طرح نگهداشت و افزایش تولید 27 مخزن

FLOW LINE HYDRAULIC CALCULATION REPORT

نگهداشت و افزایش تولید میدان نفتی بینک

Rev.	Date	Purpose of Issue/Status	Prepared by:	Checked by:	Approved by:	CLIENT Approval
D05	OCT. 2022	AFC	M.Aryafar	M.Fakharian	M.Mehrshad	
D04	AUG. 2022	IFA	M.Aryafar	M.Fakharian	M.Mehrshad	
D03	APR. 2022	IFA	M.Aryafar	M.Fakharian	M.Mehrshad	
D02	FEB. 2022	IFA	M.Aryafar	M.Fakharian	M.Mehrshad	
D01	DEC. 2021	IFA	M.Aryafar	M.Fakharian	M.Mehrshad	
D00	OCT. 2021	IFC	M.Aryafar	M.Fakharian	M.Mehrshad	

Class:2 | **CLIENT Doc. Number: F0Z-707431**

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

NISOC	نگهداشت و افزایش تولید میدان نفتی بینک فعالیت های رو زمینی در بسته های کاری تحت الارض ساخت موقعیت چاه، تاسیسات سرچاهی و خطوط جریانی مربوط به موقعیت W018S	
شماره پیمان: 053 – 073 – 9184	FLOW LINE HYDRAULIC CALCULATION REPORT	شماره صفحه : 2 از 17

پروژه	بسته کاری	صادرکننده	تسهیلات	رشته	نوع مدرک	سریال	نسخه
BK	W018S	PEDCO	110	PR	RT	0001	D05

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 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 for W018S shall be done. In addition, construction of new flowline from aforementioned well location to Binak B/C unit is 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 Well Location, Wellhead Facilities & Flowline for W018S
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

This document includes flowlines hydraulic study of W018S well which is transferred the fluid from new well BINAK Cluster Unit.

3.0 NORMATIVE REFERENCES

3.1 LOCAL CODES AND STANDARDS

- IPS-E-PR-440 Engineering Standard for Process Design of Piping Systems (Process Piping and Pipeline Sizing)

3.2 INTERNATIONAL CODES AND STANDARDS

- API American Petroleum Institute
- ASME American Society of Mechanical Engineers
- ISA Instrument Society of America
- ISO International Standards Organization
- NACE National Association of Corrosion Engineers
- API American Petroleum Institute

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-W018S-PEDCO-110-PR-PF-0001 Process Flow Diagram
- BK-W018S-PEDCO-110-PR-PI-0001 P&ID

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.

4.0 PROCESS DESCRIPTION

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)

5.0 SIMULATION METHODOLOGY

5.1 SIMULATION SOFTWARE

Following process software will be used in this project as per requirements:

- ASPEN HYSYS V.11
- OLGA 2017
- PVT SIM 2011

Aspen HYSYS, is normally used for process simulation as main modelling software, which shall utilize the Peng-Robinson equation of state.

Olga software is used for flowlines hydraulic calculation; this software allows calculation of flowline size, flow regimes, and pressure drop.

5.2 ASSUMPTIONS

Table 5-2.1: Assumption of calculation

FLOWLINE	Size	Material	Thickness (mm)	Roughness (mm)
FLOWLINE FOR W018S WELLHEAD	6”	C.S.	7.9	0.0457

5.3 PIPELINE SIZING CRITERIA FOR TWO PHASE

Lines transporting gas and liquid in two phase flow should be sized primarily on the basis of flow velocity. Flow velocity should be kept at least below fluid erosional velocity (the erosion velocity must be <1). If solid (sand) production is anticipated fluid velocity should be reduced accordingly. The velocity above which erosion may occur can be determined by the following empirical equation:

$$Ve = \frac{1.22 * C}{\sqrt{\rho m}}$$

Where:

Ve = fluid erosional velocity, m/s

C = empirical constant, to be considered as 125 for non-continuous operation And 100 for continuous operation

ρm = gas/liquid mixture density at flowing pressure and temperature, kg/m^3

The mixture density is determined from the **HYSYS** simulation program.

