

 NISOC	نگهداشت و افزایش تولید میدان نفتی بینک فعالیت های روزمینی در بسته های کاری تحت الارض عمومی و مشترک																	
شماره پیمان:	PIPELINE WALL THICKNESS CALCULATION	شماره صفحه: ۱ از ۹																
۰۵۳ - ۰۷۳ - ۹۱۸۴	<table><tr><td>پروژه</td><td>بسته کاری</td><td>صادر کننده</td><td>تسهیلات</td><td>رشته</td><td>نوع مدرک</td><td>سریال</td><td>نسخه</td></tr><tr><td>BK</td><td>SSGRL</td><td>PEDCO</td><td>110</td><td>PL</td><td>CN</td><td>0001</td><td>D04</td></tr></table>	پروژه	بسته کاری	صادر کننده	تسهیلات	رشته	نوع مدرک	سریال	نسخه	BK	SSGRL	PEDCO	110	PL	CN	0001	D04	
پروژه	بسته کاری	صادر کننده	تسهیلات	رشته	نوع مدرک	سریال	نسخه											
BK	SSGRL	PEDCO	110	PL	CN	0001	D04											

طرح نگهداشت و افزایش تولید ۲۷ مخزن

PIPELINE WALL THICKNESS CALCULATION

نگهداشت و افزایش تولید میدان نفتی بینک

D04	OCT. 2023	AFD	M.Noori	M.Fakharian	S.Faramarzpour	
D03	OCT. 2022	AFD	M.Noori	M.Fakharian	M.Mehrshad	
D02	AUG. 2022	AFD	F.Mosayebnejad	M.Fakharian	M.Mehrshad	
D01	DEC. 2021	IFA	H.Shahrokhi	M.Fakharian	M.Mehrshad	
D00	OCT. 2021	IFC	H.Shahrokhi	M.Fakharian	M.Mehrshad	
Rev.	Date	Purpose of Issue/Status	Prepared by:	Checked by:	Approved by:	CLIENT Approval

Class: 2

CLIENT Doc. Number: F0Z-707363

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
فعالیت های رو زمینی در بسته های کاری تحت الارض
عمومی و مشترک



شماره پیمان:

۰۵۳ - ۰۷۳ - ۹۱۸۴

PIPELINE WALL THICKNESS CALCULATION

نسخه	سریال	نوع مدرک	رشته	تسهیلات	صادرکننده	بسته کاری	پروژه
D04	0001	CN	PL	110	PEDCO	SSGRL	BK

شماره صفحه: ۲ از ۹

REVISION RECORD SHEET

PAGE	D00	D01	D02	D03	D04
1	X	X	X	X	X
2	X	X	X	X	X
3	X				
4	X				
5	X	X			
6	X	X			
7	X	X			
8	X	X		X	X
9	X	X		X	X
10		X			
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					
21					
22					
23					
24					
25					
26					
27					
28					
29					
30					
31					
32					
33					
34					
35					
36					
37					
38					
39					
40					
41					
42					
43					
44					
45					
46					
47					
48					
49					
50					
51					
52					
53					
54					
55					
56					
57					
58					
59					
60					
61					
62					
63					
64					
65					

PAGE	D00	D01	D02	D03	D04
66					
67					
68					
69					
70					
71					
72					
73					
74					
75					
76					
77					
78					
79					
80					
81					
82					
83					
84					
85					
86					
87					
88					
89					
90					
91					
92					
93					
94					
95					
96					
97					
98					
99					
100					
101					
102					
103					
104					
105					
106					
107					
108					
109					
110					
111					
112					
113					
114					
115					
116					
117					
118					
119					
120					
121					
122					
123					
124					
125					
126					
127					
128					
129					
130					

