# طرح نگهداشت و افزایش تولید 27 مخزن

# FLARE NETWORK STUDY REPORT

## 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**

## 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, 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.

| | |
|---|---|
| CLIENT: | National Iranian South Oilfields Company (NISOC) |
| PROJECT: | Binak Oilfield Development – Surface Facilities; New Gas Compressor Station |
| 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

The scope of this document is to establish the basic engineering data requirements needed for detail design of Binak Gas Compressor Station.

This document is intended to summarize the sizing calculations of flare network for the "Binak Gas Compressor Station" project. The current report has been performed based on Plot Plan, Flare Load Summary and Process Design Criteria.

## 3.0 NORMATIVE REFERENCES

This report should be read in conjunction with the following general standards and guidelines:

### 3.1 LOCAL CODES AND STANDARDS

- IPS-E-PR-450 — Process Design of Pressure Relieving Systems Inclusive Safety Relief Valves
- IPS-E-PR-460 — Process Design of Flare & Blowdown Systems

### 3.2 INTERNATIONAL CODES AND STANDARDS

- API-RP-521 — “Guide for Pressure-Relieving and Depressurizing Systems” Fifth Edition, 2007.
- API-RP-520 — “Sizing, Selection and Installation of Pressure-Relieving Devices in Refineries
- ISO 15156 — Petroleum and Natural Gas Industries. Materials for use in H2S Containing Environments in Oil and Gas Production

### 3.3 THE PROJECT DOCUMENTS

- Piping & Instrumentation Diagram — BK-GCS-PEDCO-120-PR-PI-0002~0025
- ESD Philosophy — BK-GCS-PEDCO-120-PR-PH-0005
- Process Design Criteria — BK-GNRAL-PEDCO-000-PR-DC-0001
- Calculation Note For PSV Sizing — BK-GCS-PEDCO-120-PR-CN-0004
- Calculation Note For Depressurizing (Min. Design Temperature ) — BK-GCS-PEDCO-120-PR-CN-0007

### 3.4 ENVIRONMENTAL DATA

Refer to "Process Basis of Design; Doc. No. BK-GNRAL-PEDCO-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.

## 3.6 ABBREVIATION

- ESD Emergency Shutdown
- SD Shutdown
- BDV Blow Down Valve
- SDV Shutdown Valve
- ESDV Emergency Shutdown Valve
- PSV Pressure Safety Valve

## 4.0 GENERAL DESCRIPTION

The flare must cater to the possibility of depressurization of equipment during emergencies, for this purpose, based on high flow rate & resulted MDMT of depressuring calculation.

Flare systems of Binak Gas Compressor Station are considered for discharge gas during depressurizing and pressure safety valve relief from compressor area (included compressors, scrubbers & air coolers), gas K.O drums and headers.

Flare system consists of following items:

- Flare Header
- Flare K.O. Drum
- Flare Drum Pumps
- Flare Stack
- Flare Ignition Package

Fluid from flare header flows to the flare K.O. drum V-2201 designed to prevent from the possibility that liquids will be entrained with the vent gases. Vent gas flow through one header to the flare stack FST-2201. The liquids (hydrocarbons, water) recovered within the flare K.O. drum are normally sent to the closed drain vessel V-2202 by flare drum pumps (P-2202-A/B).

### 4.1 RELIEF LOAD SUMMARY

For detail of the flare loads, relevant temperature and pressure refer to the document number BK-GCS-PEDCO-120-PR-LI-0008 entitled “Relief Load Summary”. Released gas characteristics (flow rate, temperature and pressure) included in this document which refer to the safety device upstream conditions (process side).

### 4.2 FLARE NETWORK SIZING

Flare lines including tail pipes, sub headers and main headers shall be determined in accordance with the clause 5 of the document number BK-00-HD-000-PR-DC-0001 entitled “Process Design Criteria”. The major criteria governing the sizing of the flare headers are the back pressure and fluid velocity. Based on API 521 recommendation, the rated flow of PSVs will be used in the calculations for the tailpipes. Peak flow of each BDV (fire case, first time step) is used for flare network sizing.

All the possible fire scenarios shall be considered. A fire scenario consists of a potential fire area of typically 300 $m^2$ where a pool fire due to hydrocarbon accumulation is likely to occur. A circle of about 10 m radius centered on the equipment protected by the relevant PSV should be considered.

Based on flare network calculation flare header with size 10” is directed to V-2201 and from there

it routed to stack with line 12".