6.0 DESIGN BASIS

6.1 FLUID COMPOSITION

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

Table 6-1.1: W018S (Asmari) Crude Oil Composition

Reservoir Oil Component	Asmari (%MOLE)
H2S	0.17
Nitrogen	0.13
CO2	0.88
Methane	14.14
Ethane	5.3
Propane	6.37
i-Butane	1.4
n-Butane	4.51
i-Pentane	1.26
n-Pentane	1.19

Reservoir Oil Component	Asmari (%MOLE)
n-Hexane	6.77
n-Heptane	6.13
n-Octane	3.98
n-Nonane	5.2
n-Decane	3.74
n-C11	3.11
$C12+_{Asmari}$	35.72
C12+ of Asmari: Sp.Gr @ 60/60 F = 0.9532 & Molecular weight = 418 Max GOR of Asmari: 230 SCF/STB	

6.2 WATER CUT

Volume percentage of formation water in crude oil is considered as following table:

Table 6-2.1: Water Cut

Crude Oil	Volume Percent (%)
Asmari	0~15

6.3 FLUID PROPERTIES

The maximum and minimum amount of oil produced from the W018S (Asmari) well is provided in the following table:

Table 6-3.1: W018S (Asmari) Wellhead Condition

WELL NO.	Minimum flow rate for well (bbl/day)	Maximum flow rate for well (bbl/day)
W018S	500	1500

6.4 TEMPERATURE OF WELLHEAD & DESTINATION PRESSURE

The outlet fluid temperature from the W018S (Asmari) well and the pressure at the flowline destination is considered in accordance with the following table:

Table 6-4.1: Temperature of Wellhead & Destination Pressure

Case	Wellhead Flowing Temperature (°C)	Pressure (barg)
W018S (Asmari)	75	12.78

6.5 ENVIRONMENTAL DATA

Table 6-5.1: Average Ambient Temperature

CASE	Temp(°C)
Winter	15
Summer	32

6.6 FLOWLINES PROPERTIES

Information about thicknesses and inner/outer diameters of different sizes of flowline is given in the following table:

Table 6-6.1: Thickness and Diameters of Flowline

Type	Nominal Diameter(in)	Wall Thickness (mm)	Outside Diameter (mm)	Inner Diameter (mm)
Asmari	6	7.9	168.3	152.5

6.7 MATERIAL

The physical properties of the flowline material are as follows:

Table 6-7.1: Physical properties

Material	Heat Capacity (j/kg.°C)	Thermal Conductivity (w/m °C)	Density (kg/m^3)
Steel	450	45.3	7800

7.0 SIMULATION RESULT

7.1 SIZING CALCULATION

Table 7-1.1: Result of W018S (Asmari) Flowline in summer (WATER CUT 15%)

Summer Case												
Flow line Well No.	OD	Mass Flow Rate	In. Velocity		Out. Velocity		Temp.		Press.		Flow Regime	EVR
			UG	UL	UG	UL	IN	OUT	IN	OUT		
	(in)	(kg/hr)	(m/s)		(m/s)		(°C)		(barg)			
W018S	6	11347.0341	1.64	0.35	1.69	1.48	74.14	36.31	16.74	12.78	Stratified/ Slug	0.10
W018S	6	3782.3447	0.85	0.09	1.09	1.25	73.99	37.82	17.98	12.78	Stratified/ Slug	0.10

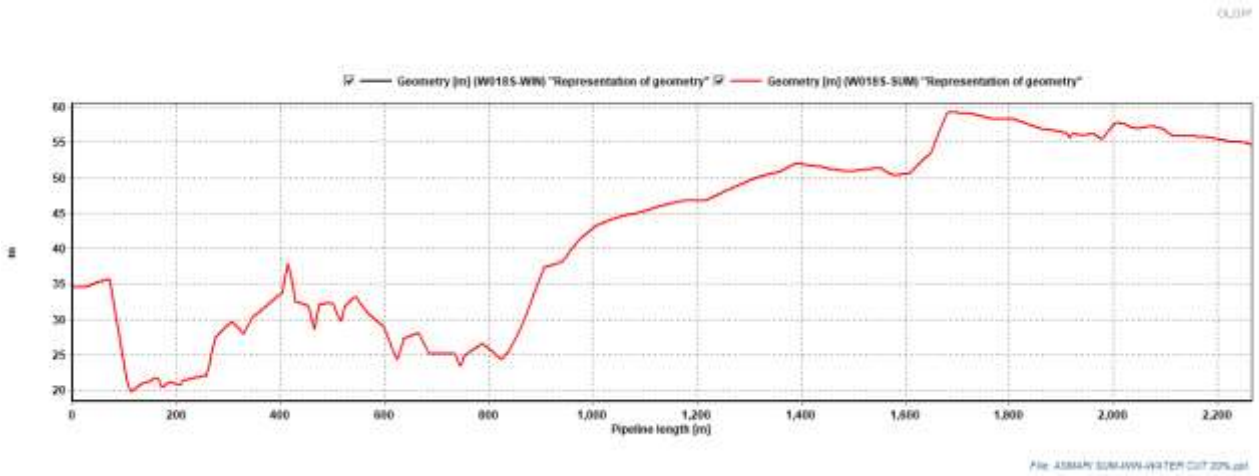
Table 7-2.1: Result of W018S (Asmari) Flowline in winter (WATER CUT 15%)

