

	نگهداشت و افزایش تولید میدان نفتی بینک سطح الارض و ابنیه تحت الارض عمومی و مشترک								
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	BK	W007S	PEDCO	110	HV	CN	0001	D03	

طرح نگهداشت و افزایش تولید ۲۷ مخزن

HVAC CALCULATION NOTE FOR SWITCHGEAR BUILDING – W007S

نگهداشت و افزایش تولید میدان نفتی بینک

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D02	FEB. 2023	IFA	H.Adineh	M.Fakharian	M.Mehrshad	
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D00	MAR. 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-707934

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

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

4.1 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)

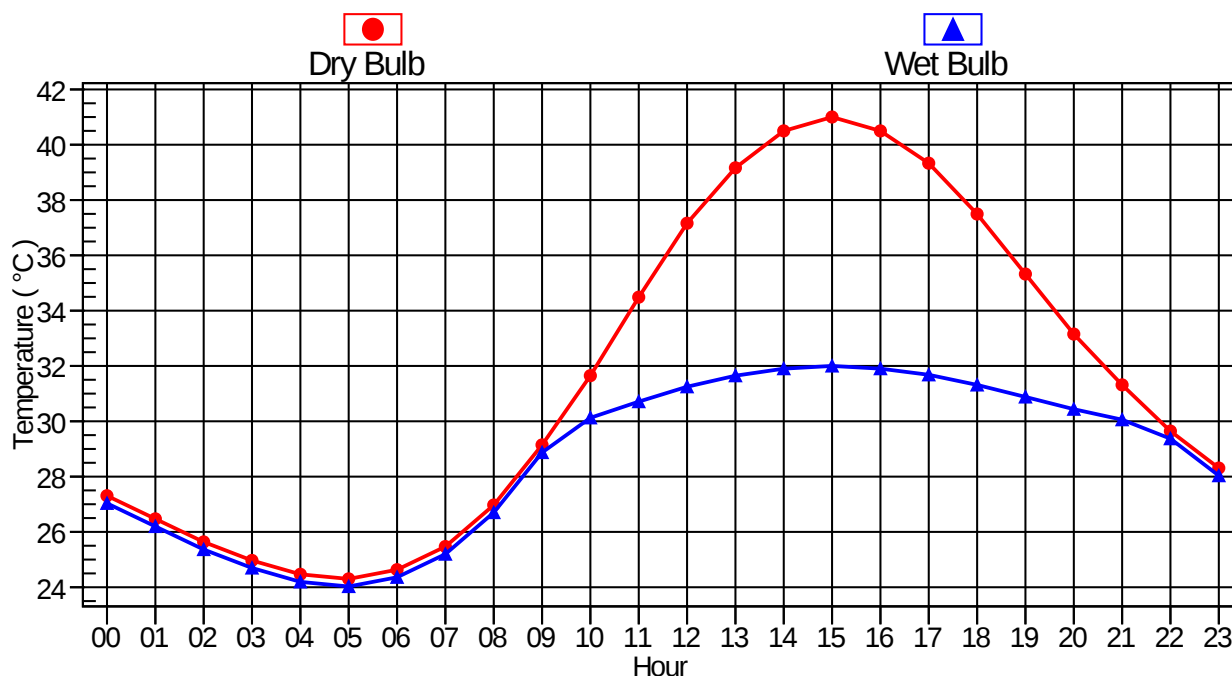
Month	N	NNE	NE	ENE	E	ESE	SE	SSE	S
January	77.5	77.5	95.1	360.4	561.2	730.9	794.1	786.3	762.3
February	89.1	89.1	206.7	484.1	668.9	760.8	782.0	718.9	671.9
March	101.4	120.5	367.4	576.2	723.5	759.6	702.5	590.8	520.1
April	113.0	252.7	487.2	636.6	705.1	688.3	568.6	408.7	322.0
May	124.3	351.1	551.9	666.3	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.

