

عمومی و مشترک



شماره پیمان:

053 - 073 - 9184

PIPING WALL THICKNESS CALCULATION							
پروژه	بسته کاری	صادر کننده	تسهيلات	رشته	نوع مدرك	سريال	نسخه
BK	SSGRL	PEDCO	110	PI	CN	0001	D03

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طرح نگهداشت و افزایش تولید 27 مخزن

PIPING WALL THICKNESS CALCULATION

نگهداشت و افزایش تولید میدان نفتی بینک

Rev.	Date	Purpose of Issue/Status	Prepared by:	Checked by:	Approved by:	CLIENT Approval
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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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PIPING WALL THICKNESS CALCULATION نوع مدرک رشته تسهیلات صادر کننده بسته کاری پروژه سريال نسخه ΒK SSGRL PEDCO 110 Ы CN 0001 D03

REVISION RECORD SHEET

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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, construction of well location, access road, wellhead facilities (with electric power supply) for W007S shall be done. In addition, construction of new flowline from aforementioned well location 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 CLIENT (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.



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2.0 SCOPE

This specification covers the wall thickness calculation for BINAK new wellhead facilities and manifold extension.

3.0 NORMATIVE REFERENCES

3.1 LOCAL CODES AND STANDARDS

ASTM A333/A333M

• IPS-E-PI-140 Engineering Standard for Onshore Transportation Pipelines

3.2 INTERNATIONAL CODES AND STANDARDS

_	INTERNATIONAL CODES AND S	HANDARDS
•	ASME B16.5	Pipe Flanges and Flanged Fitting
•	ASME B16.47	Large Diameter Steel Flanges
•	ASME B31.3	Process Piping
•	ASME B31.4	Pipeline Transportation Systems for Liquid Hydrocarbons and Other Liquids
•	ASME B31.8	Gas Transmission and Distribution Piping Systems
•	ASME B36.10	Welded and Seamless Wrought Steel Pipe
•	ASME B36.19	Stainless Steel Pipe
•	ASTM A105/A105M	Carbon Steel Forgings for Piping Applications
•	ASTM A106/A106M	Seamless Carbon Steel Pipe for High- Temperature Service
•	ASTM A153/A153M	Zinc Coating (Hot-Dip) on Iron and Steel Hardware
•	ASTM A182/A182M	Forged or Rolled Alloy and Stainless Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service
•	ASTM A216/A216M	Steel Castings, Carbon, Suitable for Fusion Welding, for High-Temperature Service
•	ASTM A234/A234M	Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service
•	ASTM A240/A240M	Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications
•	ASTM A312/A312M	Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes
•	ASTM A320/A320M	Alloy-Steel and Stainless Steel Bolting for Low- Temperature Service

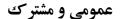
Seamless and Welded Steel Pipe for Low-

Temperature Service



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نگهداشت و افزایش تولید میدان نفتی بینک فعالیت های رو زمینی در بسته های کاری تحت الارض



PIPING WALL THICKNESS CALCULATION



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• ASTM	A351/A	.351M			stings,		ic, for P	ressu	ire-Containing
• ASTM	A352/A	352M		Pre	ssure	•	ng Part		rtensitic, for table for Low-
• ASTM	A358/A	.358M		Nic	kel St	ainless S	teel Pip	e for l	itic Chromium- High- eral Applications
• ASTM	A403/A	403M			ought ings	Austenition	c Stainle	ess St	teel Piping
• ASTM	A420/A	420M		•	•	•	•		oon Steel and e Service
• ASTM	A516/A	516M					-		n Steel, for ture Service
• ASTM	A671/A	.671M		Ele	ctric-F	usion-We eric and L	elded S	teel P	ipe for
• ASTM	A694/A	.694M		Car Fla	bon anges,	nd Alloy	Steel Fo Valves,	orging and F	s for Pipe Parts for High-
ASTM	A860/A	.860M		Wro	ought	High-Stre	ength Fe	erritic	Steel Butt-

Aluminum-Bronze Sand Castings ASTM B148 Specification for Line Pipe API 5L

Standard Finishes for Contact Faces of Pipe MSS SP-6 Flanges and Connecting-End Flanges of

Valves and Fittings

Welding Fittings

Petroleum and Natural Gas Industries-NACE MR0175-ISO 15156

Materials for Use in H2S-Containing Environments in Oil and Gas Production

3.3 THE PROJECT DOCUMENTS

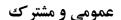
BK-SSGRL-PEDCO-110-PI-RT-0001 Piping Corrosion Study & Material Selection Report

Piping Material Specification BK-SSGRL-PEDCO-110-PI-SP-0001

3.4 **ENVIRONMENTAL DATA**

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







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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.