 NISOC	نگهداشت و افزایش تولید میدان نفتی بینک فعالیت های روزمینی در بسته های کاری تحت الارض عمومی و مشترک																									
شماره پیمان: ۰۵۳ - ۰۷۳ - ۹۱۸۴	<table><tr><th colspan="8">PIPELINE WALL THICKNESS CALCULATION</th></tr><tr><th>پروژه</th><th>بسته کاری</th><th>صادر کننده</th><th>تسهیلات</th><th>رشته</th><th>نوع مدرک</th><th>سریال</th><th>نسخه</th></tr><tr><td>BK</td><td>SSGRL</td><td>PEDCO</td><td>110</td><td>PL</td><td>CN</td><td>0001</td><td>D04</td></tr></table>	PIPELINE WALL THICKNESS CALCULATION								پروژه	بسته کاری	صادر کننده	تسهیلات	رشته	نوع مدرک	سریال	نسخه	BK	SSGRL	PEDCO	110	PL	CN	0001	D04	شماره صفحه: ۳ از ۹
PIPELINE WALL THICKNESS CALCULATION																										
پروژه	بسته کاری	صادر کننده	تسهیلات	رشته	نوع مدرک	سریال	نسخه																			
BK	SSGRL	PEDCO	110	PL	CN	0001	D04																			

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.....	6
3.5	ORDER OF PRECEDENCE.....	6
4.0	GENERAL	6
5.0	CALCULATION NOTE & DESIGN DATA	6
5.1	GENERAL	6
5.2	NOMENCLATURE.....	6
5.3	CALCULATION FORMULA.....	7
6.0	LINE SERVICE INDEX.....	7
7.0	THICKNESS CALCULATION.....	8

 NISOC	نگهداشت و افزایش تولید میدان نفتی بینک فعالیت های رو زمینی در بسته های کاری تحت الارض عمومی و مشترک								
شماره پیمان: ۰۵۳ - ۰۷۳ - ۹۱۸۴	PIPELINE WALL THICKNESS CALCULATION							شماره صفحه : ۴ از ۹	
	پروژه	بسته کاری	صادر کننده	تسهیلات	رشته	نوع مدرک	سریال		نسخه
	BK	SSGRL	PEDCO	110	PL	CN	0001	D04	

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, construction of well location, access roads, wellhead facilities for 6 new wells (with electric power supply for 2 of them) and required modifications on 4 workover wells (with electric power supply) shall be done. In addition, construction of 6 new flowlines from new wells to Binak B/C unit (with extension of relevant manifold) are in the Project scope of work.

GENERAL DEFINITION

The following terms shall be used in this document.

CLIENT:	National Iranian South Oilfields Company (NISOC)
PROJECT:	Binak Oilfield Development – Construction of New Well Locations, Modifications on Workover Wells, Wellhead Facilities, Electrification Facilities, Flowlines and Extension of Binak B/C Manifold
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.

 NISOC	نگهداشت و افزایش تولید میدان نفتی بینک فعالیت های رو زمینی در بسته های کاری تحت الارض عمومی و مشترک								
شماره پیمان: ۰۵۳ - ۰۷۳ - ۹۱۸۴	PIPELINE WALL THICKNESS CALCULATION							شماره صفحه : ۵ از ۹	
	پروژه	بسته کاری	صادر کننده	تسهیلات	رشته	نوع مدرک	سریال		نسخه
	BK	SSGRL	PEDCO	110	PL	CN	0001	D04	

2.0 SCOPE

This document covers the wall thickness calculation for Binak 6 new wellheads and flow lines based on IPS standard (IPS-E-PI-140), ASME B 31.4 and ASME B 31.8.

3.0 NORMATIVE REFERENCES

The latest edition of following codes & standards are applicable in this project (unless otherwise):

3.1 LOCAL CODES AND STANDARDS

- IPS-E-PI-140 Engineering Standard for Onshore Transportation Pipelines
- IPS-M-PI-190 Material and Equipment Standard for Line Pipe
- NOSIC-S4L8001-001D 3000 API Rating Production Wellhead Fittings-6"
- NOSIC-S4L8004-001C 3000 Bangestan Production Wellhead Fittings-6"
- NOSIC-S5L-9002-0010 5000API/3000 API Oil Well Production Wellhead Fittings 6"

3.2 INTERNATIONAL CODES AND STANDARDS

- ASTM American Society for Testing Materials Relevant Parts
- API 5L Specification for Line Pipe
- ASME B31.8 Gas Transmission and Distribution Piping Systems
- ASME B31.4 Pipeline Transportation Systems for Liquid Hydrocarbons and Other Liquids Unified screw threads
- ASME B 36.10 Welded and Seamless Wrought Steel Pipe
- NACE MR 0175-ISO 15156 Petroleum and Natural Gas Industries. Materials for use in H2S Containing Environments in Oil and Gas Production