Winter Case												
Flow line Well No.	OD	Mass Flow Rate	In. Velocity		Out. Velocity		Temp.		Press.		Flow Regime	EVR
			UG	UL	UG	UL	IN	OUT	IN	OUT		
	(in)	(kg/hr)	(m/s)		(m/s)		(°C)		(barg)			
W018S	6	11347.0341	1.72	0.35	1.78	1.50	73.86	22.62	17.09	12.78	Stratified/ Slug	0.18
W018S	6	3782.3447	1.14	0.06	0.33	0.99	73.6	22.58	18.34	12.78	Stratified/ Slug	0.03

7.2 HYDRAULIC CALCULATION

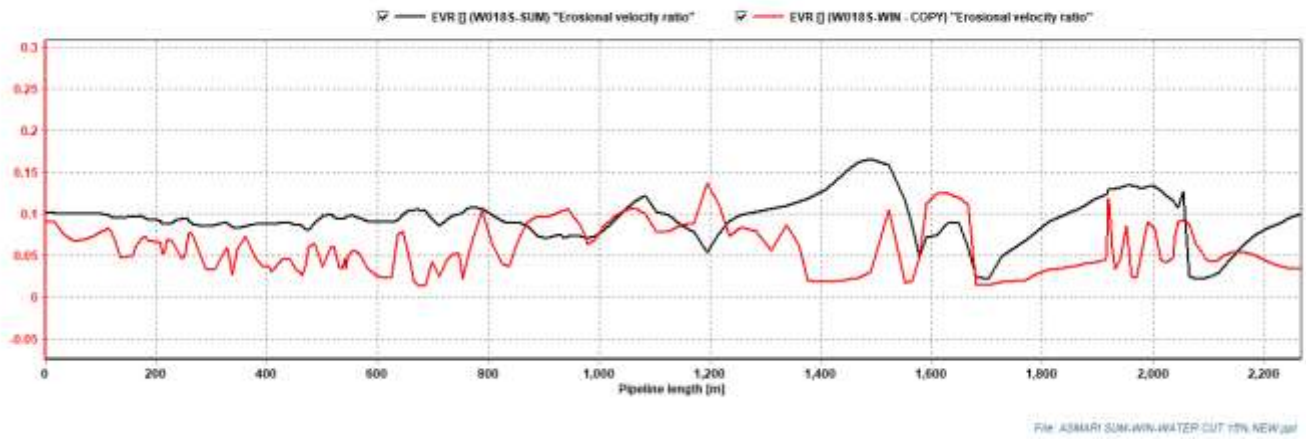
The results of the hydraulic calculations for the 6 inches flowline is shown in the following curves:

- **GEOMETRY CURVES**

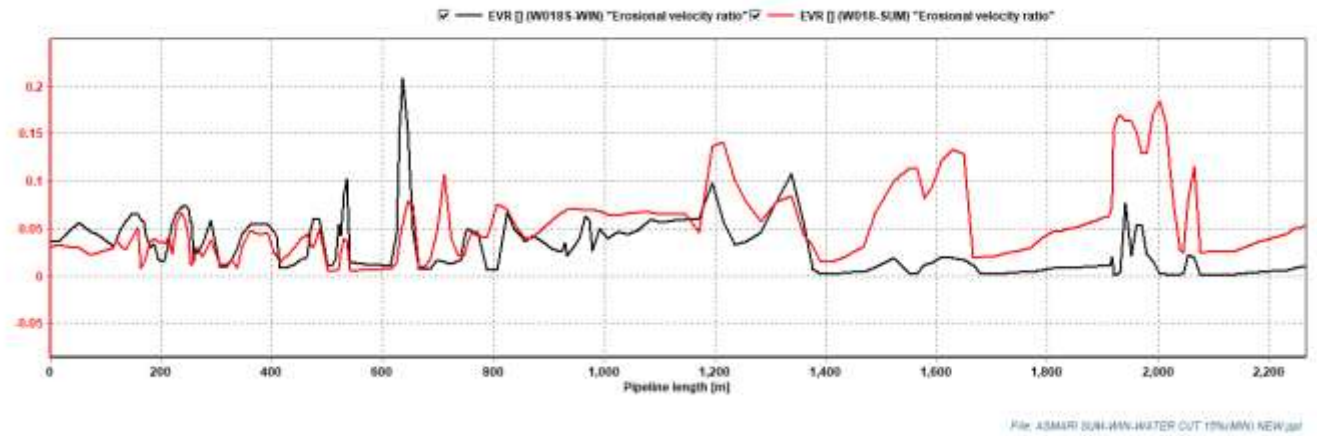


Curve 7-2.1: geometry of 6” Asmari Flowlines

- **EVR CURVES**



Curve 7-2.2: EVR of 6” Asmari Flowlines in Summer& Winter (max-flow)