4.0 ABBREVIATIONS

AFC Approved For Construction

AFD Approved For Design

API American Petroleum Institute

ASME American Society of Mechanical Engineers
ASTM American Society for Testing and Material

CL Class

Cr Chromium

C.S. Carbon Steel

EFW Electric Fusion Welded

FF Flat Faced

Gr. Grade

HIC Hydrogen-Induced Cracking

L.T.C.S. Low Temperature Carbon Steel

MSS Manufacturers Standardization Society

NPS Nominal Pipe Size

PWHT Post Weld Heat Treatment

RF Raised Face

RTJ Ring Type Joint

SAW Submerged Arc Welding

SCH. Schedule SMLS Seamless

SMYS Specified Minimum Yield Strength

S.S. Stainless Steel

STD Standard
THK Thickness



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5.0 DESIGN

5.1 DEFINITION AND TERMINOLOGY

5.1.1 CA

Corrosion Allowance (based on Piping Material Specification and Corrosion Study)

5.1.2 DESIGN LIMITS

Design Pressure / Design Temperature limits given in piping classes (based on Piping Material Specification) and are applied in Wall Thickness Calculation Table

5.2 PIPING WALL THICKNESS CALCULATIONS 5.2.1 GENERAL

Based on ASME Codes for Pressure Piping Systems B31, there are three main different codes which are applicable in this project regard to Wall Thickness Calculation as follow.

5.2.2 PIPES WHICH ARE SUBJECTED TO REQUIREMENTS OF ASME B31.3

This codes deals with the pipes that are typically found in Petrochemical, Oil refineries, Gas Plants, Cryogenic Plants and related terminals.

Pressure Design of Pipes

Piping wall thickness calculation process follows the following formula:

 $t_{mil} = t_m / ((100-M)/100) = t_m /0.875$

 $t_{\rm m} = t + c$

Where:

t_{mil} = Calculated wall thickness considering Mill Tolerance

M= Mill Tolerance=12.5

- t_{m} = Minimum required thickness including mechanical, corrosion, and erosion allowances.
- C = Sum of mechanical allowances (groove and thread depth) plus corrosion and erosion allowances.
- T = The minimum thickness, for the pipe selected considering manufacturer's minus tolerance shall be not less than t_{m}
- t = Pressure designed thickness calculated as following formula if t < D/6



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$$t = \frac{PD}{2(SEW + PY)}$$

Where:

- P = Internal Design Gauge Pressure. The design pressure of each component in a piping system shall be not less than the pressure at the most severe condition of coincident internal or external pressure and temperature (minimum or maximum) expected during service.
- D = Outside Diameter of Pipe
- S = Stress Value for Material from Table A-1 of ASME B31.3 code.
 Stress valve is indicated in that table as Basic Allowable Stress at metal Temperature. This value can easily be extracted with base of material and design metal temperature.
- E = Quality Factor, A factor deals with the manufacturing (Cast, Welded, Seamless) of the components. The factors can be extracted from table A-1A for components manufactured by casting method and Table A-1B for the components manufactured by welding or seamless methods. According to the project specification casting method cannot be used for piping components except valves. So the factor E is extracted only from Table A-1B.
- W = Weld Joint Strength Reduction Factor. That says welded joint strength may decrease during operation because of the temperature. This factor can be extracted from Table-302.3.5 of ASME B31.3.
- Y = Coefficient Value deals with the effect of dimension on a component. That can be extracted from Table 304.1.1 of ASME B31.3 if t < D/6.

For
$$t \ge D/6$$

$$Y = \frac{d+2c}{D+d+2c}$$



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5.2.3 PIPES WHICH ARE SUBJECTED TO REQUIREMENTS OF ASME B31.4 AND IPS-E-PI-140

This code deals with the Pipeline Transportation Systems for Liquid Hydrocarbons and Other Liquids Unified screw threads.

The required thickness of straight sections of pipe shall be determined in accordance with tm = t + c

Calculation of pres. design THK. for straight pipe requires special consideration of factors such as theory of failure, effects of fatigue, and thermal stress.

 $tm = [(P \times D) / (2SMYS \times FET)] + C3$

where;

tm = minimum required thickness (mm)

t = calculated thickness (mm)

C = corrosion allowance (mm)

P = design pressure (Psig)

D = outside diameter (mm)

S = specific minimum yield strength (Psi)

E = Weld Joint Factor

F = design factor

T = Temperature Derating Factor = 1

6.0 GENERAL TESTING REQUIRMENTS

- **6.1** Pressure testing of the following piping shall be in accordance with ASME B31.3 test procedures. The test pressure shall be held for a sufficient time to allow detection of any leaks and for a minimum time of 1 hour.
- a) Metallic piping including carbon steel, lined carbon steel, stainless steel, corrosion resistant alloys and ductile iron but excluding copper shall normally be tested at 1.5 x the design pressure.

7.0 APPENDIXES



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APPENDIX 1

PIPING WALL THICKNESS CALCUALATION NOTE