طرح نگهداشت و افزایش تولید 27 مخزن

PROCESS BASIS OF DESIGN

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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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CONTENTS

1.0 INTRODUCTION

Binak oilfield in Bushehr province is a part of the southern oilfields of Iran, is located 25 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
EPD/EPC 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

Sub-Surface

- **New Wells & Manifold Extension:**

With the aim of increasing the oil production rate from BINAK field, the construction of flow lines and wellhead facilities has been on the agenda. Therefore, National Iranian South Oil Company has intends to establish the project of "Construction of flow lines and wellhead Facilities for BINAK Oil Field."

The most important activities and facilities needed for the project are as follows:

- Construction of 6 wells with 6 wellhead facilities series (class 5000 for wellhead facilities & class 3000 for flow lines)
- Construction of 6 flow lines with construction and installation of supports with all necessary facilities for pipelines and connecting lines to the manifold in BINAK Cluster unit.
- Design, Construction & Extension of existing manifold for connecting new 8 flow lines (which 2 connections will be considered for future) .As mentioned flow line of the six new wells connected to the header A/B on existing manifold(expands if needed) whit new connection and oil from existing oil sump send to header A/B of manifold via oil sump pump (P-1701),also considered two new flow line connection for new.

- **Workover wells (with electric power supply):**

Electrification for Wells in Binak Oil fields including 2 parts:

- Construction of 5 outdoor substations 11/0.42 KV & 1 outdoor substation 33/0.42 KV.

In this regard, engineering, procurement & installation of power transformers, diesel generators, LV switchgear, UPS, lighting & … are in contractor scope of work.

- Routing, detail design, procurement & construction of electrical transmission lines.

Surface

- **New Compressor Station:**

This document defines process design basis for Binak Compressor Station to process sour gas from Golkhari booster/cluster and Binak production unit with cumulative rate of 15 MMSCFD. The new compressors will be added “new” section of existing Binak compressor station plant. Excluding electrical power, which is supplied from existing facilities, all required utilities should be designed as part of project.

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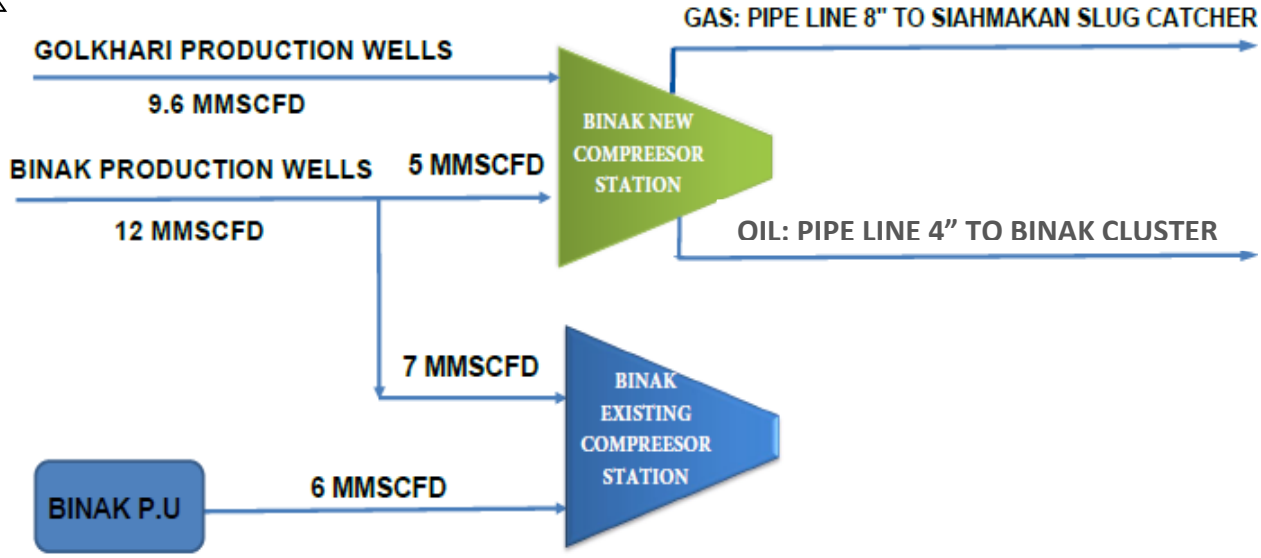

