

 NISOC	نگهداشت و افزایش تولید میدان نفتی بینک سطح الارض و ابنیه تحت الارض عمومی و مشترک								
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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

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

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1.0 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.

2.0 SCOPE

This document covers minimum necessary requirements for basis of design and main equipment's to be used for the Heating, Ventilating, Air-Conditioning and pressurizing and plumbing system for buildings for project

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3.0 NORMATIVE REFERENCES

3.1 LOCAL CODES AND STANDARDS

- IPS Iranian petroleum standards
- INBC Iranian National Building Code

3.2 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
- ASME The American Society of Mechanical Engineers

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

3.3 ENVIRONMENTAL DATA

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

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4.0 SITE CONDITIONS

The following information is related to Bandar Deylam and Genaveh.

4.1 SITE LOCATION

- Latitude 30° 32' N
- Longitude 50° 17' E
- Elevation 10 m

4.2 EXTERNAL DESIGN CONDITIONS (FOR HVAC DESIGN CALCULATION)

- Summer dry bulb temperature : 41° C
- Summer wet bulb humidity : 30.5 ° C
- Summer daily range temperature : 15.0° C
- Winter dry bulb temperature : 6.0° C
- Winter relative humidity : 100%

Note1: Outdoor refrigeration equipment shall be designed to maintain design conditions with an 50 °C temperature.

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5.0 INTERNAL DESIGN CONDITIONS

BASED ON "HVAC DESIGN CRITERIA" DOC. NUMBER: BK-GNRAL-PEDCO-000-HV-DC-0001

Room	Min. Fresh Air (Note 3)	Min. Exhaust	Room Temp Winter/Summer (Deg C)	Relative Humidity Winter/ Summer (Min/Max) %	Over Pressure Value (Pa)	Equipment Heat Gain (Watts)
Extension of Existing Elec. Building						
Co2 Room	-	6 ACH	NC	NC	Negative	-
Capacitor Room	1 ACH	-	10/30	30/60	Positive	See(13.3Design Criteria)
HV Room	1 ACH	-	10/30	30/60	Positive	See(13.3Design Criteria)
LV Room	1 ACH	-	10/30	30/60	Positive	See(13.3Design Criteria)
Battery Room	-	10 ACH	NC	NC	Negative	-

6.0 HVAC CALCULATION

6.1 DESIGN WEATHER PARAMETERS:

DESIGN PARAMETERS:

City Namebinak

Location.....IRAN

Latitude.....30.3

Deg.Longitude.....-50.2

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.....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).....-1.0 hours

Consider Daylight Savings Time.....No

Simulation Weather Data.....none N/A

Current Data is.....User Modified

Design Cooling Months.....January to December

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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	76.4	76.4	104.1	335.1	577.4	722.3	796.4	786.7	764.0
February	88.0	88.0	230.9	458.1	662.9	773.4	774.9	717.7	674.9
March	100.7	108.6	368.7	585.3	707.6	758.3	705.1	595.4	528.1
April	113.1	256.3	472.2	642.7	716.0	679.9	580.0	422.9	334.5
May	124.2	353.9	534.8	663.8	694.2	620.4	475.0	290.9	209.6
June	157.8	384.6	558.6	667.1	676.8	585.8	428.0	240.6	172.3
July	127.6	344.7	537.1	656.3	678.1	598.4	463.4	281.6	203.3
August	118.2	248.3	466.5	623.6	687.8	654.3	558.9	407.2	322.5
September	104.5	113.3	336.6	555.0	683.3	716.4	681.4	580.5	517.4
October	90.9	90.9	201.8	462.7	636.7	736.7	756.5	701.7	660.0
November	77.8	77.8	98.3	345.3	551.3	718.6	773.6	774.1	756.1
December	71.4	71.4	71.4	269.7	530.8	696.4	785.4	795.0	786.8
Month	SSW	SW	WSW	W	WNW	NW	NNW	HOR	Mult
January	789.5	796.9	721.1	569.2	354.1	83.2	76.4	579.3	1.00
February	722.0	781.4	766.3	669.5	467.5	224.5	88.0	702.0	1.00
March	596.6	704.4	761.1	720.6	569.4	368.1	116.6	809.9	1.00
April	421.4	576.3	689.2	714.5	631.4	476.0	257.9	863.7	1.00
May	289.5	470.8	624.0	691.1	655.0	542.6	355.7	877.6	1.00
June	238.3	421.9	590.9	670.1	656.4	565.4	389.3	873.7	1.00
July	278.1	456.2	609.2	671.7	644.3	540.2	353.4	863.9	1.00
August	405.5	554.8	664.2	689.2	610.9	463.3	256.0	845.0	1.00
September	580.7	681.6	714.0	684.8	554.4	333.4	114.2	785.9	1.00
October	698.5	750.4	744.7	624.3	458.7	216.5	90.9	693.3	1.00
November	770.3	775.6	718.6	559.7	335.4	103.0	77.8	579.1	1.00
December	796.5	774.3	701.4	517.9	296.9	71.4	71.4	527.6	1.00

CONSTRUCTIONS U-VALUE:

External Wall

Wall Details

Outside Surface Color Dark
Absorptivity 0.900
Overall U-Value 0.642 W/(m²-°K)

Wall Layers Details (Inside to Outside)

