



نگهداشت و افزایش تولید میدان نفتی بینک
سطح الارض

احداث ردیف تراکم گاز در ایستگاه جمع آوری بینک



شماره پیمان:

053 - 073 - 9184

CALCULATION NOTE FOR LINE SIZING

نسخه	سریال	نوع مدرک	رشته	تسهیلات	صادرکننده	بسته کاری	پروژه
D06	0005	CN	PR	120	PEDCO	GCS	BK

شماره صفحه: 1 از 9

طرح نگهداشت و افزایش تولید 27 مخزن

CALCULATION NOTE FOR LINE SIZING

نگهداشت و افزایش تولید میدان نفتی بینک

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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



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شماره صفحه: 2 از 9

REVISION RECORD SHEET

PAGE	D00	D01	D02	D03	D04	D05	D06
1	X	X	X	X	X	X	X
2	X	X	X	X	X	X	X
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126							
127							
128							
129							
130							

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 <p>NISOC</p>	<p>نگهداشت و افزایش تولید میدان نفتی بینک سطح الارض</p> <p>احداث ردیف تراکم گاز در ایستگاه جمع آوری بینک</p>																	
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BK	GCS	PEDCO	120	PR	CN	0005	D06											

CONTENTS

1.0	INTRODUCTION	4
2.0	SCOPE	5
3.0	NORMATIVE REFERENCES.....	5
3.1	LOCAL CODES AND STANDARDS.....	5
3.2	INTERNATIONAL CODES AND STANDARDS	5
3.3	THE PROJECT DOCUMENTS.....	5
3.4	ENVIRONMENTAL DATA	5
3.5	ORDER OF PRECEDENCE.....	5
4.0	LINE SIZING CRITERIA.....	6
4.1	LIQUID LINES DESIGN CRITERIA	6
5.0	BASIC FORMULAE USED FOR LINE SIZING	7
6.0	GAS LINE DESIGN CRITERIA.....	8
7.0	TWO PHASE LINE DESIGN CRITERIA.....	8
8.0	LINE SIZING RESULTS.....	9
9.0	SOFTWARE	9
10.0	RESULT.....	9

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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.

As a part of the Project, a New Gas Compressor Station (adjacent to existing Binak GCS) shall be constructed to gather of 15 MMSCFD (approx.) associated gases and compress & transfer them to Siahmakan GIS.

GENERAL DEFINITION

The following terms shall be used in this document.

COMPANY:	National Iranian South Oilfields Company (NISOC)
PROJECT:	Binak Oilfield Development – Surface Facilities; New Gas Compressor Station
EPD/EPC CONTRACTOR:	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 COMPANY (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 COMPANY rather than by an EPC/EPD CONTRACTOR, supplier or VENDOR.
MAY:	Is used where a provision is completely discretionary.

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پروژه	بسته کاری	صادرکننده	تسهیلات	رشته	نوع مدرک	سریال	نسخه											
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2.0 SCOPE

This document covers minimum necessary requirements for the design, selection, manufacture, inspection, testing and delivery of BINAK.

It shall be used in conjunction with data/requisition sheets for present document subject.

3.0 NORMATIVE REFERENCES

3.1 LOCAL CODES AND STANDARDS

- IPS-E-PR-440 Engineering Standard for Process Design of piping system

3.2 INTERNATIONAL CODES AND STANDARDS

- ASTM American Society for Testing Materials Relevant Parts

3.3 THE PROJECT DOCUMENTS



- BK-GNRAL-PEDCO-000-PR-DB-0001 Process Basis of Design
- BK-GNRAL-PEDCO-000-PR-DC-0001 Process Design Criteria
- BK-GCS-PEDCO-120-PR-PF-0001 PFD
- BK-GCS-PEDCO-120-PR-PI-0002~0014 P&IDs

3.4 ENVIRONMENTAL DATA

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

3.5 ORDER OF PRECEDENCE

In case of any conflict between the contents of this document or any discrepancy between this document and other project documents or reference standards, this issue must be reported to the CLIENT. The final decision in this situation will be made by CLIENT.

 NISOC	نگهداشت و افزایش تولید میدان نفتی بینک سطح الارض احداث ردیف تراکم گاز در ایستگاه جمع آوری بینک																
شماره پیمان: 053-073-9184	CALCULATION NOTE FOR LINE SIZING	شماره صفحه : 6 از 9															
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D06	0005	CN	PR	120	PEDCO	GCS	BK										



4.0 LINE SIZING CRITERIA

4.1 LIQUID LINES DESIGN CRITERIA

For liquid single phase the pressure drop and velocity limitation is as following table:

	DP(bar/km)		Max. Velocity (m/s)			
	Norm.	Max.	To 2"	3" to 6"	8"to18"	From 20"
Pump suction						
Liquid at bubble point/ with dissolved gas	0.6	0.9	0.6	0.9	1.2	1.5
Non boiling liquid	2.3	3.5	0.9	1.2	1.5	1.8
Unit lines						
- Liquid at bubble point/ with dissolved gas	0.6	1.0	0.6	1.0	1.4	1.8
- Non boiling liquid	2.3	3.5	0.9	1.2	1.8	2.4
Pump discharge (1)						
- Disch. Pres.<=50 barg	3.5	4.5	1.5 to 4.5			6.0
- Disch. Pres.> 50 barg	7.0	9.0	1.5 to 4.5			6.0
Gravity flow			0.25	0.45	0.6	0.6
Cooling & service water						
- Large feeders between pumps and units	1.5		1.5 to 3.0 m/s			
- Unit lines (long)		1.5	1.5	2.5	3.0	3.0
- Unit lines (short)		3.5	1.5	2.5	3.0	3.0

Note 1: 3.0 m/s maximum (2 m/s average) at storage tank inlet or in loading.