3.3 THE PROJECT DOCUMENTS

- BK-SSGRL-PEDCO-110-PL-RT-0001 Pipeline Corrosion Study & Material Selection Report
- BK-GNRAL-PEDCO-000-PR-DB-0001 Process Basis of Design
- BK-GNRAL-PEDCO-000-PL-DC-0001 Pipeline Design Criteria

 NISOC	نگهداشت و افزایش تولید میدان نفتی بینک فعالیت های رو زمینی در بسته های کاری تحت الارض عمومی و مشترک								
شماره پیمان: ۰۵۳ - ۰۷۳ - ۹۱۸۴	PIPELINE WALL THICKNESS CALCULATION							شماره صفحه: ۶ از ۹	
	پروژه	بسته کاری	صادرکننده	تسهیلات	رشته	نوع مدرک	سریال		نسخه
	BK	SSGRL	PEDCO	110	PL	CN	0001	D04	

- BK-SSGRL-PEDCO-110-PL-SP-0001 Pipeline Material Specification

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 requirements specified herein & the requirements of any other referenced document, this subject shall be reflected to CLIENT and the final decision will be made by CLIENT.

4.0 GENERAL

Candidate material for pipeline as per Corrosion Study & Material Selection Report (with Doc. No. BK-SSGRL-PEDCO-110-PL-RT-0001) is carbon steel with 3 mm corrosion allowance. This document presents the calculation procedure of carbon steel pipeline wall thickness.

The types, size, length, operating & design pressure and temperature and service condition of pipelines (according to process documents such as Process Basis of Design with Doc. No. BK-GNRAL-PEDCO-000-PR-DB-0001, Pipeline Design Criteria with Doc. No. BK-GNRAL-PEDCO-000-PL-DC-0001) are as following tables.

5.0 CALCULATION NOTE & DESIGN DATA

5.1 GENERAL

The required thickness of straight sections of pipe shall be determined in accordance with Eq. (2) $t_m = t + c$

5.2 NOMENCLATURE

tm: Minimum required thickness, including mechanical, corrosion, and erosion allowances

- **t** Calculated Wall Thickness (in)
- **ts** Selected Wall Thickness (in)
- **P** Design Pressure (psig)
- **D** Nominal Pipe Diameter (in)
- **Sy** Specified Minimum Yield Strength (psi) (as per appendix D)
- **F** Design Factor (as per Table 841.1.6-2)
- **E** Longitudinal Joint Efficiency (as per Table 841.1.7-1)
- **C** Corrosion & Erosion Allowance (in)

 NISOC	نگهداشت و افزایش تولید میدان نفتی بینک فعالیت های روزمینی در بسته های کاری تحت الارض عمومی و مشترک																									
شماره پیمان: ۰۵۳ - ۰۷۳ - ۹۱۸۴	<table><tr><th colspan="8">PIPELINE WALL THICKNESS CALCULATION</th></tr><tr><th>پروژه</th><th>بسته کاری</th><th>صادر کننده</th><th>تسهیلات</th><th>رشته</th><th>نوع مدرک</th><th>سریال</th><th>نسخه</th></tr><tr><td>BK</td><td>SSGRL</td><td>PEDCO</td><td>110</td><td>PL</td><td>CN</td><td>0001</td><td>D04</td></tr></table>	PIPELINE WALL THICKNESS CALCULATION								پروژه	بسته کاری	صادر کننده	تسهیلات	رشته	نوع مدرک	سریال	نسخه	BK	SSGRL	PEDCO	110	PL	CN	0001	D04	شماره صفحه: ۸ از ۹
PIPELINE WALL THICKNESS CALCULATION																										
پروژه	بسته کاری	صادر کننده	تسهیلات	رشته	نوع مدرک	سریال	نسخه																			
BK	SSGRL	PEDCO	110	PL	CN	0001	D04																			

7.0 THICKNESS CALCULATION

- For Pipeline

Piping Class	Material	Design PRESS. <P> (Psig)	Design TEMP. (deg. C)	Corrosion Allowance <C>(mm)	Specific Min. Yield Strength <Sy> (Psi)	Design Factor <F>	Welding Factor <E>
LN15	API 5L-B PSL 2 for <2"	1035	85	3	35000	0.72	1.00
	API 5L-X52 PSL 2 for ≥2"				52000		