Figure No.1: Overall Block Diagram in Binak Compressor Station Area

- **Pipeline 8" & 4":**

With the aim of increasing the oil production rate from BINAK field, the construction of 8 inch gas transmission pipeline from new BINAK Compressor Station to SIAHMAKAN Gas Injection Station and 4 inch gas condensate transmission pipeline from new BINAK Compressor Station to BINAK Cluster, has been on the agenda.

3.0 NORMATIVE REFERENCES

3.1 LOCAL CODES AND STANDARDS

In design of this plant all of the IPS standard relevant to process must be considered, some of them which are more compatible to this project are listed below.

• Engineering Standard for Process Flow Diagram	IPS-E- PM-100
• Engineering Standard for General Design Requirements of Process Machineries	IPS-E- PR- 170
• Basic Design Package and Recommended Practice for Feasibility Studies	IPS-E- PR-150
• Engineering Standard for Basic Engineering Design Data	IPS-E-PR- 200

• Engineering Standard for Piping & Instrumentation Diagrams	IPS-E-PR- 230
• Engineering Standard for Process Design of Liquid & Gas Transfer & Storage	IPS-E-PR- 360
• Engineering Standard for Process Design of Piping Systems (Process Piping and Pipeline Sizing)	IPS-E-PR- 440
• Engineering Standard for Process Design of Pressure Relieving Systems Inclusive Safety Relief Valves	IPS-E-PR- 450
• General Standard For Towers, Reactors, Pressure Vessels And Internals	IPS-G-ME- 150

3.2 INTERNATIONAL CODES AND STANDARDS

11	ANSI	American National Standards Institute
12	API	American Petroleum Institute
13	ASME	American Society of Mechanical Engineers
14	ISA	Instrument Society of America
15	ISO	International Standards Organization
16	NACE	National Association of Corrosion Engineers
17	NFPA	National Fire Protection Association
18	OSHA	Occupational Safety and Health Act

3.3 THE PROJECT DOCUMENTS

The provided data of this document, such as summer and winter feed composition of GCS and 6 wellhead facilities series, Extension of existing manifold and Construction of two new pipelines are based on unit specifications which are given by client.

3.4 ENVIRONMENTAL DATA

Refer to "Process Basis of Design; section 7".

3.5 ABBREVIATIONS

NISOC:	National Iranian South Oil Company
PEDCO	Petro Iran Development Company
PFD	Process Flow Diagram
P&ID	Piping and Instrumentation Diagram
KOM	Kick off Meeting

MMSCFD	Million Standard Cubic Feet per Day
BBL	Barrel
SBLPD	Standard Barrel per Day
DP	Differential Pressure

4.0 PROCESS DESIGN BASIS

A new Binak compressor station with working (design) capacity of 15 MMSCFD with TEG dehydration package should be added into existing Binak compressor station facilities to increase feed gas pressure from 5.5 Barg to 54.8 Barg .In order to maximize flexibility of new compressor station, 2 +1 arrangement (2 in operation and 1 as standby) is considered for the system. Moreover:

- Flare system with smokeless facilities
- Instrument air and plant air facilities to cover demand of process