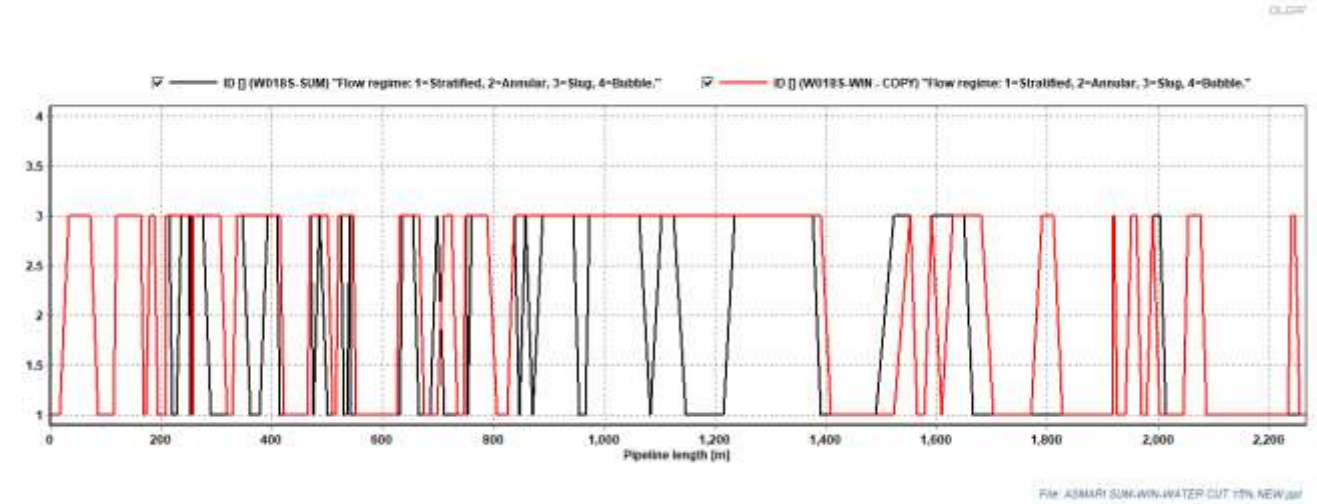


Curve 7-2.3: EVR of 6" Asmari Flowlines in Summer& Winter (min-flow)

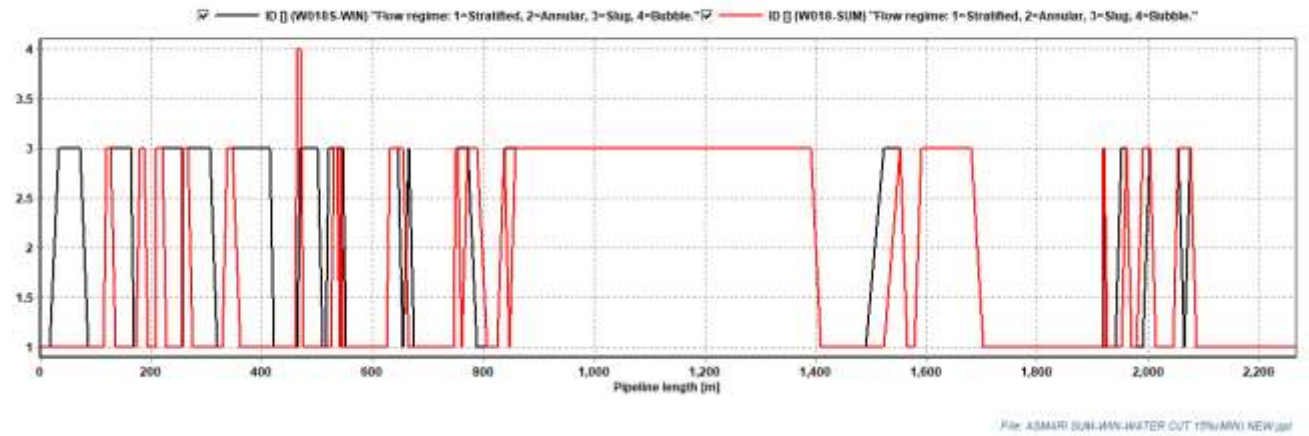
Conclusions

- The above diagram shows the variations of gas velocity inside flowlines. It is obvious that at the beginning of flow line after passing choke valve, manifold and main pipeline the gas velocity increases to about 0.18 m/s due to change in flow characteristics.

