



نگهداشت و افزایش تولید میدان نفتی بینک
سطح الارض و ابنیه تحت الارض

عمومی و مشترک



شماره پیمان:

053 - 073 - 9184

Specification For Pressure Vessels

نسخه	سریال	نوع مدرک	رشته	تسهیلات	صادرکننده	بسته کاری	پروژه
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طرح نگهداشت و افزایش تولید 27 مخزن

Specification For Pressure Vessels

نگهداشت و افزایش تولید میدان نفتی بینک

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IFA: Issued For Approval
AFD: Approved For Design
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AB-A: As-Built -Approved



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1.0 INTRODUCTION

Binak oilfield in Bushehr province, 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 EPC CONTRACTOR and approved by GC & 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 specification outlines the general requirements for the designing, material supply, fabrication and test of Pressure Vessels and it is intended to supplement the Iranian Petroleum Standard IPS-G-ME-150, "General Standard for Towers, Reactors, Pressure Vessels and Internals" 2nd Revision, Jul.

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2019. However, Generally Pressure Vessels should meet requirements of ASME code “Unfired Pressure Vessel, Sec. VIII, Div.1 2019”

The following paragraphs specifying the modifications follow the IPS-G-ME-150 numbers and each paragraph denotes an addition, modification, substitution or deletion:

- Sub. (Substitution):
The clause in IPS-G-ME-150(2) shall be deleted and replaced by the new clause in this specification.
- Del. (Deletion):
The clause in IPS-G-ME-150(2) shall be deleted without any replacement.
- Add. (Addition):
The clause in this specification shall be added to IPS-G-ME-150(2) with a new number.
- Mod. (Modification):
The clause in IPS-G-ME-150(2) shall be modified and / or a new description and/or condition shall be added to that clause.

3.0 NORMATIVE REFERENCES

If not mentioned, Latest revision of standards should be used.

3.1 LOCAL CODES AND STANDARDS

- | | |
|------------------|--|
| • IPS-M-PI-150 | Material and Equipment Standard for Flanges & Fittings |
| • IPS-E-TP-350 | Engineering Standard for Linings |
| • IPS-E-CE-120 | Engineering Standard Foundations |
| • IPS-E-CE-500 | Engineering Standard for Loads |
| • IPS-E-TP-700 | Engineering Standard for Thermal Insulation |
| • NIOEC-SP-41-03 | NIOEC Specification for Pressure Vessels |
| • IPS-E-TP-740 | Engineering Standard for General Standard for Packing and Packages |
| • IPS-E-TP-100 | Engineering Standard for Paint |
| • IPS-E-GN-100 | Engineering Standard for Units |
| • IPS-D-ME-010 | Drawing Standard for Vertical Vessel Support Skirt Opening Details |
| • IPS-D-ME-002 | Drawing Standard for Lifting Lug to Lift Vessels Up to 60 Tons |
| • IPS-D-ME-003 | Drawing Standard for Lifting Lug to Lift Vessels Up to 200 Tons |
| • IPS-D-EL-413 | Reference Drawing Grounding Installation Details Earthing Lug Category 400 |
| • IPS-E-EL-100 | Engineering Standard for Electrical System Design |

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- IPS-G-GN-210 General Standard for Packing and Packages

3.2 INTERNATIONAL CODES AND STANDARDS (MODIFICATION ON IPS CLAUSE 2)

(Following standards shall be added to references list)

- ASME American Society of Mechanical Engineers
 - ASME Section II Material Specification
 - ASME Section VIII, Div. 1 Boiler And Pressure Vessel Code
 - ASME Section VIII, Div. 2 Pressure Vessels Alternative Rules
 - ASME Section V Non-Destructive Examination
 - ASME Section IX Welding and Brazing Qualifications
 - ASME SA-370 Standard Test Methods and Definitions for Mechanical Testing of Steel Products
 - B16.9 Steel Butt Welding Fittings
 - B16.11 Forged Steel Fittings, Socket Welding and Threaded
 - B16.20 Metallic Gaskets for Pipe Flanges: Ring-Joint, Spiral-Wound, and Jacketed
 - B16.21 Non- Metallic Gaskets For Pipe Flanges
 - B16.25 Butt Welding Ends
 - B 1.1 Unified Inch Screw Threads (UN and UNR Thread Form)
 - B 16.5 Pipe Flanges and Flanged Fittings
 - B 16.47 Flanges Larger Than DN600
 - B 18.2.2 Square and Hex Nuts
- ASTM American Society For Testing And Materials
 - ASTM A578 Standard Specification for Straight-Beam Ultrasonic Examination of Rolled Steel Plates for Special Applications
- ASCE American Society Of Civil Engineers
 - ASCE 7-10 American Society of Civil Engineers 7-10
- AWS American Welding Society
- EJMA Expansion Joint Manufacturers Association, Inc.
- ISO International Organization for Standardization
 - ISO 9001 Quality Management Systems - Requirements
- Welding Research Council (WRC)
 - 107 Local Stresses in Spherical & Cylindrical Shells Due to External Loading