Layers	Thickness mm	Density kg/m ³	Specific Ht. kJ / (kg - °K)	R-Value (m ² -°K)/W	Weight kg/m ²
Inside surface resistance	0.000	0.0	0.00	0.12064	0.0
concrete	300.000	2242.6	0.84	0.17334	672.8
insulation	50.000	32.0	0.92	1.13000	1.6
face brick	100.000	2002.3	0.92	0.07504	200.2
Outside surface resistance	0.000	0.0	0.00	0.05864	0.0
Totals	450.000	-	-	1.55766	874.6

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External Roof

Roof Details

Outside Surface Color Dark
Absorptivity 0.900
Overall U-Value 0.522 W/(m²-°K)

Roof Layers Details (Inside to Outside)

Layers	Thickness mm	Density kg/m ³	Specific Ht. kJ / (kg - °K)	R-Value (m ² -°K)/W	Weight kg/m ²
Inside surface resistance	0.000	0.0	0.00	0.12064	0.0
Concrete	400.000	2242.6	0.84	0.23112	897.0
board insulation	50.000	32.0	0.92	1.13000	1.6
Cement mortar	50.800	640.7	0.84	0.29352	32.5
Terrazo	20.000	608.7	0.84	0.08000	12.2
Outside surface resistance	0.000	0.0	0.00	0.05864	0.0
Totals	520.800	-		1.91392	943.4

Doors Input Data

1 x 2.5

Door Details:

Gross Area 2.5 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

1.2*2.5

Door Details:

Gross Area 5.0 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

2*2.5

Door Details:

Gross Area 5.0 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

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6.2 SPACE INPUT DATA

CAPACITOR BANK

1. General Details:

Floor Area 33.0 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
OA Requirement 2 0.00 L/(s-m²)
Space Usage Defaults ASHRAE Standard 62.1-2007

2. Internals:

2.1. Overhead Lighting:

Fixture Type Free Hanging
Wattage 20.00 W/m²
Ballast Multiplier 1.20
Schedule Lighting

2.4. People:

Occupancy 0.0 Person
Activity Level Office Work
Sensible 71.8 W/person
Latent 60.1 W/person
Schedule None

2.2. Task Lighting:

Wattage 0.00 W/m²
Schedule None

2.5. Miscellaneous Loads:

Sensible 0 W
Schedule None
Latent 0 W
Schedule None

2.3. Electrical Equipment:

Wattage 10000.0 Watts
Schedule Equipment

3. Walls, Windows, Doors:

Exp.	Wall Gross Area (m ²)	Window 1 Qty.	Window 2 Qty.	Door 1 Qty.
N	32.0	0	0	0
E	20.0	0	0	1

3.1. Construction Types for Exposure N

Wall Type External Wall

3.2. Construction Types for Exposure E

Wall Type External Wall
Door Type 1.2*2.5

4. Roofs, Skylights:

Exp.	Roof Gross Area (m ²)	Roof Slope (deg.)	Skylight Qty.
H	33.0	0	0

4.1. Construction Types for Exposure H

Roof Type External Roof

5. Infiltration:

Design Cooling 1.00 ACH
Design Heating 1.00 ACH
Energy Analysis 0.00 L/s
Infiltration occurs at all hours.

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6. Floors:

Type	Slab Floor On Grade
Floor Area	33.0 m ²
Total Floor U-Value	2.000 W/(m ² -°K)
Exposed Perimeter	11.8 m
Edge Insulation R-Value	0.00 (m ² -°K)/W

7. Partitions:

7.1. 1st Partition Details:

Partition Type	Wall Partition
Area	19.8 m ²
U-Value	0.700 W/(m ² -°K)
Uncondit. Space Max Temp	37.0 °C
Ambient at Space Max Temp	41.0 °C
Uncondit. Space Min Temp	27.0 °C
Ambient at Space Min Temp	6.0 °C

7.2. 2nd Partition Details:

Partition Type	Wall Partition
Area	32.0 m ²
U-Value	0.700 W/(m ² -°K)
Uncondit. Space Max Temp	28.0 °C
Ambient at Space Max Temp	41.0 °C
Uncondit. Space Min Temp	25.0 °C
Ambient at Space Min Temp	6.0 °C

 NISOC	نگهداشت و افزایش تولید میدان نفتی بینک سطح الارض و ابنیه تحت الارض عمومی و مشترک								
شماره پیمان: 053 - 073 - 9184	HVAC Calculation Note For Extension of Existing Elect. Building								شماره صفحه: 12 از 24
	پروژه	بسته کاری	صادرکننده	تسهيلات	رشته	نوع مدرک	سریال	نسخه	
	BK	GCS	PEDCO	120	HV	CN	0002	D01	

HV ROOM

1. General Details:

Floor Area 147.0 m²
 Avg. Ceiling Height 4.1 m
 Building Weight 318.6 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 62.1-2007

2. Internals:

2.1. Overhead Lighting:

Fixture Type Free Hanging
 Wattage 1000 W
 Ballast Multiplier 1.20
 Schedule Lighting

2.4. People:

Occupancy 0.0 People
 Activity Level Office Work
 Sensible 71.8 W/person
 Latent 60.1 W/person
 Schedule People

2.2. Task Lighting:

Wattage 0.00 W/m²
 Schedule None

2.5. Miscellaneous Loads:

Sensible 0 W
 Schedule None
 Latent 0 W
 Schedule None

2.3. Electrical Equipment:

Wattage 14000.0 Watts
 Schedule Equipment

3. Walls, Windows, Doors:

Exp.	Wall Gross Area (m ²)	Window 1 Qty.	Window 2 Qty.	Door 1 Qty.
N	48.0	0	0	0
E	25.0	0	0	1

3.1. Construction Types for Exposure N

Wall Type External Wall

3.2. Construction Types for Exposure E

Wall Type External Wall
 Door Type 2*2.5

4. Roofs, Skylights:

Exp.	Roof Gross Area (m ²)	Roof Slope (deg.)	Skylight Qty.
H	147.0	0	0

4.1. Construction Types for Exposure H

Roof Type External Roof

5. Infiltration:

Design Cooling 0.00 ACH
 Design Heating 0.00 ACH
 Energy Analysis 0.00 L/s

Infiltration occurs at all hours.

