH/Hz) | 230/1/50 | 230/1/50 |
| Max. Power Consumption (w) Each Eq. (Cooling/Heating) | By Vendor | By Vendor |
| REMARKE  | Outdoor and Indoor Unit (With Thermostat & All Standard Accessory)-T3 | Outdoor and Indoor Unit (With Thermostat & All Standard Accessory)-T3 |

## Exhaust fan selection

**WC**

Air Flow = 1.9 (area, m²) × 2.6 (height, m) × 15 ACH ÷ 60 min

=1.235 m³/min

=20.58 L/S

=43.61 cfm

**Pantry**

Air Flow = 3.78 (area, m²) × 3.00 (height, m) × 6 ACH ÷ 60 min

=1.134 m³/min

=18.9 L/S

=40.05 cfm

|  |  |
| --- | --- |
| Item | Service Area |
| WC | Pantry |
| Equipment QTY. | 1 | 1 |
| Air Flow(L/S) | 20.58 | 18.9 |
| Air Flow(CFM) | 43.61 | 40.05 |
| Component Pressure Drop | Diffuser (In.WG.) | 0.00 | 0.00 |
| Sand Trap Louver (In.WG.) | 0.00 | 0.00 |
| Door Louver (In.WG.) | 0.00 | 0.00 |
| Ducting (In.WG.) | 0.0037 | 0.0061 |
| Total External Pressure Drop \* | (In.WG.) | 0.0037 | 0.0061 |
| (Pa) | 0.9207 | 1.5179 |
| Exhaust Fan ID | 1101-EF-BK05-01 | 1101-EF-BK05-02 |
| Exhaust Fan type | Ceiling Mounted  | Ceiling Mounted  |
| Power Supply (V/PH/Hz) | 230/1/50 | 230/1/50 |
| Power Consumption (w) Each Eq. | By Vendor | By Vendor |
| REMARKE  | - | - |

\*Total Pressure Drop Include Louver and etc. Should Be Specified By Vendor.