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- 297 Local Stresses in Cylindrical Shells Due to External Loadings on Nozzles–Supplement to WRC Bulletin No. 107
- BS PD 5500, APP. G British Standard; Specification for Unfired Fusion Welded Pressure Vessels (Recommendations for the Design of Local Loads, Thermal Gradients, etc.)
- NACE/ISO National Association Of Corrosion Engineers
 - NACE MR0175/ISO 15156 Petroleum and Natural Gas Industries Materials for Use in H₂S-Containing Environments in Oil and Gas Production
 - RP0472 Methods and Controls to Prevent In-Service Environmental Cracking of Carbon Steel Weldments in Corrosive Petroleum Refining Environments
 - NACE TM0177 Standard Test Method – Laboratory Testing of Metals for Resistance to Sulfide Stress Cracking and Stress Corrosion Cracking in H₂S Environments
- API American Petroleum Institute
 - API 601 Metallic Gaskets for Raised Face Pipe Flanges and Flanged Connections (Double Jacketed Corrugated and Spiral-Wound)
 - API Publ. 941 Steel for Hydrogen Service at Elevated Temperatures and Pressures in Petroleum Refineries and Petrochemical Plants

3.3 THE PROJECT DOCUMENTS

- BK-00-HD-000-PR-DB-0002 Process Basis of Design
- BK-00-HD-000-ME-DC-0001 Mechanical Design Criteria
- BK-00-HD-000-ST-DC-0001 Structural Design Criteria
- BK-00-HD-000-PI-SP-0006 Specification For Painting
- BK-00-HD-000-PI-SP-0007 Specification for Lining (Internal Protection of Equipment by Painting)
- BK-00-HD-000-PI-SP-0008 Specification for Material Requirements in Sour service
- BK-00-HD-000-PI-SP-0011 Specification For Welding of Plant Piping System
- BK-00-HD-000-ME-DW-0001 Standard Detail Drawing For Pressure Vessels and Heat Exchangers
- BK-GNRAL-PEDCO-000-EL-DC-0001 Electrical System Design Criteria
- BK-GNRAL-PEDCO-000-EL-DW-0002 Typical Installation Details & Notes For Earthing and Lightning Protection System

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- Piping and Instrumentation Diagrams

3.4 ENVIRONMENTAL DATA

Refer to "Process Basis of Design, Doc. No. BK-00-HD-000-PR-DB-0002".

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 UNITS (MODIFICATION ON IPS CLAUSE 4)

International System of Units (SI Units) shall be used for all documents. However, there are recognized exceptions for Pressure Unit (bar) and Nominal Pipe Size (inch).

5.0 DOCUMENTATION REQUIREMENTS (IPS CLAUSE 6)

5.1 ADDITION TO IPS CLAUSE 6.1

6.1.6 The vendor shall perform a complete Calculation book, in accordance with the ASME VIII, Div. 1 and other design codes and send to purchaser for approval. Calculation report shall include checking strength of all parts of the vessel, whether under pressure or not. Comply with codes requirement, the vendor shall check and guarantee stability under all possible load conditions including wind, earthquake, concentrated loads, transport and lifting, etc. during operation.

6.0 MATERIAL (IPS CLAUSE 7.1)

6.1 MODIFICATION ON IPS CLAUSE 7.1.1

7.1.1.1 All material used in the fabrication shall be new and have a minimum quality as specified in the requisition and shall be in accordance with ASME Sec.II Part D / ASTM specifications and standard.