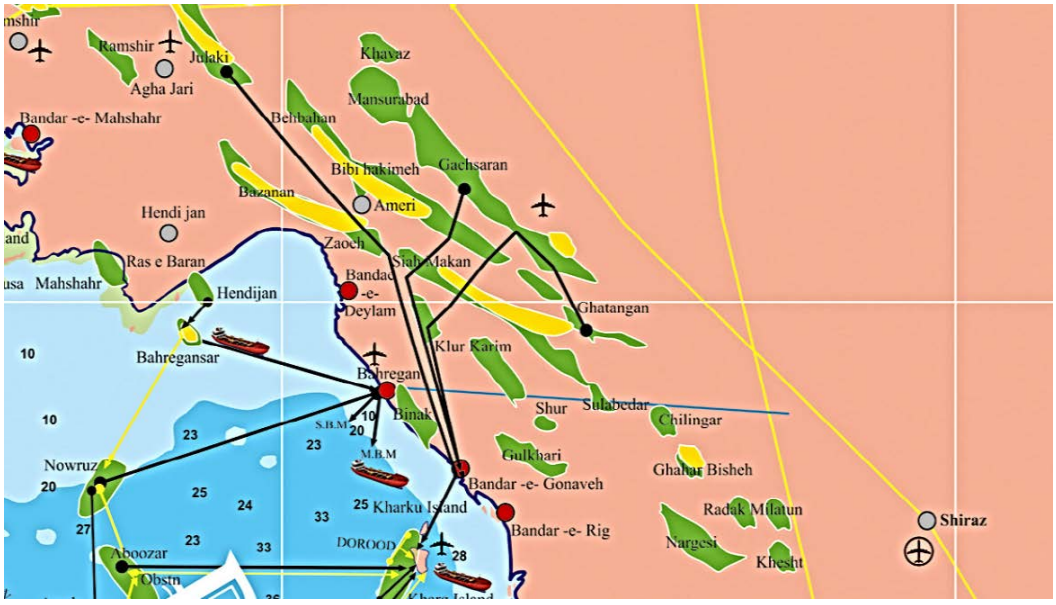

Figure No.2: Relative Location of Binak Oil Reservoir in South West of Iran

- Fire water system should be considered within design package.
- Nitrogen for tank blanketing, compressors sealing.
- Corrosion inhibitor package
- Fuel gas system
- Diesel Fuel Storage and pumping system
- Open & Closed Drain System
- Service Water System
- Oil water sump

- Waste Water collection pit
- Electrical Power System

and all required utility and off-site should be considered for safe operation of new compressor station.

5.0 FEED CHARACTERISTICS

5.1 COMPRESSOR STATION FEED CHARACTERISTICS

Table No.5-1.1 indicates feed Properties for use in design of compressor station:

Table No.5-1.1: Binak Compressor Station Feed Composition (dry basis)

Components	GOLKHARI		Binak	
	(Mol. %) in Summer	(Mol. %) in Winter	(Mol. %) in Summer	(Mol. %) in Winter
CO2	3.030	2.970	3.510	3.630
H2S	6.821	6.201	2.850	3.140
Methane	67.757	71.887	58.364	62.046
Ethane	11.951	11.231	17.658	17.592
Propane	6.311	5.021	10.719	9.181
i-Butane	0.620	0.430	1.290	0.940
n-Butane	1.310	0.870	2.980	2.030
i-Pentane	0.670	0.400	0.770	0.460
n-Pentane	0.320	0.180	0.500	0.280
n-Hexane	0.580	0.290	0.820	0.400
n-Heptane	0.150	0.070	0.290	0.120
n-Octane	0.050	0.020	0.080	0.030
n-Nonane	0.030	0.010	0.030	0.010
n-Decane	0.010	0.000	0.010	0.000
Nitrogen	0.390	0.420	0.130	0.140
Total	**100**	**100**	**100**	**100**
Feed Pressure, Barg	**5.5**	**5.5**	**5.5**	**5.5**
Feed Temperature, °C	**32.00**	**15.5**	**46.11**	**26.67**

5.2 GAS & CONDENSATE PIPELINE STUDY

There are two gas and condensate pipelines to be studied in this document which is described as below table:

Table No.5-2.1: Gas/Condensate Pipeline Properties

Item	Pipeline	Estimated Diameter (in)	Length (km)	From	To	Destination pressure (Barg)
1	Gas to SIAHMAKAN Gas Injection Station	8”	~44	BINAK Compressor Station	SIAHMAKAN Gas Injection Station	40
2	Gas condensate to BINAK Cluster	4”	~ 1.4	BINAK Compressor Station	BINAK BINAK Cluster	12.8

5.3 FLOWLINES AND WELLHEAD FACILITIES

Dry basis composition of the incoming fluid is given in following tables:

Table No.5-3.1: Asmari and Bangestan Crude Oil Composition

Reservoir Oil Component	Bangestan (%MOLE)	ASMARI (%MOLE)
H2S	0.32	0.17
Nitrogen	0.06	0.13
CO2	1.77	0.88
Methane	28.14	14.14
Ethane	9.74	5.3
Propane	7.78	6.37
i-Butane	1.47	1.4
n-Butane	4.16	4.51
i-Pentane	1.36	1.26
n-Pentane	1.36	1.19
n-Hexane	5.44	6.77
n-Heptane	6.24	6.13
n-Octane	3.81	3.98
n-Nonane	3.29	5.2
n-Decane	3.07	3.74
n-C11	2.58	3.11
C12+*BANGESTAN	19.31	-
C12+*ASMARI	-	35.72
C12+ of BANGESTAN: Sp.Gr = 0.9312 & Molecular weight = 454 C12+ of ASMARI: Sp.Gr = 0.9532 & Molecular weight = 418		

The volume percentage of water formed in crude oil is as following table:

Table No.5-3.2: Water Cut

Crude Oil	Volume Percent (%)
Asmari	0 ~ 15
Bangestan	3 ~ 40

The maximum and minimum amount of oil produced from the Bangestan & Asmari wells is provided in the following table:

Table No.5-3.3: Fluid Properties

WELL NO.	Minimum flow rate for well (bbl/day)	Maximum flow rate for well (bbl/day)
W018S (AS)	500	1500
W008N (AS)	500	1500
W028	1500	2500
W035	1500	2500
W046S	1000	1500
W007S	500	1000
BINK 5	500	1000
BINK 12	500	1000
BINK 14	500	1000
BINK 15	500	1000

5.4 WELLHEAD OPERATING CONDITION

Preliminary wellhead information for new oil production wells and flowlines from wellhead to production unit are reported in following table:

Table No.5-4.1: Asmari and Bangestan Wellhead Condition

RESERVOIR	Asmari	Bangestan
Wellhead Pressure (before Choke valve) (Barg)	43.81	43.81
Wellhead Shut-in Pressure (Barg)	193.79	310.34
Wellhead Temperature (before Choke valve) (°C)	75	80

Note: Pressure at the flow line destination is considered 12.78 Barg

6.0 EQUIPMENT DESIGN BASIS

6.1 COMPRESSORS

Three reciprocating compressor are considered to increase pressure of 15 MMSCMD of natural gas.

Table No.6-1.1: Binak Compressor Station Condition

BINAK New GCS	
Design Data	**BINAK STATION**
Gas transport Capacity (MMSCMD)	15.00
No. Of Duty / Stand By Gas Compressor Trains	2+1
Gas Product Outlet Temperature From GCS (˚C)	~ 60
Product Dew Point (˚C)	5

UTILITY CONDITIONS OF BINAK NEW GCS

6.2 COMPRESSED AND INSTRUMENT AIR

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Table No.6-2.1: Operating Conditions at Producer's Battery limit

System	Temperature (°C)			Pressure (bar g)		
	Min	Norm.	Max	Min	Norm.	Max

Instrument Air	-	60	65	-	9	-
Plant Air	-	60	65	-	4.5	-

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Table No.6-2.2: Operating Conditions at User's Battery limit

System	Temperature (°C)			Pressure (bar g)		
	Min	Norm.	Max	Min	Norm.	Max
Instrument Air	-	60	65	4.5	-	8.0
Plant Air	-	60	65	4.5	-	9.0

Table No.6-2.3: Mechanical Design Conditions

System	Temperature (°C)	Pressure (bar g)
Instrument Air	85	12.5
Plant Air	85	12.5

Other Characteristics

Plant air

- Oil and dust free
- Saturated Air

Instrument air

- Dew point at operating pressure: -40°C maximum at 8 barg.
- Oil content : nil
- Max. Particle size : 3µ