 NISOC	نگهداشت و افزایش تولید میدان نفتی بینک سطح الارض و ابنیه تحت الارض عمومی و مشترک																	
شماره پیمان: 053 – 073– 9184	HVAC Calculation Note For Extension of Existing Elect. Building <table><tr><td>پروژه</td><td>بسته کاری</td><td>صادرکننده</td><td>تسهیلات</td><td>رشته</td><td>نوع مدرک</td><td>سریال</td><td>نسخه</td></tr><tr><td>BK</td><td>GCS</td><td>PEDCO</td><td>120</td><td>HV</td><td>CN</td><td>0002</td><td>D01</td></tr></table>	پروژه	بسته کاری	صادرکننده	تسهیلات	رشته	نوع مدرک	سریال	نسخه	BK	GCS	PEDCO	120	HV	CN	0002	D01	شماره صفحه: 13 از 24
پروژه	بسته کاری	صادرکننده	تسهیلات	رشته	نوع مدرک	سریال	نسخه											
BK	GCS	PEDCO	120	HV	CN	0002	D01											

6. Floors:

Type	Floor Above Unconditioned Space
Floor Area	147.0 m ²
Total Floor U-Value	0.568 W/(m ² -°K)
Unconditioned Space Max Temp.	37.0 °C
Ambient at Space Max Temp.	41.0 °C
Unconditioned Space Min Temp.	12.0 °C
Ambient at Space Min Temp.	6.0 °C

7. Partitions:

7.1. 1st Partition Details:

Partition Type	Wall Partition
Area	25.0 m ²
U-Value	0.700 W/(m ² -°K)
Uncondit. Space Max Temp	37.0 °C
Ambient at Space Max Temp	41.0 °C
Uncondit. Space Min Temp	12.0 °C
Ambient at Space Min Temp	6.0 °C

7.2. 2nd Partition Details:

Partition Type	Wall Partition
Area	33.0 m ²
U-Value	0.700 W/(m ² -°K)
Uncondit. Space Max Temp	34.0 °C
Ambient at Space Max Temp	41.0 °C
Uncondit. Space Min Temp	15.0 °C
Ambient at Space Min Temp	6.0 °C

 NISOC	نگهداشت و افزایش تولید میدان نفتی بینک سطح الارض و ابنیه تحت الارض عمومی و مشترک								
شماره پیمان: 053 - 073 - 9184	HVAC Calculation Note For Extension of Existing Elect. Building								شماره صفحه: 14 از 24
	پروژه	بسته کاری	صادرکننده	تسهیلات	رشته	نوع مدرک	سریال	نسخه	
	BK	GCS	PEDCO	120	HV	CN	0002	D01	

LV ROOM

1. General Details:

Floor Area 177.0 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 62.1-2007

2. Internals:

2.1. Overhead Lighting:

Fixture Type Free Hanging
Wattage 1000 W
Ballast Multiplier 1.20
Schedule Lighting

2.4. People:

Occupancy 0.0 People
Activity Level Office Work
Sensible 71.8 W/person
Latent 60.1 W/person
Schedule People

2.2. Task Lighting:

Wattage 0.00 W/m²
Schedule None

2.5. Miscellaneous Loads:

Sensible 0 W
Schedule None
Latent 0 W
Schedule None

2.3. Electrical Equipment:

Wattage 26000.0 Watts
Schedule Equipment

3. Walls, Windows, Doors:

Exp.	Wall Gross Area (m ²)	Window 1 Qty.	Window 2 Qty.	Door 1 Qty.
E	25.0	0	0	1
S	40.0	0	0	0
S	71.3	0	0	0
W	25.0	0	0	1

3.1. Construction Types for Exposure E

Wall Type External Wall
Door Type 2*2.5

3.2. Construction Types for Exposure S

Wall Type External Wall

3.3. Construction Types for Exposure S

Wall Type External Wall

3.4. Construction Types for Exposure W

Wall Type External Wall
Door Type 1 x 2.5

4. Roofs, Skylights:

Exp.	Roof Gross Area (m ²)	Roof Slope (deg.)	Skylight Qty.
H	177.0	0	0

4.1. Construction Types for Exposure H

Roof Type External Roof

5. Infiltration:

Design Cooling 0.00 ACH
Design Heating 0.00 ACH
Energy Analysis 0.00 L/s
Infiltration occurs at all hours.