7.0 DESIGN (IPS CLAUSE 7.2)

7.1 MODIFICATION ON IPS CLAUSE 7.2.2.1

7.2.2.1.1 The design pressure of vessel shall be the greater of followings:

- 1) The specified design pressure on process data sheet
- 2) Equal to the maximum operating pressure plus 10 percent or plus 350 kPa, whichever is greater.

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7.2 ADDITION TO IPS ARTICLE 7.2.2.3

7.2.2.3.9 Local loading: For Nozzles directly connected to process piping, and also for anywhere imposed any local loads and/or moments, which will cause high local stresses in a part of pressure containing envelope, the subject components shall be investigated to WRC 107 and 297 or any other method for local stress calculation approved by owner. The piping load applied on vessel nozzles, which shall be used in WRC calculation, shall not be less than specified in “Appendix N”.

7.2.2.3.10 For large, thin vessels, supplier shall make a design check and, if necessary provide additional stiffening to prevent shell distortion during fabrication, heat treatment, hydro testing,

7.3 ADDITION TO IPS ARTICLE 7.2.2.6

7.2.2.6.5 The inside diameter of shells and heads shall be matched as closely as possible at the weld seams. Generally, when a difference in thickness exist between shell and head plates, the inside diameter shall be maintained. The minimum allowable offset between shell and adjacent head sections shall not exceed the code limit.

7.4 ADDITION TO IPS ARTICLE 7.2.2.9.2

7.2.2.9.2.1 For skirt supported alloy vessels, at least the top 450 mm of skirt material shall be the same material as the vessel.

7.2.2.9.13 Vessels with saddle supports shall be designed to prevent deformation under all load conditions. The design of saddles shall be in accordance with the revised L.P. Zick analysis as noted in ASME Pressure Vessel and Piping, Design and Analysis/ A Decade of Progress, Volume 2, 1982.

8.0 FABRICATION (IPS CLAUSE 7.3)

8.1 ADDITION TO IPS ARTICLE 7.3.3

7.3.3.11 Qualification for welding procedures and welders shall be in accordance with the requirements of ASME Code Section IX.

In Sour services, each Welding Specification (WPS), shall be qualified for the required hardness as per NACE MR0175/ISO 15156 commitments.

7.3.3.12 Where meeting of more than two weld seams is unavoidable, then intermediate stress relief shall be applied.

7.3.3.13 Edges shall be visibly checked before welding to ensure that there are no cracks laminations or other serious defects. Immediately prior to welding the edges shall be properly cleaned and dried.

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8.2 ADDITION TO IPS ARTICLE 7.3.7



7.3.7.3 When post weld heat treatment is required, no welding (other than diaphragm closures) to pressure parts shall be performed after such heat treatment. Local post weld heat treatment shall be conducted only with prior written approval from purchaser.

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Appendix N (Addition)
Nozzle Load table (as Min.)

NOZZLE SIZE (In)	150LB & 300LB FLANGE RATING					
	FORCES KN			MOMENTS KN.m		
	FL	FA	FC	MC	MT	ML
2	2.80	2.80	2.10	0.28	0.42	0.36
3	4.20	4.20	3.15	0.63	0.95	0.82
4	5.60	5.60	4.20	1.12	1.68	1.46
6	8.40	8.40	6.30	2.52	3.78	3.28
8	11.20	11.20	8.40	4.48	6.72	5.82
10	14.00	14.00	10.50	7.00	10.50	9.10
12	16.80	16.80	12.60	10.08	15.12	13.10
14	19.60	19.60	14.70	13.72	20.58	17.84
16	22.40	22.40	16.80	17.92	26.88	23.30
18	25.20	25.20	18.90	22.68	34.02	29.48
20	28.00	28.00	21.00	28.00	42.00	36.40
22	30.80	30.80	23.10	33.88	50.82	44.04
24	33.60	33.60	25.20	40.32	60.48	52.42
26	36.40	36.40	27.30	47.32	70.98	61.52
28	39.20	39.20	29.40	54.88	82.32	71.34
30	42.00	42.00	31.50	63.00	94.50	81.90
32	44.80	44.80	33.60	71.68	107.52	93.18
34	47.60	47.60	35.70	80.92	121.38	105.20
36	50.40	50.40	37.80	90.72	136.08	117.94
38	53.20	53.20	39.90	101.08	151.62	131.40
40	56.00	56.00	42.00	112.00	168.00	145.60