CALCULATING PROCEDURE BY ASME B31.4

$$t = \frac{P \times D}{2 \times S_y \times F \times E}$$

$$t_m = t + C$$

where ;

t_m = minimum required thickness (mm)

t = calculated thickness (mm)

C = corrosion allowance (mm)

P = design pressure (Psig)

D = outside diameter (mm)

S_y = specific minimum yield strength (Psi)

E = Weld Joint Factor

F = design factor

NPS	PIPE O.D.	CALCULATED THICKNESS		SELECTED WALL THICK. (mm)
Inch	<D> (mm)	t (mm)	t _m (mm)	
1/2	21.3	0.43	3.43	Sch.160
3/4	26.7	0.55	3.55	Sch.160
1	33.4	0.68	3.68	Sch.160
1 1/2	48.3	0.99	3.99	Sch.160
2	60.3	0.83	3.83	Sch. 40
3	88.9	1.22	4.22	Sch. 40
4	114.3	1.57	4.57	7.9 mm (Note 1)
6	168.3	2.33	5.33	7.9 mm (Note 1)

Note 1:

Final thickness of flowlines will be 7.9mm. So considering design pressure of 1035 psi and design factor of 0.72, the actual corrosion allowance would be 5.5 mm which is sufficient for the corrosion calculations.

 NISOC	نگهداشت و افزایش تولید میدان نفتی بینک فعالیت های روزمینی در بسته های کاری تحت الارض عمومی و مشترک																									
شماره پیمان: ۰۵۳ - ۰۷۳ - ۹۱۸۴	<table><tr><th colspan="8">PIPELINE WALL THICKNESS CALCULATION</th></tr><tr><th>پروژه</th><th>بسته کاری</th><th>صادر کننده</th><th>تسهیلات</th><th>رشته</th><th>نوع مدرک</th><th>سریال</th><th>نسخه</th></tr><tr><td>BK</td><td>SSGRL</td><td>PEDCO</td><td>110</td><td>PL</td><td>CN</td><td>0001</td><td>D04</td></tr></table>	PIPELINE WALL THICKNESS CALCULATION								پروژه	بسته کاری	صادر کننده	تسهیلات	رشته	نوع مدرک	سریال	نسخه	BK	SSGRL	PEDCO	110	PL	CN	0001	D04	شماره صفحه: ۹ از ۹
PIPELINE WALL THICKNESS CALCULATION																										
پروژه	بسته کاری	صادر کننده	تسهیلات	رشته	نوع مدرک	سریال	نسخه																			
BK	SSGRL	PEDCO	110	PL	CN	0001	D04																			

- For Crossings

Piping Class	Material	Design PRESS. <P> (Psig)	Design TEMP. (deg. C)	Corrosion Allowance <C>(mm)	Specific Min. Yield Strength <S _y > (Psi)	Design Factor <F>	Welding Factor <E>
LN15	API 5L-B PSL 2 for <2"	1035	85	3	35000	0.6	1.00
	API 5L-X52 PSL 2 for ≥2"				52000		

CALCULATING PROCEDURE BY ASME B31.4

$$t = \frac{P \times D}{2 \times S_y \times F \times E}$$

$$t_m = t + C$$

where ;

t_m = minimum required thickness (mm)

t = calculated thickness (mm)

C = corrosion allowance (mm)

P = design pressure (Psig)

D = outside diameter (mm)

S_y = specific minimum yield strength (Psi)

E = Weld Joint Factor

F = design factor

NPS	PIPE O.D.	CALCULATED THICKNESS		SELECTED WALL THICK. (mm)
		t (mm)	t _m (mm)	
1/2	21.3	0.52	3.52	Sch.160
3/4	26.7	0.66	3.66	Sch.160
1	33.4	0.82	3.82	Sch.160
1 1/2	48.3	1.19	4.19	Sch.160
2	60.3	1.00	4.00	Sch. 80
3	88.9	1.47	4.47	Sch. 40
4	114.3	1.90	4.90	7.9 mm (Note 1)
6	168.3	2.79	5.79	7.9 mm (Note 1)

Note 1:

Final thickness of flowlines will be 7.9mm. So considering design pressure of 1035 psi and design factor of 0.6, the actual corrosion allowance would be 5 mm which is sufficient for the corrosion calculations.