 NISOC	نگهداشت و افزایش تولید میدان نفتی بینک سطح الارض و ابنیه تحت الارض عمومی و مشترک																	
شماره پیمان: 053 – 073– 9184	HVAC Calculation Note For Extension of Existing Elect. Building <table><tr><td>پروژه</td><td>بسته کاری</td><td>صادرکننده</td><td>تسهیلات</td><td>رشته</td><td>نوع مدرک</td><td>سریال</td><td>نسخه</td></tr><tr><td>BK</td><td>GCS</td><td>PEDCO</td><td>120</td><td>HV</td><td>CN</td><td>0002</td><td>D01</td></tr></table>	پروژه	بسته کاری	صادرکننده	تسهیلات	رشته	نوع مدرک	سریال	نسخه	BK	GCS	PEDCO	120	HV	CN	0002	D01	شماره صفحه: 15 از 24
پروژه	بسته کاری	صادرکننده	تسهیلات	رشته	نوع مدرک	سریال	نسخه											
BK	GCS	PEDCO	120	HV	CN	0002	D01											

6. Floors:

Type	Floor Above Unconditioned Space
Floor Area	177.0 m ²
Total Floor U-Value	0.568 W/(m ² -°K)
Unconditioned Space Max Temp.	37.0 °C
Ambient at Space Max Temp.	41.0 °C
Unconditioned Space Min Temp.	12.0 °C
Ambient at Space Min Temp.	6.0 °C

7. Partitions:

7.1. 1st Partition Details:

Partition Type	Wall Partition
Area	23.0 m ²
U-Value	0.700 W/(m ² -°K)
Uncondit. Space Max Temp	37.0 °C
Ambient at Space Max Temp	41.0 °C
Uncondit. Space Min Temp	12.0 °C
Ambient at Space Min Temp	6.0 °C

7.2. 2nd Partition Details:

(No partition data).

6.3 AIR SYSTEM SIZING SUMMARY FOR ELECT. BUILDING (CAPACITOR BANK)

Air System Information

Air System Name **ELECT. BUILDING**
 Equipment Class **TERM**
 Air System Type **SPLT-FC**

Number of zones **1**
 Floor Area **33.0** 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**

Air System Information

Air System Name **ELECT. BUILDING**
 Equipment Class **TERM**
 Air System Type **SPLT-FC**

Number of zones **1**
 Floor Area **33.0** m²
 Location **binak, IRAN**

Sizing Calculation Information

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

 NISOC	نگهداشت و افزایش تولید میدان نفتی بینک سطح الارض و ابنیه تحت الارض عمومی و مشترک								
شماره پیمان: 053 - 073 - 9184	HVAC Calculation Note For Extension of Existing Elect. Building								شماره صفحه: 16 از 24
	پروژه	بسته کاری	صادر کننده	تسهیلات	رشته	نوع مدرک	سریال	نسخه	
	BK	GCS	PEDCO	120	HV	CN	0002	D01	

Zone Sizing Data

Zone Name	Maximum Cooling Sensible (kW)	Design Airflow (L/s)	Minimum Airflow (L/s)	Time of Peak Load	Maximum Heating Load (kW)	Zone Floor Area (m²)	Zone L/(s-m²)
Zone 1	13.2	684	684	Jul 1500	0.5	33.0	20.74

Terminal Unit Sizing Data - Cooling

Zone Name	Total Coil Load (kW)	Sens Coil Load (kW)	Coil Entering DB / WB (°C)	Coil Leaving DB / WB (°C)	Water Flow @ 5.6 °K (L/s)	Time of Peak Load
Zone 1	14.6	13.0	30.9 / 20.2	15.1 / 14.1	-	Jul 1500

Terminal Unit Sizing Data - Heating, Fan, Ventilation

Zone Name	Heating Coil Load (kW)	Heating Coil Ent/Lvg DB (°C)	Htg Coil Water Flow @11.1 °K (L/s)	Fan Design Airflow (L/s)	Fan Motor (BHP)	Fan Motor (kW)	OA Vent Design Airflow (L/s)
Zone 1	0.5	9.9 / 10.4	-	684	0.000	0.000	0

Space Loads and Airflows

Zone Name / Space Name	Mult.	Cooling Sensible (kW)	Time of Load	Air Flow (L/s)	Heating Load (kW)	Floor Area (m²)	Space L/(s-m²)
Zone 1							
CAPACITOR ROOM	1	13.2	Jul 1500	684	0.5	33.0	20.74

 NISOC	نگهداشت و افزایش تولید میدان نفتی بینک سطح الارض و ابنیه تحت الارض عمومی و مشترک								
شماره پیمان: 053 - 073 - 9184	HVAC Calculation Note For Extension of Existing Elect. Building								شماره صفحه: 17 از 24
	پروژه	بسته کاری	صادر کننده	تسهیلات	رشته	نوع مدرک	سریال	نسخه	
	BK	GCS	PEDCO	120	HV	CN	0002	D01	

TABLE 1.1.A. COMPONENT LOADS FOR SPACE " CAPACITOR ROOM " IN ZONE " Zone 1 "						
DESIGN COOLING			DESIGN HEATING			
COOLING DATA AT Jul 1500 COOLING OA DB / WB 41.0 °C / 30.5 °C OCCUPIED T-STAT 30.0 °C			HEATING DATA AT DES HTG HEATING OA DB / WB 6.0 °C / 6.0 °C OCCUPIED T-STAT 10.0 °C			
		Sensible	Latent		Sensible	Latent
SPACE LOADS	Details	(W)	(W)	Details	(W)	(W)
Window & Skylight Solar Loads	0 m ²	0	-	0 m ²	-	-
Wall Transmission	49 m ²	266	-	49 m ²	126	-
Roof Transmission	33 m ²	267	-	33 m ²	69	-
Window Transmission	0 m ²	0	-	0 m ²	0	-
Skylight Transmission	0 m ²	0	-	0 m ²	0	-
Door Loads	3 m ²	145	-	3 m ²	70	-
Floor Transmission	33 m ²	0	-	33 m ²	45	-
Partitions	52 m ²	36	-	52 m ²	0	-
Ceiling	0 m ²	0	-	0 m ²	0	-
Overhead Lighting	792 W	792	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	10000 W	10000	-	0	0	-
People	0	0	0	0	0	0
Infiltration	-	498	1447	-	181	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	10% / 10%	1200	145	10%	49	0
>> Total Zone Loads	-	13205	1592	-	540	0