6.3 NITROGEN

Table No.6-3.1: Operating Conditions at Producer's Battery limit

System	Temperature (°C)			Pressure (bar g)		
	Min	Norm.	Max	Min	Norm.	Max

Nitrogen	-	60	-	-	8	-

Table No.6-3.2: Operating Conditions at User's Battery limit

System	Temperature (°C)			Pressure (bar g)		
	Min	Norm.	Max	Min	Norm.	Max
Nitrogen	-	60	-	-	7.5	-

Table No.6-3.3: Mechanical Design Conditions

System	Temperature (°C)	Pressure (bar g)
Nitrogen	85	12.5

6.4 FUEL OIL

Table No.6-4.1: Characteristics

Specification	Unit	Value	Test Method
Specific gravity at 60/60°F	-	0.820-0.860	ASTM D1298
FBP	°C	385 max	ASTM D86
Flash point	°F	130 min	ASTM D93
Sulphur total	%wt	1.0 max	ASTM D129
Viscosity kinematics at 100°F	cS	2.0-5.5	ASTM D445
Cloud point	°F	35 max	ASTM D2500
Pour point	°F	25 max	ASTM D97
Carbon residue (on 10% bottoms)	%wt	0.10 max	ASTM D189
Ash	%wt	0.01 max	ASTM D482
Water & sediment	%vol	0.05 max	ASTM D2709
Diesel index		55 min	ASTM IP21
Cetane index		50 min	ASTM D,976

Table No.6-4.2: Operating Conditions at User's Battery limit

System	Temperature (°C)	Pressure (Barg)

	Min	Norm.	Max	Min	Norm.	Max
Fuel Oil	-	Amb.	-	-	1.5	-

Table No.6-4.3: Mechanical Design Conditions

System	Temperature (°C)	Pressure (Barg)
Fuel Oil (V-2206)	85	ATM +FULL OF WATER

6.5 FUEL GAS

Table No.6-5.1: Operating Conditions at Producer's Battery limit

System	Temperature (°C)			Pressure (bar g)		
	Min	Norm.	Max	Min	Norm.	Max
Fuel Gas	-	48	-	-	4.9	-

Table No.6-5.2: Operating Conditions at User's Battery limit

System	Temperature (°C)			Pressure (bar g)		
	Min	Norm.	Max	Min	Norm.	Max
Fuel Gas	-	33~36	-	-	0.5~4.7	-

Table No.6-5.3: Mechanical Design Conditions

System	Temperature (°C)	Pressure (Barg)
Fuel Gas (V-2205)	85	9

Fuel Gas Physical Properties

Fuel gas is supplied from flashed gas in gas separator located in process area. Refer to Process Flow Diagram (PFDs) for Separation (BK-GCS-PEDCO-120-PR-PF-0001-PFD) for more detail for composition and specification of fuel gas.

6.6 ELECTRIC POWER

For plant electricity supply and also frequency and voltages levels, refer to Job specification "Electrical Design Criteria".

6.7 WATER

Table No.6-7.1: Operating conditions at producer's battery limit

System	Temperature (°C)			Pressure (bar g)		
	Min	Norm.	Max	Min	Norm.	Max
Plant (Utility)/Potable Water(NOTE)	-	Amb	-	-	0.7	-
Fire water	-	Amb	-	-	11	-

Note: Elevated Tank

Table No.6-7.2: Operating conditions at user's battery limit

System	Temperature(ºC)			Pressure (bar g)		
	Min	Norm.	Max	Min	Norm.	Max
Plant (Utility)/Potable Water	-	Amb	-	-	0.5	-
Fire water	-	Amb	-	-	10	-

Table No.6-7.3: Mechanical Design Conditions

System	Temperature (°C)	Pressure (bar g)
Plant (Utility)/Potable Water (TK-2209)	85	Atm+Full Of Water
Fire water (TK-2301 A/B)	85	Atm+Full Of Water

6.8 FLARE NETWORK

Table No.6-8.1: Operating Conditions

System	Maximum Back Pressure (barg)
LP Flare Network	*NOTE

Table No.6-8.2: Mechanical Design Conditions

System	Temperature (°C)	Pressure (bar g)
LP Flare Network	150*NOTE	*NOTE

*NOTE: Maximum back pressure will be finalized after flare network calculation.