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Design Temperature Profile

Design Temperature Profiles for July



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4.2 CONSTRUCTIONS U-VALUE:

Wall (Anti acid ceramic tile)

Wall Details

Outside Surface Color Medium
Absorptivity 0.675
Overall U-Value 0.217 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
Anti acid ceramic tile	12.500	1000.0	0.34	0.03676	12.5
Cement plaster	25.000	1600.0	0.80	0.03125	40.0
Wall brick	200.000	2000.0	0.20	1.00000	400.0
Rock wool	50.000	25.0	0.05	1.00000	1.3
Cement plaster	30.000	1600.0	0.80	0.03750	48.0
Face brick	70.000	2000.0	0.03	2.33000	140.0
Outside surface resistance	0.000	0.0	0.00	0.05864	0.0
Totals	387.500	-		4.61479	641.8

Wall (Cement plaster)

Wall Details

Outside Surface Color Medium
Absorptivity 0.675
Overall U-Value 0.218 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
Cement plaster	25.000	1600.0	0.80	0.03125	40.0
Wall brick	200.000	2000.0	0.20	1.00000	400.0
Rock wool	50.000	25.0	0.05	1.00000	1.3
Cement plaster	30.000	1600.0	0.80	0.03750	48.0
Face brick	70.000	2000.0	0.03	2.33000	140.0
Outside surface resistance	0.000	0.0	0.00	0.05864	0.0
Totals	375.000	-		4.57803	629.3

Roof

Roof Details

Outside Surface Color Medium
Absorptivity 0.675
Overall U-Value 0.479 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
HW concrete	200.000	2242.6	0.84	0.11556	448.5
Rock wool	50.000	25.0	0.84	1.00000	1.3
LW concrete	100.000	640.7	0.84	0.57779	64.1
Waterproofing/isogume or similar	4.000	1000.0	1.67	0.17390	4.0
Cement plaster	25.000	1600.0	0.80	0.03750	40.0
Terrazzo tile	25.000	2000.0	0.84	0.00185	50.0
Outside surface resistance	0.000	0.0	0.00	0.05864	0.0
Totals	404.000	-		2.08588	607.8

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M.D.-1

Door Details:

Gross Area 2.6 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

M.D.-2

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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4.3 SPACE INPUT DATA:

00-Switchgear Room

1. General Details:

Floor Area 59.5 m²
Avg. Ceiling Height 4.5 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 14.00 W/m²
Ballast Multiplier 1.25
Schedule Lighting

2.2. Task Lighting:

Wattage 0.00 W/m²
Schedule None

2.3. Electrical Equipment:

Wattage 6500.0 Watts
Schedule Electrical Eq.

2.4. People:

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

2.5. Miscellaneous Loads:

Sensible 0 W
Schedule None
Latent 0 W
Schedule None

3. Walls, Windows, Doors:

Exp.	Wall Gross Area (m ²)	Window 1 Qty.	Window 2 Qty.	Door 1 Qty.
SE	26.5	0	0	1
SW	45.6	0	0	0
NW	26.7	0	0	1
NE	31.3	0	0	0

3.1. Construction Types for Exposure SE

Wall Type Wall (Cement plaster)
Door Type M.D.-2

3.2. Construction Types for Exposure SW

Wall Type Wall (Cement plaster)

3.3. Construction Types for Exposure NW

Wall Type Wall (Cement plaster)
Door Type M.D.-1

3.4. Construction Types for Exposure NE

Wall Type Wall (Cement plaster)

4. Roofs, Skylights:

Exp.	Roof Gross Area (m ²)	Roof Slope (deg.)	Skylight Qty.
H	59.5	0	0

4.1. Construction Types for Exposure H

Roof Type Roof

5. Infiltration:

Design Cooling 1.00 ACH
Design Heating 1.00 ACH
Energy Analysis 1.00 ACH

Infiltration occurs at all hours

6. Floors:

Type Slab Floor On Grade
Floor Area 59.5 m²
Total Floor U-Value 0.568 W/ (m²-°K)
Exposed Perimeter 28.9 m
Edge Insulation R-Value 0.00 (m²-°K)/W

7. Partitions:

(No partition data).

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01-Battery Room

1. General Details:

Floor Area 9.9 m²
Avg. Ceiling Height 5.3 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 14.00 W/m²
Ballast Multiplier 1.25
Schedule Lighting

2.2. Task Lighting:

Wattage 0.00 W/m²
Schedule None

2.3. Electrical Equipment:

Wattage 200.0 Watts
Schedule Electrical Eq.