TABLE 1.1.B. ENVELOPE LOADS FOR SPACE " CAPACITOR ROOM " IN ZONE " Zone 1 "						
				COOLING	COOLING	HEATING
	Area	U-Value	Shade	TRANS	SOLAR	TRANS
	(m ²)	(W/(m ² ·°K))	Coeff.	(W)	(W)	(W)
N EXPOSURE						
WALL	32	0.642	-	133	-	82
E EXPOSURE						
WALL	17	0.642	-	133	-	44
DOOR	3	5.800	-	145	-	70
H EXPOSURE						
ROOF	33	0.522	-	267	-	69

6.4 AIR SYSTEM SIZING SUMMARY FOR ELECT. BUILDING (HV ROOM, LV ROOM)

Air System Information

Air System Name ELECT. BUILDING(LV,HV)
Equipment Class SPLT AHU
Air System Type SZCAV

Number of zones 1
Floor Area 324.0 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

 NISOC	نگهداشت و افزایش تولید میدان نفتی بینک سطح الارض و ابنیه تحت الارض عمومی و مشترک																	
شماره پیمان: 053 - 073-9184	HVAC Calculation Note For Extension of Existing Elect. Building	شماره صفحه: 18 از 24																
	<table><tr><td>پروژه</td><td>بسته کاری</td><td>صادرکننده</td><td>تسهیلات</td><td>رشته</td><td>نوع مدرک</td><td>سریال</td><td>نسخه</td></tr><tr><td>BK</td><td>GCS</td><td>PEDCO</td><td>120</td><td>HV</td><td>CN</td><td>0002</td><td>D01</td></tr></table>		پروژه	بسته کاری	صادرکننده	تسهیلات	رشته	نوع مدرک	سریال	نسخه	BK	GCS	PEDCO	120	HV	CN	0002	D01
	پروژه		بسته کاری	صادرکننده	تسهیلات	رشته	نوع مدرک	سریال	نسخه									
BK	GCS	PEDCO	120	HV	CN	0002	D01											

Central Cooling Coil Sizing Data

Total coil load	94.4	kW	Load occurs at	Jul 1500
Sensible coil load	67.5	kW	OA DB / WB	41.0 / 30.5 °C
Coil L/s at Jul 1500	3332	L/s	Entering DB / WB	32.8 / 22.7 °C
Max block L/s	3332	L/s	Leaving DB / WB	16.1 / 15.2 °C
Sum of peak zone L/s	3332	L/s	Coil ADP	14.2 °C
Sensible heat ratio	0.711		Bypass Factor	0.100
m ² /kW	3.4		Resulting RH	38 %
W/m ²	291.5		Design supply temp.	16.9 °C
Water flow @ 5.6 °K rise	N/A		Zone T-stat Check	1 of 1 OK
Load occurs at	Jul 1400		Max zone temperature deviation	0.0 °K

Supply Fan Sizing Data

Actual max L/s	3332	L/s	Fan motor BHP	6.96	BHP
Standard L/s	3328	L/s	Fan motor kW	5.52	kW
Actual max L/(s-m ²)	10.28	L/(s-m ²)	Fan static	994	Pa

Outdoor Ventilation Air Data

Design airflow L/s	708	L/s
L/(s-m ²)	2.18	L/(s-m ²)

 NISOC	نگهداشت و افزایش تولید میدان نفتی بینک سطح الارض و ابنیه تحت الارض عمومی و مشترک								
شماره پیمان: 053 - 073 - 9184	HVAC Calculation Note For Extension of Existing Elect. Building								شماره صفحه: 19 از 27
	پروژه	بسته کاری	صادر کننده	تسهیلات	رشته	نوع مدرک	سریال	نسخه	
	BK	GCS	PEDCO	120	HV	CN	0002	D01	

Zone Sizing Data

Zone Name	Maximum Cooling Sensible (kW)	Design Airflow (L/s)	Minimum Airflow (L/s)	Time of Peak Load	Maximum Heating Load (kW)	Zone Floor Area (m²)	Zone L/(s-m²)
Zone 1	52.8	3332	3332	Jul 1600	1.7	324.0	10.28

Zone Terminal Sizing Data

No Zone Terminal Sizing Data required for this system.

Space Loads and Airflows

Zone Name / Space Name	Mult.	Cooling Sensible (kW)	Time of Load	Air Flow (L/s)	Heating Load (kW)	Floor Area (m²)	Space L/(s-m²)
Zone 1							
LV ROOM	1	33.4	Aug 1600	2112	1.0	177.0	11.93
HV ROOM	1	19.3	Jul 1600	1220	0.7	147.0	8.30

 NISOC	نگهداشت و افزایش تولید میدان نفتی بینک سطح الارض و ابنیه تحت الارض عمومی و مشترک								
شماره پیمان: 053 - 073 - 9184	HVAC Calculation Note For Extension of Existing Elect. Building								شماره صفحه: 20 از 27
	پروژه	بسته کاری	صادر کننده	تسهیلات	رشته	نوع مدرک	سریال	نسخه	
	BK	GCS	PEDCO	120	HV	CN	0002	D01	