➢ FLOW REGIME CURVES



Curve 7-2.4: Flow Regime of W018S Asmari Flowline (max-flow)

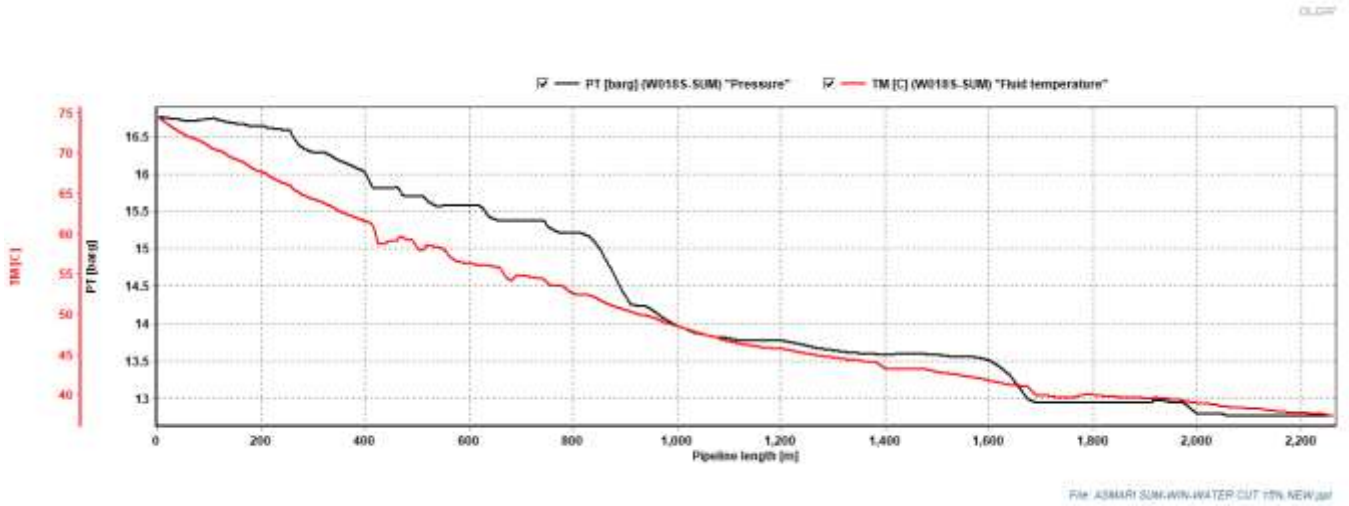


Curve 7-2.5: Flow Regime of W018S Asmari Flowline (min-flow)

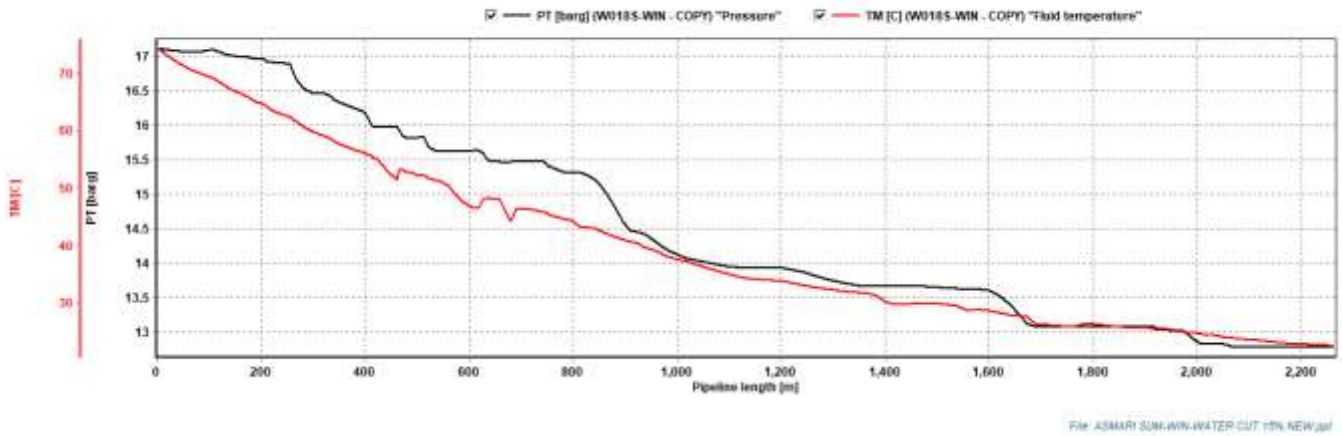
Conclusions

- The above diagrams show the variations of flow regime indicator flow line. In downstream of choke valve, the flow regime is generally stratified flow but in receiving area outlet cluster to BINAK is generally bubble flow.