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نسخه	سریال	نوع مدرک	رشته	تسهیلات	صادرکننده	بسته کاری	پروژه											
D06	0005	CN	PR	120	PEDCO	GCS	BK											

5.0 BASIC FORMULAE USED FOR LINE SIZING

- Friction Factor

1) Laminar Zone ($N_{RE} \leq 2,000$)

$$f = \frac{64}{N_{RE}}$$

where,

N_{RE} = Reynolds Number, Dimensionless Group

2) Turbulent Zone ($N_{RE} \geq 4,000$)

$$\frac{1}{\sqrt{f}} = -2 \times \log \left[\frac{k/D}{3.7065} - \frac{5.0452}{N_{RE}} \log A_4 \right]$$

where,

f = Moody Friction Factor

k = Absolute Pipe Roughness, m

D = Inside Pipe Diameter, m

N_{RE} = Reynolds Number, Dimensionless Group

$$A_4 = \frac{(k/D)^{1.1098}}{2.8257} + \left(\frac{7.149}{N_{RE}} \right)^{0.8981}$$

- Pressure Drop

Darcy-Weisbach Equation

$$h_f = \left(f \frac{L}{D} \right) \left(\frac{V^2}{2g} \right)$$

where,

h_f = Friction Loss, m



L = Pipe Length, m

D = Average Inside Diameter of Pipe, m

V = Average Pipe Velocity, m/sec

g = Gravitational Constant, 9.8m/sec²

f = Friction Factor, Dimensionless Number

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6.0 GAS LINE DESIGN CRITERIA

For gas single phase the pressure drop and velocity limitation is as following table:

<u>SERVICE</u>	pv^2 Maxi (Pa)	ΔP (Norm./Max) (bar/km)
- Single phase		Max=3.5
	$p \leq 20 \text{ barg}$	6000
	$20 < p < 50 \text{ barg}$	7500
	$50 < p < 80 \text{ barg}$	10000
	$p \geq 80 \text{ barg}$	15000
- Compressor Suction	Same as Single Phase in Continuous Operation	0.2/0.7
- Compressor Discharge		0.45/1.15

- Roughness factor for piping is assumed as commercial steel pipe which is 0.05 mm.
- Relief valve inlet and outlet lines shall be sized based on the requirements in API RP 520.
- Pressure drop in the PSV inlet line shall not exceed 3% of the set pressure based on the rated capacity of the valve
- V Max value shall be consistent with the pv^2 criteria used for general gas lines design.
- Velocity shall be limited in the range given in annex1 (identical to guide book 4.4.1 "piping", chap.II, graph II.2) depending on compressor type

7.0 TWO PHASE LINE DESIGN CRITERIA

The following guidelines are recommended in sizing the lines with two phase lines:

High velocity in two phase lines can cause rapid wear by erosion, hence the calculated velocity shall not exceed the erosion velocity (the velocity at which erosion may occur).



The erosion velocity is calculated by the formula given in API RP 14E as:

$$V_e = \frac{1.22C}{\sqrt{\rho_m}}$$

V_e : erosional velocity in m/s

ρ_m : Gas/liquid mixture density at flowing conditions in kg/m^3

The multiphase mixture density ρ_m can be determined by the following equation:

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$$\rho_m = \frac{m_m}{\frac{m_L}{\rho_L} + \frac{m_G}{\rho_G}}$$

Where:

m_m : total mass flow rate, kg/sec ($m_m = m_L + m_G$)

m_L : liquid mass flow rate, kg/sec

m_G : Gas mass flow rate, kg/sec

C: empirical constant equal to 122.045 to 152.556 for continuous flow. "C" value up to 244 can be considered on peak flow rate only in case of absence of abrasive (solid) particles such as sand.

It is widely accepted in the industry that above simple criterion is inadequate, where it is for clean service (non-corrosive and sand free) and the limits should be reduced if sand and the limits should be reduced if sand or corrosive conditions are present.

Alternatively the mixture density can be determined from the HYSYS simulation program.

8.0 LINE SIZING RESULTS

All Two phase, gas and liquid line sizing was performed according to the above design criteria and the result is shown on Attachment 01.

9.0 SOFTWARE

For the purpose of calculating line sizes and pressure drops the following software shall be used:

- Aspen Hysys 11
- In house Line Calculation Spreadsheet.

10.0 RESULT



Please find Attachment-01