3. Walls, Windows, Doors:

Exp.	Wall Gross Area (m ²)	Window 1 Qty.	Window 2 Qty.	Door 1 Qty.
SE	26.5	0	0	1
SW	45.6	0	0	0
NW	26.7	0	0	1
NE	31.3	0	0	0

3.1. Construction Types for Exposure SE

Wall Type Wall (Anti acid ceramic tile)

3.2. Construction Types for Exposure NE

Wall Type Wall (Anti acid ceramic tile)
Door Type M.D.-1

3.3. Construction Types for Exposure NW

Wall Type Wall (Anti acid ceramic tile)

4. Roofs, Skylights:

Exp.	Roof Gross Area (m ²)	Roof Slope (deg.)	Skylight Qty.
H	59.5	0	0

4.1. Construction Types for Exposure H

Roof Type Roof

5. Infiltration:

Design Cooling 6.00 ACH
Design Heating 6.00 ACH
Energy Analysis 6.00 ACH

Infiltration occurs at all hours.

6. Floors:

Type Slab Floor On Grade
Floor Area 9.9 m²
Total Floor U-Value 0.568 W/(m²-°K)
Exposed Perimeter 9.5 m
Edge Insulation R-Value 0.00 (m²-°K)/W

7. Partitions:

(No partition data).

2.4. People:

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

2.5. Miscellaneous Loads:

Sensible 0 W
Schedule None
Latent 0 W
Schedule None

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4.4 SYSTEM INPUT DATA:

1. General Details:

Air System Name Default System
Equipment Type Terminal Units
Air System Type Split 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: Switchgear Room	
00-Switchgear Room	x1
Zone 2: Battery Room	
01-Battery Room	x1

Thermostats and Zone Data:

Zone	Cooling T-Stat Occ. (°C)	Cooling T-Stat Unocc. (°C)	Heating T-Stat Occ. (°C)	Heating T-Stat Unocc. (°C)	T-Stat Throttling Range (°C)
1	30.0	30.0	10.0	10.0	0.83
2	27.0	27.0	21.0	21.0	0.83

Thermostat Schedule Fan
Unoccupied Cooling is Available

Common Terminal Unit Data:

Cooling Coil:

Design Supply Temperature 22.0 °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 ASHRAE Std 62.1-2010

Terminal Units Data:

Zone All
Terminal Type Fan Coil
Minimum Airflow 0.00 L/s/person
Fan Performance 0 Pa
Fan Overall Efficiency 50 %

4. Sizing Data (Computer-Generated):

System Sizing Data:

Sizing Data:

Cooling Supply Temperature 22.0 °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 Data:

Zone Airflow Sizing Method Peak zone sensible load
Space Airflow Sizing Method Individual peak space loads

Zone	Supply Airflow (L/s)	Zone Htg Unit (kW)	Reheat Coil (kW)	Ventilation (L/s)
1	946.0	-	-	0.0
2	365.1	-	-	0.0

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4.5 AIR SYSTEM SIZING SUMMARAIR

Air System Information

Air System Name Default System
Equipment Class TERM
Air System Type SPLT-FC

Number of zones 2
Floor Area 69.4 m²
Location Binak, IRAN

Sizing Calculation Information

Calculation Months Jan to Dec
Sizing Data Calculated

Zone L/s Sizing Peak zone sensible load
Space L/s Sizing Individual peak space loads

Air System Information

Air System Name Default System
Equipment Class TERM
Air System Type SPLT-FC

Number of zones 2
Floor Area 69.4 m²
Location Binak, IRAN

Sizing Calculation Information

Calculation Months Jan to Dec
Sizing Data Calculated

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 (m ²)	Zone L / (s-m ²)
Switchgear Room	9.1	946	946	Jul 1500	0.9	59.5	15.90
Battery Room	2.2	365	365	Jul 1500	2.3	9.9	36.87

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
Switchgear Room	13.1	9.1	30.5 / 25.1	22.5 / 22.0	-	Jul 1500
Battery Room	2.8	2.1	27.6 / 24.3	22.9 / 22.6	-	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)
Switchgear Room	3.1	21.8 / 24.5	-	946	0.000	0.000	0
Battery Room	2.3	21.0 / 26.3	-	365	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 (m ²)	Space L / (s-m ²)
Switchgear Room							
00-Switchgear Room	1	9.1	Jul 1500	946	0.9	59.5	15.90
Battery Room							
01-Battery Room	1	2.2	Jul 1500	365	2.3	9.9	36.87

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4.6 VENTILATION SIZING SUMMARY

1. Summary

Ventilation Sizing Method ASHRAE Std 62.1-2010
Design Condition Cooling operation