TABLE 1.1.A. COMPONENT LOADS FOR SPACE " LV ROOM " IN ZONE " Zone 1 "						
	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Aug 1600 COOLING OA DB / WB 40.6 °C / 30.4 °C OCCUPIED T-STAT 30.0 °C			HEATING DATA AT DES HTG HEATING OA DB / WB 6.0 °C / 6.0 °C OCCUPIED T-STAT 10.0 °C		
		Sensible	Latent		Sensible	Latent
SPACE LOADS	Details	(W)	(W)	Details	(W)	(W)
Window & Skylight Solar Loads	0 m ²	0	-	0 m ²	-	-
Wall Transmission	154 m ²	924	-	154 m ²	395	-
Roof Transmission	177 m ²	1346	-	177 m ²	370	-
Window Transmission	0 m ²	0	-	0 m ²	0	-
Skylight Transmission	0 m ²	0	-	0 m ²	0	-
Door Loads	8 m ²	356	-	8 m ²	174	-
Floor Transmission	177 m ²	501	-	177 m ²	0	-
Partitions	23 m ²	80	-	23 m ²	0	-
Ceiling	0 m ²	0	-	0 m ²	0	-
Overhead Lighting	1200 W	1200	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	26000 W	25999	-	0	0	-
People	0	0	0	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	10% / 10%	3041	0	10%	94	0
>> Total Zone Loads	-	33447	0	-	1033	0

TABLE 1.1.B. ENVELOPE LOADS FOR SPACE " LV ROOM " IN ZONE " Zone 1 "						
				COOLING	COOLING	HEATING
	Area	U-Value	Shade	TRANS	SOLAR	TRANS
	(m ²)	(W/(m ² ·°K))	Coeff.	(W)	(W)	(W)
E EXPOSURE						
WALL	20	0.642	-	150	-	51
DOOR	5	5.800	-	237	-	116
S EXPOSURE						
WALL	40	0.642	-	224	-	103
S EXPOSURE						
WALL	71	0.642	-	399	-	183
W EXPOSURE						
WALL	23	0.642	-	150	-	58
DOOR	3	5.800	-	119	-	58
H EXPOSURE						
ROOF	177	0.522	-	1346	-	370

 NISOC	نگهداشت و افزایش تولید میدان نفتی بینک سطح الارض و ابنیه تحت الارض عمومی و مشترک								
شماره پیمان: 053 – 073 – 9184	HVAC Calculation Note For Extension of Existing Elect. Building							شماره صفحه: 21 از 27	
	پروژه	بسته کاری	صادر کننده	تسهيلات	رشته	نوع مدرک	سريال		نسخه
	BK	GCS	PEDCO	120	HV	CN	0002	D01	

TABLE 1.2.A. COMPONENT LOADS FOR SPACE " HV ROOM " IN ZONE " Zone 1 "						
	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jul 1600 COOLING OA DB / WB 40.6 °C / 30.4 °C OCCUPIED T-STAT 30.0 °C			HEATING DATA AT DES HTG HEATING OA DB / WB 6.0 °C / 6.0 °C OCCUPIED T-STAT 10.0 °C		
		Sensible	Latent		Sensible	Latent
SPACE LOADS	Details	(W)	(W)	Details	(W)	(W)
Window & Skylight Solar Loads	0 m ²	0	-	0 m ²	-	-
Wall Transmission	68 m ²	358	-	68 m ²	175	-
Roof Transmission	147 m ²	1213	-	147 m ²	307	-
Window Transmission	0 m ²	0	-	0 m ²	0	-
Skylight Transmission	0 m ²	0	-	0 m ²	0	-
Door Loads	5 m ²	237	-	5 m ²	116	-
Floor Transmission	147 m ²	416	-	147 m ²	0	-
Partitions	58 m ²	144	-	58 m ²	0	-
Ceiling	0 m ²	0	-	0 m ²	0	-
Overhead Lighting	1200 W	1200	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	14000 W	13999	-	0	0	-
People	0	0	0	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	10% / 10%	1757	0	10%	60	0
>> Total Zone Loads	-	19326	0	-	658	0

TABLE 1.2.B. ENVELOPE LOADS FOR SPACE " HV ROOM " IN ZONE " Zone 1 "						
				COOLING	COOLING	HEATING
	Area	U-Value	Shade	TRANS	SOLAR	TRANS
	(m ²)	(W/(m ² ·°K))	Coeff.	(W)	(W)	(W)
N EXPOSURE						
WALL	48	0.642	-	200	-	123
E EXPOSURE						
WALL	20	0.642	-	158	-	51
DOOR	5	5.800	-	237	-	116
H EXPOSURE						
ROOF	147	0.522	-	1213	-	307