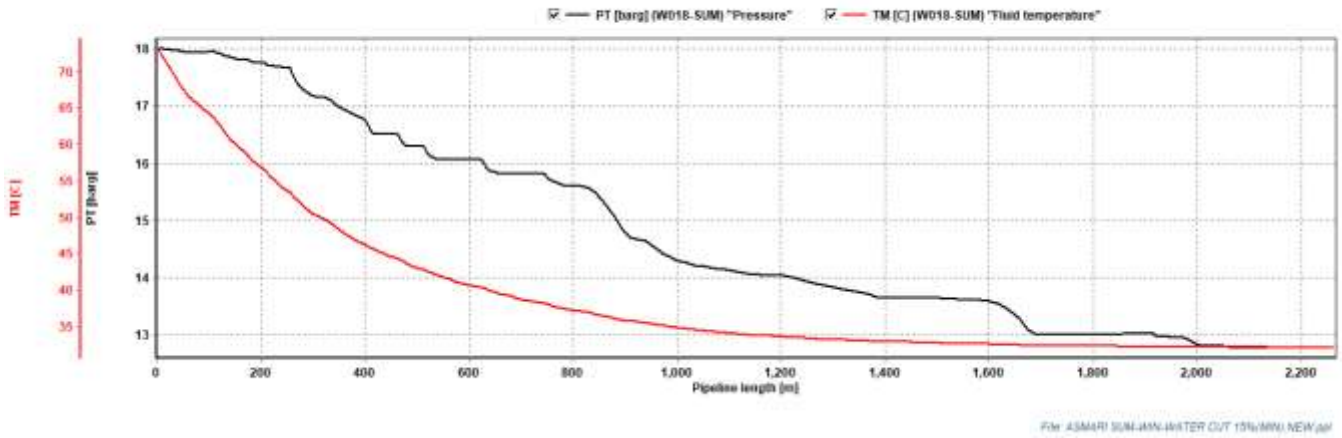
➢ PRESSURE and TEMPERATURE PROFILES



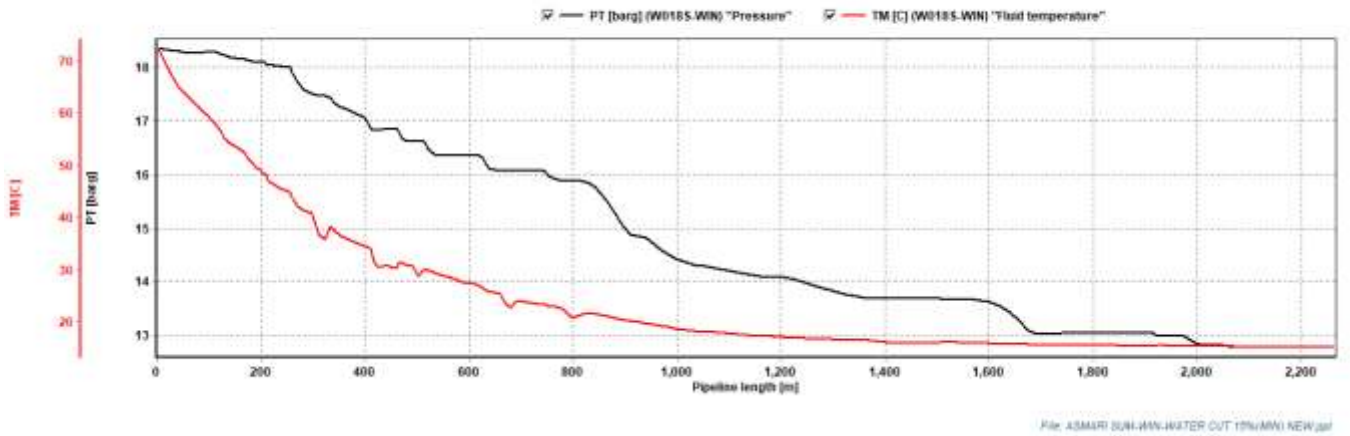
Curve 7-2.6: Temp/Press. Profile of 6" Asmari W018S Flow Line in summer (max-flow)



Curve 7-2.7: Temp/Press. Profile of 6” Asmari W018S Flow Line in winter (max-flow)