2. Space Ventilation Analysis Table

Zone Name / Space Name	Mult.	Supply Air (L/s) (Vpz)	Space Floor Area (m²) (Az)	Area Outdoor Air Rate (L/ (s-m²)) (Ra)	Time Averaged Occupancy (Occupants) (Pz)	People Outdoor Air Rate (L/s/person) (Rp)	Air Distribution Effectiveness (Ez)	Space Outdoor Air (L/s) (Voz)	Breathing Zone Outdoor Air (L/s) (Vbz)	Space Ventilation Efficiency (Evz)
Switchgear Room										
00-Swithchgear Room	1	946	59.5	0.00	0.0	0.00	1.00	0	0	1.000
Battery Room										
01-Battery Room	1	365	9.9	0.00	0.0	0.00	1.00	0	0	1.000
Totals (incl. Space Multipliers)		1311							0	1.000

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4.7 AIR SYSTEM DESIGN LOAD SUMMARY:

ZONE LOADS	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		
	Details	Sensible (W)	Latent (W)	Details	Sensible (W)	Latent (W)
Window & Skylight Solar Loads	0 m ²	0	-	0 m ²	-	-
Wall Transmission	170 m ²	266	-	170 m ²	261	-
Roof Transmission	69 m ²	304	-	69 m ²	185	-
Window Transmission	0 m ²	0	-	0 m ²	0	-
Skylight Transmission	0 m ²	0	-	0 m ²	0	-
Door Loads	10 m ²	519	-	10 m ²	403	-
Floor Transmission	69 m ²	0	-	69 m ²	108	-
Partitions	0 m ²	0	-	0 m ²	0	-
Ceiling	0 m ²	0	-	0 m ²	0	-
Overhead Lighting	0 W	30	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	6700 W	6700	-	0	0	-
People	0	0	0	0	0	0
Infiltration	-	2458	4262	-	1937	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	10% / 10%	1028	426	10%	289	0
>> Total Zone Loads	-	11304	4688	-	3183	0
Zone Conditioning	-	11166	4688	-	5445	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	-	11166	4688	-	5445	0
Terminal Unit Cooling	-	11166	4684	-	0	0
Terminal Unit Heating	-	0	-	-	5445	-
>> Total Conditioning	-	11166	4684	-	5445	0
Key:	Positive values are clg loads Negative values are htg loads			Positive values are htg loads Negative values are clg loads		

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4.8 ZONE DESIGN LOAD SUMMARY:

Switchgear Room	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 30.0 °C			OCCUPIED T-STAT 10.0 °C		
ZONE LOADS	Details	Sensible (W)	Latent (W)	Details	Sensible (W)	Latent (W)
Window & Skylight Solar Loads	0 m ²	0	-	0 m ²	-	-
Wall Transmission	123 m ²	169	-	123 m ²	107	-
Roof Transmission	60 m ²	248	-	60 m ²	114	-
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	353	-	8 m ²	176	-
Floor Transmission	60 m ²	0	-	60 m ²	60	-
Partitions	0 m ²	0	-	0 m ²	0	-
Ceiling	0 m ²	0	-	0 m ²	0	-
Overhead Lighting	0 W	25	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	6500 W	6500	-	0	0	-
People	0	0	0	0	0	0
Infiltration	-	985	1948	-	358	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	10% / 10%	828	195	10%	82	0
>> Total Zone Loads	-	9108	2143	-	897	0

Battery Room	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 27.0 °C			OCCUPIED T-STAT 21.0 °C		
ZONE LOADS	Details	Sensible (W)	Latent (W)	Details	Sensible (W)	Latent (W)
Window & Skylight Solar Loads	0 m ²	0	-	0 m ²	-	-
Wall Transmission	48 m ²	98	-	48 m ²	154	-
Roof Transmission	10 m ²	56	-	10 m ²	71	-
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	166	-	3 m ²	226	-
Floor Transmission	10 m ²	0	-	10 m ²	48	-
Partitions	0 m ²	0	-	0 m ²	0	-
Ceiling	0 m ²	0	-	0 m ²	0	-
Overhead Lighting	0 W	4	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	200 W	200	-	0	0	-
People	0	0	0	0	0	0
Infiltration	-	1473	2314	-	1579	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	10% / 10%	200	231	10%	208	0
>> Total Zone Loads	-	2197	2545	-	2286	0

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4.9 SPACE DESIGN LOAD SUMMARY:

TABLE 1.1.A. COMPONENT LOADS FOR SPACE " 00-Switchgear Room " IN ZONE " Switchgear Room "						
	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jul 1500 COOLING OA DB / WB 41.0 °C / 32.0 °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	123 m ²	169	-	123 m ²	107	-
Roof Transmission	60 m ²	248	-	60 m ²	114	-
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	353	-	8 m ²	176	-
Floor Transmission	60 m ²	0	-	60 m ²	60	-
Partitions	0 m ²	0	-	0 m ²	0	-
Ceiling	0 m ²	0	-	0 m ²	0	-
Overhead Lighting	0 W	25	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	6500 W	6500	-	0	0	-
People	0	0	0	0	0	0
Infiltration	-	985	1948	-	358	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	10% / 10%	828	195	10%	82	0
>> Total Zone Loads	-	9108	2143	-	897	0

TABLE 1.1.B. ENVELOPE LOADS FOR SPACE " 00-Switchgear Room " IN ZONE " Switchgear Room "						
	Area (m ²)	U-Value (W/ (m ² -°K))	Shade Coeff.	COOLING	COOLING	HEATING
				TRANS	SOLAR	TRANS
				(W)	(W)	(W)
SE EXPOSURE						
WALL	22	0.218	-	31	-	19
DOOR	5	5.800	-	232	-	116
SW EXPOSURE						
WALL	46	0.218	-	61	-	40
NW EXPOSURE						
WALL	24	0.218	-	32	-	21
DOOR	3	5.800	-	121	-	60
NE EXPOSURE						
WALL	31	0.218	-	45	-	27
H EXPOSURE						
ROOF	60	0.479	-	248	-	114

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TABLE 2.1.A. COMPONENT LOADS FOR SPACE " 01-Battery Room " IN ZONE " Battery Room "						
	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jul 1500 COOLING OA DB / WB 41.0 °C / 32.0 °C OCCUPIED T-STAT 27.0 °C			HEATING DATA AT DES HTG HEATING OA DB / WB 6.0 °C / 6.0 °C OCCUPIED T-STAT 21.0 °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	48 m ²	98	-	48 m ²	154	-
Roof Transmission	10 m ²	56	-	10 m ²	71	-
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	166	-	3 m ²	226	-
Floor Transmission	10 m ²	0	-	10 m ²	48	-
Partitions	0 m ²	0	-	0 m ²	0	-
Ceiling	0 m ²	0	-	0 m ²	0	-
Overhead Lighting	0 W	4	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	200 W	200	-	0	0	-
People	0	0	0	0	0	0
Infiltration	-	1473	2314	-	1579	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	10% / 10%	200	231	10%	208	0
>> Total Zone Loads	-	2197	2545	-	2286	0

TABLE 2.1.B. ENVELOPE LOADS FOR SPACE " 01-Battery Room " IN ZONE " Battery Room "						
				COOLING	COOLING	HEATING
	Area	U-Value	Shade	TRANS	SOLAR	TRANS
	(m ²)	(W/ (m ² ·°K))	Coeff.	(W)	(W)	(W)
SE EXPOSURE						
WALL	17	0.217	-	35	-	54
NE EXPOSURE						
WALL	14	0.217	-	30	-	46
DOOR	3	5.800	-	166	-	226
NW EXPOSURE						
WALL	17	0.217	-	33	-	54
H EXPOSURE						
ROOF	10	0.479	-	56	-	71

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5.0 Equipment Selection

5.1 AIR CONDITIONING UNIT

Item	Service Area	
	Switchgear Room	Battery Room
Sensible Cooling Load(w)	9108	2197
Latent Cooling Load(w)	2143	2545
Total Cooling Load(w)	11251	4742
Total Cooling Load (btu/hr)	38424	16195
Sensible Heating Load(w)	897	2286
Sensible Heating Load (btu/hr)	3063	7807
Split Unit ID Indoor Unit ID	1201-SUI-W007S-01	1201-SUI-W007S-02
Split Unit Outdoor Unit ID	1201-SUO-W007S-01	1201-SUO-W007S-02
Equipment QTY.	2	1
Equipment Type	Wall Mounted Split Unit	Wall Mounted Split Unit
Cooling Load+ 10% Over Cap. (btu/hr) Each	21133	17814
Selected Eq. Nominal Cooling Cap. (btu/hr) Each	24000	18000
Selected Eq. Actual Cooling Cap. (btu/hr) Each	24500	18300
Selected Eq. Actual Heating Cap. (btu/hr) Each	24500	20800
Power Supply (V/PH/Hz)	230/1/50	230/1/50
Max. Power Consumption (w) Each Eq. (Cooling/Heating)*	2420/2500	1710/1800
REMARKE	Outdoor and Indoor Unit (With Thermostat & All Standard Accessory)-T3	Outdoor and Indoor Unit (With Thermostat & All Standard Accessory)-T3

* Max. Power Consumption Should Be Finalized By Vendor.