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NOZZLE SIZE (In)	600LB FLANGE RATING					
				D02		
	FORCES KN			MOMENTS KNm		
	FL	FA	FC	MC	MT	ML
2	3.20	3.20	2.40	0.32	0.48	0.42
3	4.80	4.80	3.60	0.72	1.08	0.94
4	6.40	6.40	4.80	1.28	1.92	1.66
6	9.60	9.60	7.20	2.88	4.32	3.74
8	12.80	12.80	9.60	5.12	7.68	6.66
10	16.00	16.00	12.00	8.00	12.00	10.40
12	19.20	19.20	14.40	11.52	17.28	14.98
14	22.40	22.40	16.80	15.68	23.52	20.38
16	25.60	25.60	19.20	20.48	30.72	26.62
18	28.80	28.80	21.60	25.92	38.88	33.70
20	32.00	32.00	24.00	32.00	48.00	41.60
22	35.20	35.20	26.40	38.72	58.08	50.34
24	38.40	38.40	28.80	46.08	69.12	59.90
26	41.60	41.60	31.20	54.08	81.12	70.30
28	44.80	44.80	33.60	62.72	94.08	81.54
30	48.00	48.00	36.00	72.00	108.00	93.60
32	51.20	51.20	38.40	81.92	122.88	106.50
34	54.40	54.40	40.80	92.48	138.72	120.22
36	57.60	57.60	43.20	103.68	155.52	134.78
38	60.80	60.80	45.60	115.52	173.28	150.18
40	64.00	64.00	48.00	128.00	192.00	166.40



نگهداشت و افزایش تولید میدان نفتی بینک
سطح الارض و ابنیه تحت الارض

عمومی و مشترک



شماره پیمان:

053 - 073 - 9184

Specification For Pressure Vessels

نسخه	سریال	نوع مدرک	رشته	تسهیلات	صادرکننده	بسته کاری	پروژه
D02	0001	SP	ME	000	PEDCO	GNRAL	BK

شماره صفحه : 13 از 15

NOZZLE SIZE (In)	<div>900LB FLANGE RATING</div> <div>D02</div>					
	FORCES KN			MOMENTS KNm		
	FL	FA	FC	MC	MT	ML
2	5.40	5.40	4.05	0.54	0.81	0.70
3	8.10	8.10	6.08	1.22	1.82	1.58
4	10.80	10.80	8.10	2.16	3.24	2.81
6	16.20	16.20	12.15	4.86	7.29	6.32
8	21.60	21.60	16.20	8.64	12.96	11.23
10	27.00	27.00	20.25	13.50	20.25	17.55
12	32.40	32.40	24.30	19.44	29.16	25.27
14	37.80	37.80	28.35	26.46	39.69	34.40
16	43.20	43.20	32.40	34.56	51.84	44.93
18	48.60	48.60	36.45	43.74	65.61	56.86
20	54.00	54.00	40.50	54.00	81.00	70.20
22	59.40	59.40	44.55	65.34	98.01	84.94
24	64.80	64.80	48.60	77.76	116.64	101.09
26	70.20	70.20	52.65	91.26	136.89	118.64
28	75.60	75.60	56.70	105.84	158.76	137.59
30	81.00	81.00	60.75	121.50	182.25	157.95
32	86.40	86.40	64.80	138.24	207.36	179.71
34	91.80	91.80	68.85	156.06	234.09	202.88
36	97.20	97.20	72.90	174.96	262.44	227.45
38	102.60	102.60	76.95	194.94	292.41	253.42
40	108.00	108.00	81.00	216.00	324.00	280.80



نگهداشت و افزایش تولید میدان نفتی بینک
سطح الارض و ابنیه تحت الارض

عمومی و مشترک



شماره پیمان:

053 - 073 - 9184

Specification For Pressure Vessels

نسخه	سریال	نوع مدرک	رشته	تسهیلات	صادرکننده	بسته کاری	پروژه
D02	0001	SP	ME	000	PEDCO	GNRAL	BK