**NOTE: Mechanical design temperature will be finalized after flare network calculation.

UTILITY CONDITIONS OF W007S; W046S, BK-05; BK-12; BK-14, BK15

6.9 WATER

Table No.6-9.1: Operating conditions

System	Temperature (°C)			Pressure (bar g)		
	Min	Norm	Max	Min	Norm.	Max
Plant (Utility)/Potable Water(NOTE)	-	Amb	-	-	0.4	-

Note: Elevated Tank

Table No.6-9.2: Mechanical Design Conditions

System	Temperature (°C)	Pressure (bar g)
Plant (Utility)/Potable Water	85	Atm+Full Of Water

6.10 FUEL OIL

Table No.6-10.1: Operating Conditions

System	Temperature (°C)			Pressure (Barg)		
	Min	Norm.	Max	Min	Norm.	Max
Fuel Oil	-	Amb.	-	-	0.25	-

Table No.6-10.2: Mechanical Design Conditions

System	Temperature (°C)	Pressure (Barg)
Fuel Oil	85	Atm+Full Of Water

7.0 SITE CONDITION

7.1 SITE LOCATION

Binak oilfield in Bushehr province is a part of the southern oilfields of Iran, is located 25 km northwest of Genaveh city.

Longitude: 50°, 35'
Latitude: 29°, 73'

- GCS UTM COORDINATES:

Table No.7-1.1: GCS UTM COORDINATION

NORTHING	EASTING
3289991.269	437245.830
3289761.280	437704.660

H.P.G and H.P.P. elevation +100.00 correspond to +11.20 M.S.L.

- SIAHMAKAN UTM COORDINATES:

Table No.7-1.2: SIAHMAKAN UTM COORDINATION

NORTHING	EASTING
3331743.89	438033.74

- BINAK **CLUSTER** UTM COORDINATES:

Table No.7-1.3: BINAK CLUSTER UTM COORDINATES

NORTHING	EASTING
3290752.321	438636.645

- WELLS COORDINATES

Table No.7-1.4: WELLS COORDINATES

WELL NO.	RESERVOIR	UTM COORDINATION	
		NORTHING	EASTING
W-018S	ASMARI	3291914	437440
W-008N	ASMARI	3291837	438713
W-028	BANGESTAN	3293091	437126
W-035	BANGESTAN	3293648	436604
W-046S	BANGESTAN	3294379	435604
W-007S	BANGESTAN	3290543	437425
BK-5	-	3286512	41725
BK-12	-	3288580	440692
BK-14	-	3295176	437805
BK-15	-	3287973	442385

7.2 GEOTECHNICAL DATA

According to general geological zoning of Iran, the proposed plant area is located in the coastal zone of Zagros Folded Belt in south-central Fars along the Persian Gulf.

From the lithological point of view the Zagros Folded Belt composed of a sequence of thick bedded sedimentary rocks mainly limestone, dolomite and marl of Paleozoic to Cenozoic age, folded during middle to Late Alpine Organic Stage in Tertiary.

7.3 BAROMETRIC PRESSURE

Table No.7-3.1: BAROMETRIC PRESSURE

Barometric pressure	BINAK New GCS	Flow Lines & Wellhead Facilities
Winter (Psia)	14.37	13.7
Summer (Psia)	13.26	13.2

7.4 ELEVATION

- Elevation from sea level for BINAK New GCS ~ 12.5 m
- Elevation from sea level for W-018S ~ 33.6 m
- Elevation from sea level for W-008N ~ 76.0 m
- Elevation from sea level for W-028 ~ 33.2 m
- Elevation from sea level for W-035 ~ 30.1 m
- Elevation from sea level for W-046S ~ 57.9 m
- Elevation from sea level for W-007S ~ 26.2 m
- Elevation from sea level for BK-5 ~ 50.0 m
- Elevation from sea level for BK-12 ~ 69.0 m
- Elevation from sea level for BK-14 ~ 190.0 m
- Elevation from sea level for BK-15 ~ 125.0 m

7.5 SOILS CONDITIONS

BINAK New GCS:

The basic data required are as follows:

- Seismic Zone : 0.3 g
- Soil Temp. in Winter :15.6ºC
- Soil Temp. in Summer: 32.2ºC

Flow Lines & Wellhead Facilities:

- Seismic Zone : 0.3 g

7.6 SOLAR RADIATION

BINAK New GCS:

- Solar radiation (maximum): 1010 W /m2

Flow Lines & Wellhead Facilities:

- Solar radiation: 946 W /m2

7.7 AMBIENT CONDITIONS

Table No.7-7.1: Ambient Conditions

LOCATION	BINAK New GCS	Flow Lines & Wellhead Facilities
Maximum ambient temperature (°C)	50	50
Minimum ambient temperature (°C)	5	-5
Maximum steel surface exposed to sun (°C)	85	85
Maximum summer dry bulb (°C)	50	-
DB/RH for Summer HVAC Design	41 °C / 61 % (Note */ Note**)	
DB FOR Winter HVAC Design	6 °C Note *	

* Refer to " HVAC Design Criteria; N.I.O.C. NO.: F-1-B-422001".

* *Refer to “NISOC Meteorological Studies Report".

7.8 RELATIVE HUMIDITY

BINAK New GCS & Flow Lines & Wellhead Facilities:

- Maximum Design relative humidity (%): 100
- Minimum Design relative humidity (%): 0

7.9 RAINFALL

BINAK New GCS:

- Maximum rainfall during one hour: 53 mm

Table No.7-9.1: BINAK New GCS RAINFALL

Month	Average Monthly (mm)
January	83.5
February	37.2
March	45.0
April	18.2
May	5.6
June	0.7
July	0.0
August	0.4
September	0.2
October	3.4
November	57.5
December	81.2
Annual	332.9

Flow Lines & Wellhead Facilities:

- Maximum rainfall during one year: 487.5 mm
- Maximum rainfall during one day: 138 mm

7.10 WIND CONDITIONS

BINAK New GCS:

<u>Design velocity and direction of prevailing wind:</u>

Wind velocity at 10m above ground level for:

- Structure calculation: 120 Km/h
- Wind velocity for thermal calculations 5 m/s
- Prevailing wind direction: NW to SE
- Flare thermal radiation 10 m/s

Flow Lines & Wellhead Facilities:

- Structure calculation: 120 Km/h

7.11 LIGHTINING STORMS

BINAK New GCS:

Isoceraunic Level 15 storm-day/year. The EPC Contractor shall inquiry and verifies these data from the related authorities.

7.12 AVERAGE LIGHTNING FLASH DENSITY

Flow Lines & Wellhead Facilities:

According to below map, 10-15 thunderstorm days per year exist in BINAK field. Average lightning flash density (Ng) may be estimated from following relationship:

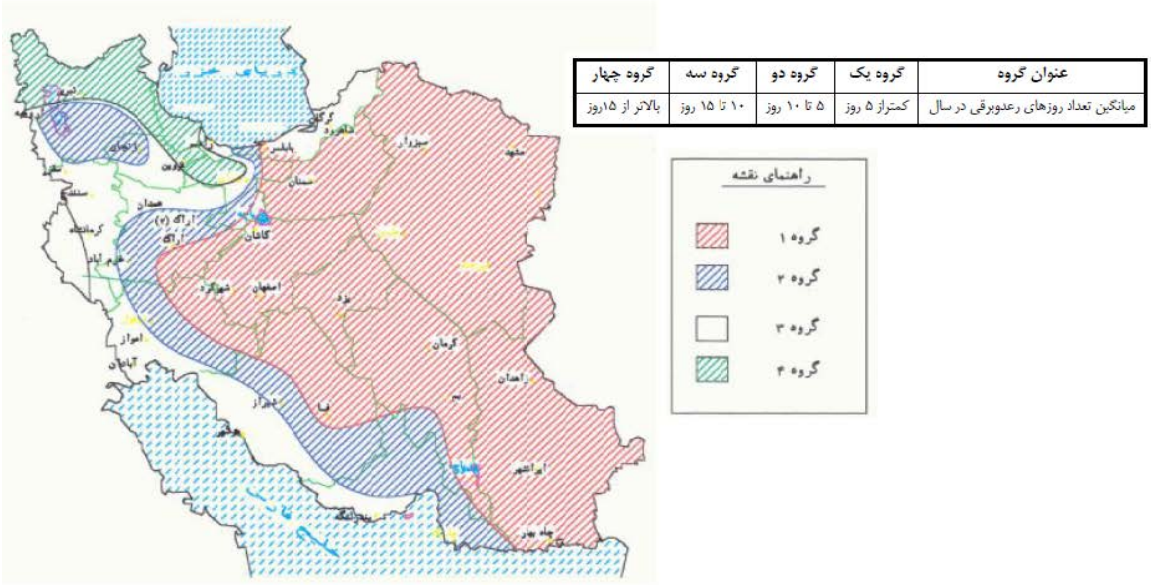
$$N_g = 0.04(T_d)^{1.25}$$

$$T_d = 15$$

$$N_g = 0.04(15)^{1.25} = 1.18$$

N_d = yearly lightning strike frequency to the structure or object

N_g = lightning ground flash density in flashes/km2/year



عنوان گروه	گروه یک	گروه دو	گروه سه	گروه چهار
میانگین تعداد روزهای رعدوبرقی در سال	کمتراز ۵ روز	۵ تا ۱۰ روز	۱۰ تا ۱۵ روز	بالاتر از ۱۵روز

8.0 GENERAL MATTERS

8.1 UNITS OF MEASUREMENT

As a general rule, the SI metric system of units shall be used and particularly:

- Pressure (gauge) Barg
- Pressure (absolute) Bara
- Mass kg
- Temperature °C
- Length m & mm except the pipes diameter for which "inches" are allowed
- Liquid relative density sp. gr. T ◦C /15◦C
- Liquid absolute density kg/cm3 at 15◦C
- Vapour flowing density kg/cm3
- Mass kg/h
- Liquid m3/h, l/min for fire fighting
- Normal conditions :
  Vapour Nm3 (m3 at 0◦C & 1.013 bar a) or Sm3 vapour (at 15◦C & 1.013 bar a)
  Liquid Std m3 (m3 at 15◦C)
- Specific enthalpy kj/kg
- Heat rate MW
- Gross calorific value kj/kg
- Viscosity (Dynamic) cp
- In addition to the above units, the following units shall be used for material balance purposes:
- Vapour flow rate MMSCFD Million Standard cubic feet per day (at 15◦C and 1.013 Bara).
- Liquid flow rate SBLPD or SBOPD Standard barrel of liquid, or Oil, per day (at 15◦C & 1.013 bar a).
- Absolute press=gauge press + barometric pressure.
- Gas Volumetric flow rate (standard [m3/hr], MMSCFD)
- Liquid volumetric flow rate ([m3/hr], STB/D at 15.50 [°C] and 14.70 [psia])

8.2 SERVICE LIFE

The design service life of the onshore plant is 25 years. (For Gas Compressor Station) and for other facilities (Transmission Pipelines & Flow lines & Wellhead facilities) shall be designed for a service life of 20 years.

8.3 TURNDOWN AND OVERDESIGN

Turndown refers to how flexible a compressor is at different operating conditions (flow and pressure).The greater the turndown capability of the compressor unit, the greater the flexibility the compressor unit has to operate under different flow and pressure conditions.

The turn down ratio and over design of compressor station plant is considered to be 40 % and 110% respectively.

9.0 LIST OF ENGINEERING SOFTWARS

Following computer programs approved and authorized for use during EPC stage:

Aspen HYSYS (Ver. 7.3 and higher): Plant Thermodynamic Simulation

Aspen Flare System Analyzer: Flare Network Calculation

Honeywell Predict 6.1: Corrosion prediction Tool

Flare sim: Flare Radiation Studies

Olga: Steady State Pipeline Hydraulic Calculation and Surge Analysis

AutoCAD P&ID: Process Drawing (PFD, P&IDs)

DNV Phast: Fire and Explosion Analysis (Consequence Analysis)

HTRI: Heat Exchanger Thermal Calculations