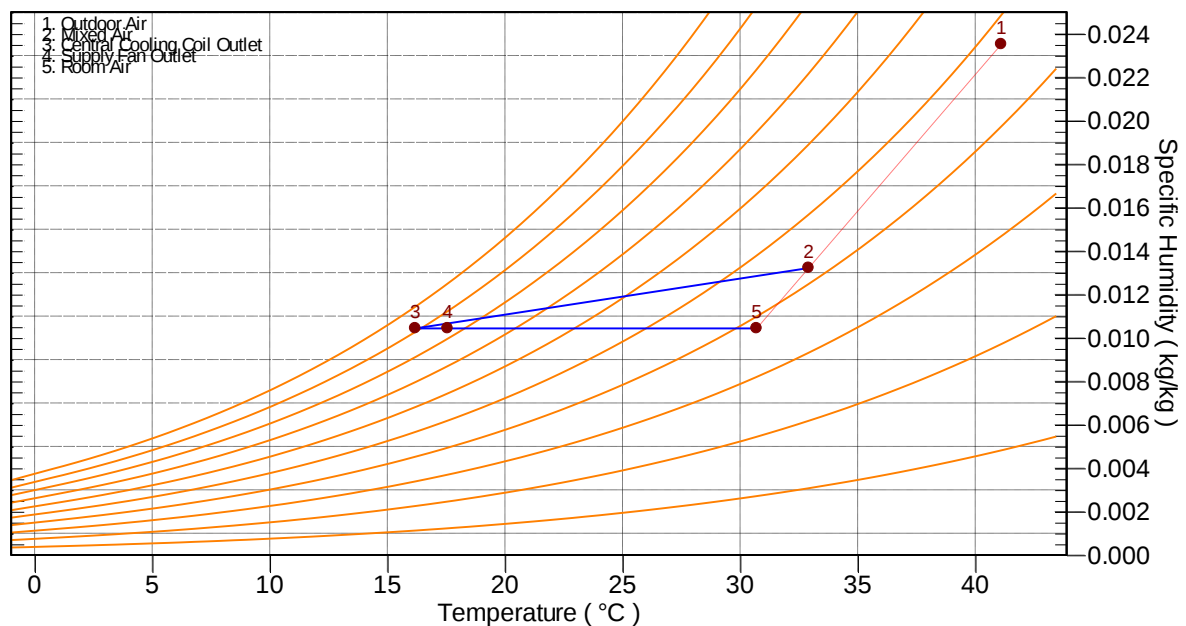
 NISOC	نگهداشت و افزایش تولید میدان نفتی بینک سطح الارض و ابنیه تحت الارض عمومی و مشترک							
شماره پیمان: 053 - 073 - 9184	HVAC Calculation Note For Extension of Existing Elect. Building							
	پروژه	بسته کاری	صادر کننده	تسهیلات	رشته	نوع مدرک	سریال	نسخه
	BK	GCS	PEDCO	120	HV	CN	0002	D01
شماره صفحه: 22 از 27								

PSYCHROMETRIC CHART FOR LV ROOM, HV ROOM IN ELECT. BUILDING:

Location: binak, IRAN

Altitude: 10.0 m.

Data for: July DESIGN COOLING DAY, 1500



 NISOC	نگهداشت و افزایش تولید میدان نفتی بینک سطح الارض و ابنیه تحت الارض عمومی و مشترک								
شماره پیمان: 053 - 073-9184	HVAC Calculation Note For Extension of Existing Elect. Building							شماره صفحه: 23 از 27	
	پروژه	بسته کاری	صادر کننده	تسهیلات	رشته	نوع مدرک	سریال		نسخه
	BK	GCS	PEDCO	120	HV	CN	0002	D01	

EQUIPMENT SELECTION:
EXHAUST FANS (22-EF-01 IS EXISTING)

Equipment No:	22-EF-01	22-EF-02
Quantity	1	1
Type	WALL MOUNTED	WALL MOUNTED
Flow Rate(CMH)	1000 ≈ (ACH-10)	220L/S ≈ (ACH-6)
Static Pressure	1.25 mm WG→12.5 pa	Sand trap louver: 6mmh2o=57pa Exhaust Air Louver: 38 pa →100 pa
Service Area	Battery Room	CO2 Room
Remarks		

 NISOC	نگهداشت و افزایش تولید میدان نفتی بینک سطح الارض و ابنیه تحت الارض عمومی و مشترک								
شماره پیمان: 053 – 073– 9184	HVAC Calculation Note For Extension of Existing Elect. Building							شماره صفحه: 24 از 27	
	پروژه	بسته کاری	صادر کننده	تسهیلات	رشته	نوع مدرک	سریال		نسخه
	BK	GCS	PEDCO	120	HV	CN	0002	D01	

PACKAGE UNIT(PACKAGE UNIT IS EXISTING):

PACHAGE 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 TEMP DEG. °F :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 °F
COM. DATA	POWER=25HP 400-3-50
	THR=75450 KCAL/HR
CONDENSER DATA	QTY=2
	HP=3 HP
FAN DATA	ELECT-400-3-50
	RPM=1450 ELECT-400-3-50
MODEL	SIMILAR TO SARAN P.U MODEL SPAR 25-1 ROOF TOP
QUANTITY	QTY=2 ONE AS STANDBY

SPLIT TYPE D-X AIR CONDITIONER

 NISOC	نگهداشت و افزایش تولید میدان نفتی بینک سطح الارض و ابنیه تحت الارض عمومی و مشترک								
شماره پیمان: 053 - 073 - 9184	HVAC Calculation Note For Extension of Existing Elect. Building							شماره صفحه: 25 از 27	
	پروژه	بسته کاری	صادر کننده	تسهیلات	رشته	نوع مدرک	سریال		نسخه
	BK	GCS	PEDCO	120	HV	CN	0002	D01	

Capacitor Bank:

Design Actual Sensible Cooling Load : 13205 W

Design Actual Latent Cooling Load : 1592W

Design Total Cooling Load : 13205+1592=14797 W=50500 btu/hr

Equipment selection:

Indoor Unit Equipment No: 22-SUI-04

Quantity: 1

Total EQ. Cooling Load : 36900 btu/hr→1×48000 btu/hr nominal capacity

(nominal capacity will be checked by vendor according to ambient temperature)