شماره صفحه : 14 از 15

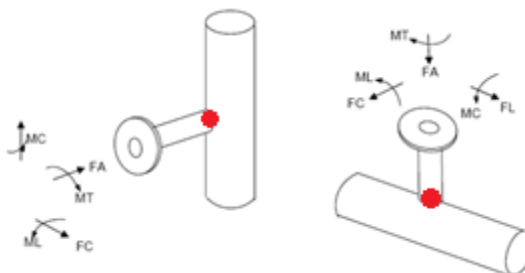
NOZZLE SIZE (In)	<div>1500LB FLANGE RATING</div> <div>D02</div>					
	FORCES KN			MOMENTS KN.m		
	FL	FA	FC	MC	MT	ML
2	9.00	9.00	6.75	0.90	1.35	1.17
3	13.50	13.50	10.13	2.03	3.04	2.63
4	18.00	18.00	13.50	3.60	5.40	4.68
6	27.00	27.00	20.25	8.10	12.15	10.53
8	36.00	36.00	27.00	14.40	21.60	18.72
10	45.00	45.00	33.75	22.50	33.75	29.25
12	54.00	54.00	40.50	32.40	48.60	42.12
14	63.00	63.00	47.25	44.10	66.15	57.33
16	72.00	72.00	54.00	57.60	86.40	74.88
18	81.00	81.00	60.75	72.90	109.35	94.77
20	90.00	90.00	67.50	90.00	135.00	117.00
22	99.00	99.00	74.25	108.90	163.35	141.57
24	108.00	108.00	81.00	129.60	194.40	168.48
26	117.00	117.00	87.75	152.10	228.15	197.73
28	126.00	126.00	94.50	176.40	264.60	229.32
30	135.00	135.00	101.25	202.50	303.75	263.25
32	144.00	144.00	108.00	230.40	345.60	299.52
34	153.00	153.00	114.75	260.10	390.15	338.13
36	162.00	162.00	121.50	291.60	437.40	379.08
38	171.00	171.00	128.25	324.90	487.35	422.37
40	180.00	180.00	135.00	360.00	540.00	468.00

 NISOC	<p>نگهداشت و افزایش تولید میدان نفتی بینک سطح الارض و ابنیه تحت الارض</p> <p>عمومی و مشترک</p>							
شماره پیمان: 053 - 073 - 9184	Specification For Pressure Vessels							شماره صفحه : 15 از 15
	نسخه	سریال	نوع مدرک	رشته	تسهیلات	صادر کننده	بسته کاری	
	D02	0001	SP	ME	000	PEDCO	GNRAL	BK

Notes:



1. All forces and moments act on the intersection of the nozzle center line axis with the mid thickness plane of the shell or head plates.



2. All forces and moments in the above table shall be considered as a base for piping and equipment calculation as an external load on nozzles.
3. All forces and moments in the above table are positive and sign notation is as per WRC bulletin 107. If other solution methods are used, loads shall be converted into the applicable sign notation.
4. The supplier shall ensure that all nozzles shall be suitable for the nozzle loads shown in the above table and provide the necessary local calculations in accordance with WRC bulletin 107 and ASME VIII DIV 1.
5. It is recommended that the supplier notify the contractor where calculations require an increase in thickness of the reinforcing greater than construction code and/or project specification allowable thicknesses.
6. In the case of specific loads not included in the above table, the agreed loads shall be indicated in equipment engineering drawing.
7. All cost for the above reinforcement shall be included in the suppliers price.
8. Loading nomenclature:
FC = Circumferential Force / FL = Longitudinal Force / FA = Axial Force
MC = Circumferential Moment / ML = Longitudinal Moment / MT = Torsional Moment
9. For nozzle on dish:
FC (nozzle on dish) = FL (nozzle on shell)
MC (nozzle on dish) = ML (nozzle on shell)
10. In general, the mentioned values in this specification shall be read by the vendor as minimum requirements and by pipe-stress engineer as maximum allowable.
11. For cases, where the calculated actual loads exceed these values, the calculated loads have to be issued to the vendor for the approval.
12. For vessels at a design pressure of 7 barg or less, multiply the Table values by 0.8 (Applicable only for 150 LB Flange Rating).
13. For vessels at design temperature of 150oC or less and thickness of 10 mm or less multiply the values by 0.5 (Applicable only for 150 LB Flange Rating).