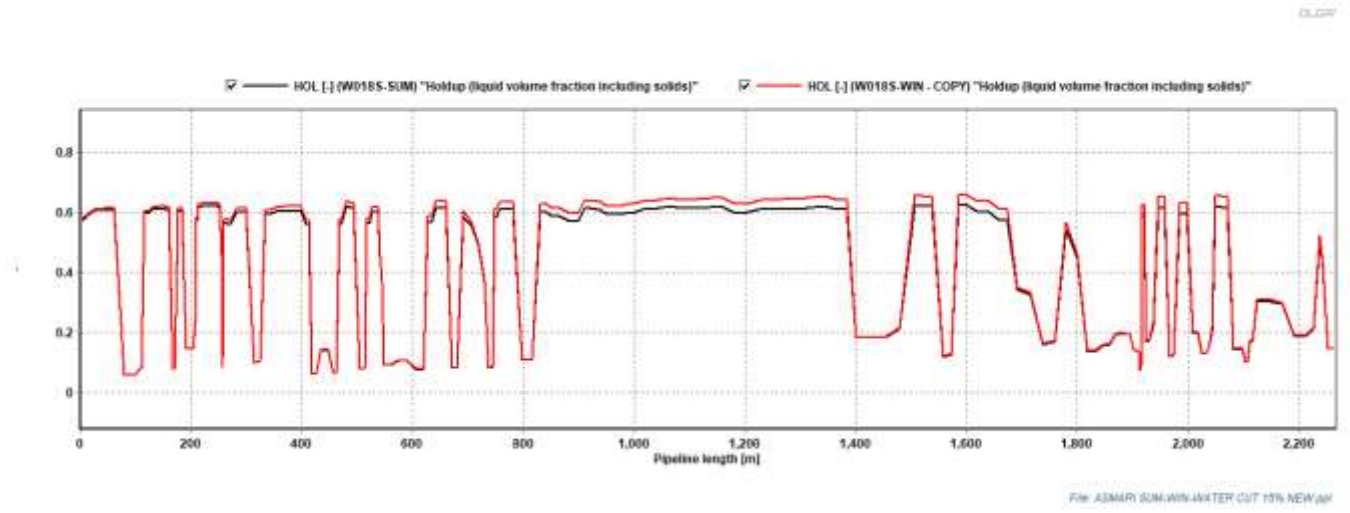
Curve 7-2.8: Temp/Press. Profile of 6” Asmari W018S Flow Line in summer (min-flow)



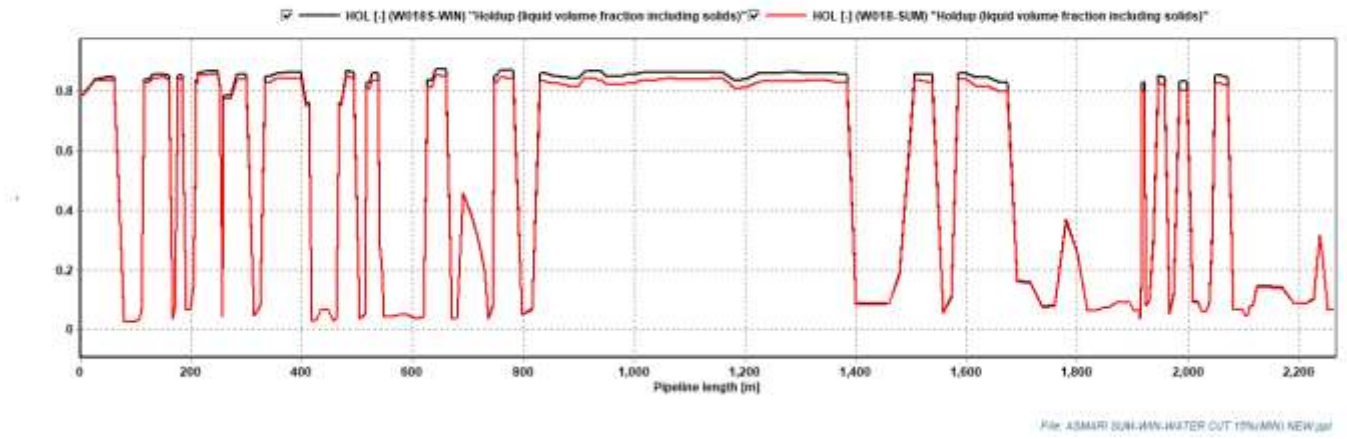
Curve 7-2.9: Temp/Press. Profile of 6" Asmari W018S Flow Line in winter (min-flow)

Conclusions

- It is found out from above diagrams that the pressure of fluid in downstream of choke valves is maximum 18.34 BARG and will reach to 12.78 BARG at the BINAK Cluster B.L.
- It is obvious that temperature of fluid in downstream of choke valves is 74.14 °C, 36.31 °C then reaches to ambient temperature at BINAK Cluster B.L.