 NISOC	نگهداشت و افزایش تولید میدان نفتی بینک سطح الارض و ابنیه تحت الارض عمومی و مشترک								
شماره پیمان: ۰۵۳ - ۰۷۳ - ۹۱۸۴	HVAC CALCULATION NOTE FOR SWITCHGEAR BUILDING – W007S								شماره صفحه: ۲۰ از ۲۱
	پروژه	بسته کاری	صادرکننده	تسهیلات	رشته	نوع مدرک	سریال	نسخه	
	BK	W007S	PEDCO	110	HV	CN	0001	D02	

5.2 EXHAUST FAN SELECTION

Air Flow = $9.9 \text{ (area, m}^2\text{)} \times 5.3 \text{ (height, m)} \times 6 \text{ ACH} \div 60 \text{ min}$

=5.247 m³/min

=87.45 L/S

=185.3 cfm

Battery Room (Nickel–Cadmium (Ni-Ca) Battery) Air-Change per Hour (ACH) rate is based on:

- NFPA 76 (Standard for the Fire Protection of Telecommunications Facilities 2009 Edition) - Fan capacity should be 1 CFM per square feet of floor space.
- NFPA 111 (Standard on Stored Electrical Energy Emergency and Standby Power Systems 2005 Edition) - Recommends a minimum of 2 air-changes per hour to remove gasses generated by vented batteries.
- ASHRAE Guideline 21 (Guide for Ventilation and Thermal Management of Batteries for Stationary Applications) - 1 CFM per charging amp, no less than 6 air-changes per hour.
- IMC (International Mechanical Code) - Fan capacity should be 1 CFM per square feet of floor space.
- IEEE 1635 (Institute of Electrical and Electronics Engineers Standard) - 1 CFM per charging amp, no less than 6 air-changes per hour.

 NISOC	نگهداشت و افزایش تولید میدان نفتی بینک سطح الارض و ابنیه تحت الارض عمومی و مشترک								
شماره پیمان: ۰۵۳ - ۰۷۳ - ۹۱۸۴	HVAC CALCULATION NOTE FOR SWITCHGEAR BUILDING – W007S							شماره صفحه: ۲۱ از ۲۱	
	پروژه	بسته کاری	صادرکننده	تسهیلات	رشته	نوع مدرک	سریال		نسخه
	BK	W007S	PEDCO	110	HV	CN	0001	D02	

Item		Service Area
		Battery Room
Equipment QTY.		1
Air Flow(L/S)		87.45
Air Flow(CFM)		185.30
Component Pressure Drop	Diffuser (In.WG.)	0.00
	Sand Trap Louver (In.WG.)	0.31
	Door Louver (In.WG.)	0.00
	Ducting (In.WG.)	0.00
Total Pressure Drop *	(In.WG.)	0.31
	(Pa)	77.14
Exhaust Fan ID		1201-EF-W007S-01
Exhaust Fan type		Wall Mounted/Axial
Power Supply (V/PH/Hz)		230/1/50
Power Consumption (w) Each Eq.**		180
REMARKE		Equipped With Exhaust Air Louver - Explosion Proof - Eexd-IIC-T3

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

** Power Consumption Should Be Finalized By Vendor.

5.3 SAND TRAP LOUVER SELECTION

$$\text{Air Flow} = 87.45 \frac{L}{S} = 185.30 \text{ CFM}$$

$$V_k = 400 \text{ fpm} = 2 \frac{m}{S} \text{ (Face velocity)}$$

$$\text{Required } A_k = \text{Air Flow} \div V_k = 185.30 \div 400 \text{ fpm} = 0.46 \text{ ft}^2 = 0.043 \text{ m}^2$$

Selected product information:

Model = SH.SAL.L- 18 × 12 (Shahrokhi Manufacturing CO.)

$$A_k = 0.046 \text{ m}^2, W=0.45 \text{ m}, H=0.3 \text{ m}, P.D. = 0.310 \text{ in.wg} = 77.14 \text{ pa}$$