Type : DUCTED SPLIT (Tropical)

Outdoor Unit Equipment No: 22-SUO-04

Quantity: 1

50500 btu/hr - 36900 btu/hr = 13600 btu/hr→1×18000 btu/hr nominal load-wall mounted split unit

(nominal capacity shall be checked by vendor according to ambient temperature)

Indoor Unit Equipment No: 22-SUI-03

Quantity: 1

Type : wall mounted (Tropical)

Outdoor Unit Equipment No: 22-SUO-03

SAND TRAP LOUVER

Capacitor Bank Sand Trap Louver:

According to "Shahrokhi Manufacturing co." catalogue for Sand Trap Louver:

V_k = Face Velocity in FPM

A_k = effective free area in square feet = CFM/FPM

Pressure Drop = 6mmH₂O ≈ 57 pa ≈ 0.23 in.wg

Air Flow Rate: 100 l/s

from "Shahrokhi Manufacturing co." catalogue for Sand Trap Louver:

 NISOC	نگهداشت و افزایش تولید میدان نفتی بینک سطح الارض و ابنیه تحت الارض عمومی و مشترک								
شماره پیمان: 053 – 073– 9184	HVAC Calculation Note For Extension of Existing Elect. Building								شماره صفحه: 26 از 27
	پروژه	بسته کاری	صادر کننده	تسهیلات	رشته	نوع مدرک	سریال	نسخه	
	BK	GCS	PEDCO	120	HV	CN	0002	D01	

if 0.23 in.wg Pressure Drop $\rightarrow V_k=343$ FPM

Air Flow Rate: 100 l/s ≈ 211 CFM $\rightarrow$

$A_k=211/343=0.615 \rightarrow W=24"$ & $H=12"$

Co2 Room Sand Trap Louver:

Pressure Drop = 6mmH₂O ≈ 57 pa ≈ 0.23 inwg

Air Flow Rate: 220 l/s

from "Shahrokhi Manufacturing co." catalogue for Sand Trap Louver:

0.23 inwg Pressure Drop $\rightarrow V_k=343$ FPM

Air Flow Rate: 220 l/s ≈ 466 CFM $\rightarrow$

$A_k=466/343=1.36 \rightarrow W=36"$ & $H=18"$

HIGH VOLTAGE ROOM and LOW VOLTAGE ROOM:

FROM HAP4.9: Central Cooling Coil Sizing Data:

Total coil load	26.9	Tons
Total coil load	322.3	MBH
Sensible coil load	229.2	MBH
Coil CFM at Jul 1500	7060	CFM
Max block CFM	7060	CFM
Sum of peak zone CFM	7060	CFM
Sensible heat ratio	0.711	
ft ² /Ton	129.9	
BTU/(hr-ft ²)	92.4	
Water flow @ 10.0 °F rise	N/A	

Existing Package Unit Cooling Capacity = 53400 kcal/hr ≈ 17.66 ton

Total Cooling Load – Package Unit Cooling Capacity = 26.9 – 17.66 = 9.24 ton

LV & HV Split units new loads = 9.24 ton

Zone Name / Space Name	Mult.	Cooling Sensible (MBH)	Time of Load	Air Flow (CFM)	Heating Load (MBH)	Floor Area (ft ²)	Space CFM/ft ²
Zone 1							
LV ROOM	1	114.1	Aug 1600	4475	3.5	1905.2	2.35
HV ROOM	1	65.9	Jul 1600	2585	2.2	1582.3	1.63

$$\text{HV load Ratio} = \frac{65900}{65900+114100} = \frac{69700}{180000} \approx 0.366$$

$$\text{HV load} = 0.366 \times 9.24 \text{ ton} = 3.38 \text{ ton} \approx 40580 \text{ btu/hr}$$

HV load $\div$ Quantity = 40580 btu/hr $\div$ 2 = 20290 btu/hr (Actual Capacity) $\rightarrow 2 \times 28000$ btu/hr nominal load-wall mounted split unit.

 NISOC	نگهداشت و افزایش تولید میدان نفتی بینک سطح الارض و ابنیه تحت الارض عمومی و مشترک								
شماره پیمان: 053 – 073– 9184	HVAC Calculation Note For Extension of Existing Elect. Building							شماره صفحه: 27 از 27	
	پروژه	بسته کاری	صادر کننده	تسهیلات	رشته	نوع مدرک	سریال		نسخه
	BK	GCS	PEDCO	120	HV	CN	0002	D01	

(nominal capacity shall be checked by vendor according to ambient temperature)

Equipment selection:

Indoor Unit Equipment No: 22-SUI-02A,B

Quantity: 2

Type : Wall Mounted (Tropical)

Outdoor Unit Equipment No: 22-SUO-02A,B

Quantity: 2

LV load (actual) = 9.24 ton – 3.38 ton = 5.86 ton $\approx$ 70320 btu/hr

LV load ÷ Quantity = 70320 btu/hr ÷ 4 = 17580 btu/hr (actual) $\rightarrow$ 4 $\times$ 24000 btu/hr nominal load-wall mounted split unit.

(nominal capacity shall be checked by vendor according to ambient temperature)

Equipment selection:

Indoor Unit Equipment No: 22-SUI-01A,B,C,D

Quantity: 4

Type : Wall Mounted (Tropical)

Outdoor Unit Equipment No: 22-SUO-01A,B,C,D

Quantity: 4