Curve 7-2.10: HOL. Profile of 6" Asmari W018S Flow Line in summer/winter (max-flow)



Curve 7-2.11: HOL. Profile of 6” Asmari W018S Flow Line in summer/winter (min-flow)

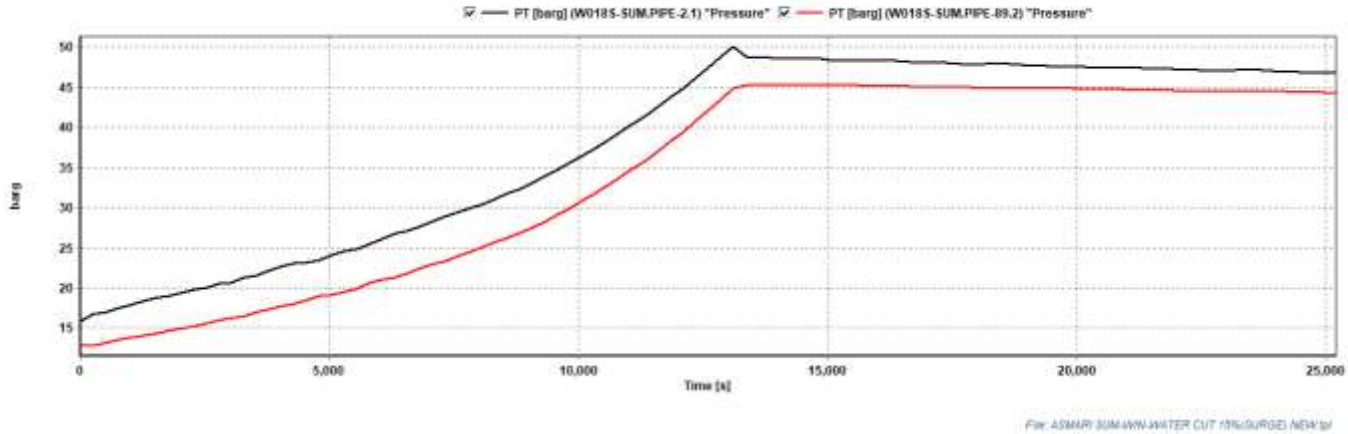


Figure 7-2.12: Surge Pressure for ASMARI Flow lines disposal wells (summer case)

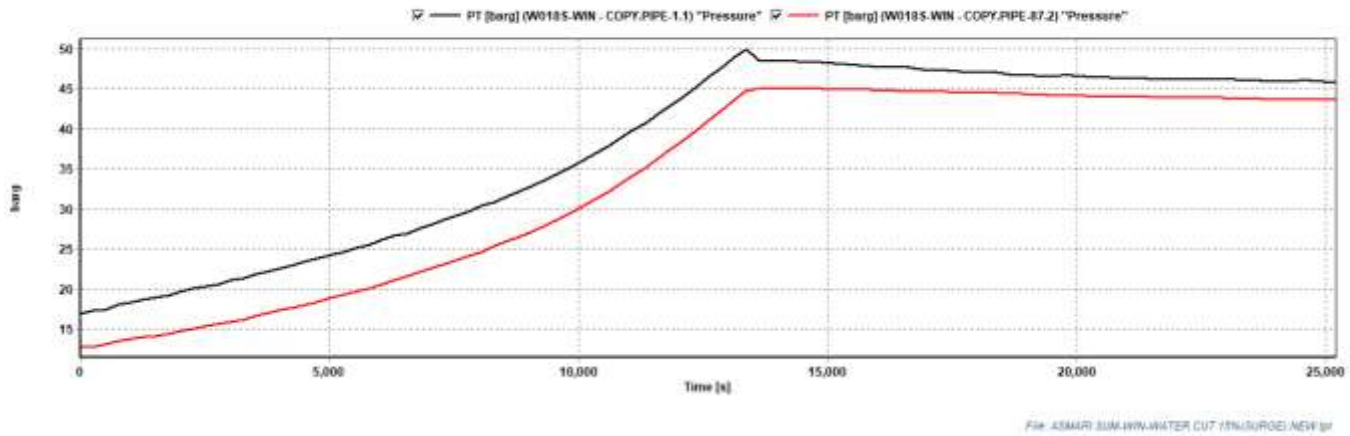


Figure 7-2.12: Surge Pressure for ASMARI Flow lines disposal wells (winter case)

Conclusions

According to project P&ID the design pressure of BINAK flow line is (3000 psia) 205 barg, If PSHH on well head is set to(740 psia) 50 barg, this pressure rise does not expose the flow line and related equipment/devices to danger.