## 5.0 FLARE NETWORK SIMULATION BASIS

Aspen Flare System Analyzer Ver. 11 has been used for flare header, sub-header and tail pipe sizing with the following basis:

- Piping roughness for carbon steel: 0.04572 mm
- Flare tip pressure drop: 0.1 barg
- VLE and enthalpy: Peng-Robinson equation of state
- Friction factor: Chen correlation
- Pressure drop: Beggs and Brill correlations
- Back pressure: Back pressure to be compatible with relief valve type and BDV's restriction orifice follows:
  - 10 % of PSV set pressure for the Conventional valve type
  - 50 % of PSV set pressure for the balanced valve type
  - 50 % of pressure upstream orifice for the BDV's to ensure critical flow in the orifice

### 5.1 DIFFERENT SCENARIOS

Following scenarios have been considered within the current study:

- Case 1: BDV-Fire
- Case 2: Cold Shutdown Blow Down
- Case 3: Spurious Blow Down
- Case 4: Fire Case area 1(PSV-2111/2112, PSV-2113/2114,PSV-2131A ,PSV-2121A,PSV-2271 are in fire)
- Case 5: Fire Case area 2 (PSV2131A ,PSV2121A,PSV2131B ,PSV2121B are in fire)
- Case 6: Fire Case area 3 (PSV2131B,PSV2121B,PSV2131C,PSV2121C,PSV2141 are in fire)
- Case 7: Block Outlet PSV-2122/2123
- Case 8: Block Outlet PSV-2132/2133
- Case 9: PCV-2152(Relief total flow rate of compressor station)
- Case 10: PCV-2135 A/B
- Case 11: Block Outlet PSV-2113/2114
- Case 12: Block Outlet PSV-2111/2112
- Case 13: Block Outlet PSV-2141/2142

## 6.0 RESULTS

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Case 4 with 39824 kg/hr gas flow rate (Relief total flow rate of compressor station) is governing scenario for flare header sizing.

Flare network simulation results for the designed arrangement in main scenario have been summarized in below table.

Based on results obtained, the MDMT for flare network system is about -28°C in spurious blow down case, so the material of piping for this System is selected Carbon Steel.

Flare stack's diameter is 12 inch. Obviously calculated size of piping & flare stack shall be finalized by flare package vendor at detail design phase, due to finalization of plot plan, piping plan.

The calculated size of relieving devices downstream Lines is reported in below table and for calculated header size refer to attachment 1.

Schematic of the flare distribution networks and simulation report are presented in attachment 1.

NOTE 1: According to Fire Case area 1, design pressure for LP Flare K.O drum (V-2201) should be consider to 5.5 bar g.

**Table 1 - Flare network simulation results**

**Flare Load Summary For LP Flare**

| Source | Location | Flowrate kg/hr | Relieving Temp(°C) | Set Pressure(barg) | Back Temp (°C) | Back Pressure (barg) | MW | Tail Pipe Rho V2 (kg/m.s$^2$) | Tail Pipe Size | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|
| **DEPRESSURIZING FIRE CASE** | | | | | | | | | | |
| BDV-2134A | V-2102 A | 778.4 | 60.0 | 22.0 | 52.0 | 0.8 | 24.52 | 1262 | 3" | |
| BDV-2134B | V-2102 B | 778.4 | 60.0 | 22.0 | 52.0 | 0.8 | 24.52 | 1277 | 3" | |
| BDV-2132A | AE-2102 A | 1333.0 | 60.0 | 62.0 | 42.8 | 1.2 | 24.52 | 47444 | 1 1/2" | |
| BDV-2132B | AE-2102 B | 1333.0 | 60.0 | 62.0 | 42.8 | 1.1 | 24.52 | 48077 | 1 1/2" | |
| BDV-2141 | V-2103 | 1722.0 | 60.0 | 62.0 | 42.6 | 1.1 | 24.56 | 81573 | 1 1/2" | |
| BDV-2151 | PK-2101 | 4578.0 | 60.0 | 62.0 | 41.5 | 0.9 | 24.57 | 44904 | 3" | |
| BDV-2110 | V-2105 | 5665.4 | 36.9 | 9.0 | 30.9 | 0.1 | 24.52 | 318 | 3" | |
| **Flare Load** | | **16188** | | | | | | | | |
| **COLD SHUTDOWN** | | | | | | | | | | |
| BDV-2134A | V-2102 A | 796.4 | 21.0 | 22.0 | 12.7 | 0.8 | 21.6 | 1289 | 3" | |
| BDV-2134B | V-2102 B | 796.4 | 21.0 | 22.0 | 12.7 | 0.8 | 21.6 | 1304 | 3" | |
| BDV-2132A | AE-2102 A | 1414.0 | 21.0 | 62.0 | 1.7 | 1.2 | 21.6 | 51409 | 1 1/2" | |
| BDV-2132B | AE-2102 B | 1414.0 | 21.0 | 62.0 | 1.7 | 1.2 | 21.6 | 52088 | 1 1/2" | |
| BDV-2141 | V-2103 | 1825.0 | 21.0 | 60.0 | 1.7 | 1.5 | 21.6 | 88142 | 1 1/2" | |
| BDV-2151 | PK-2101 | 4843.0 | 21.0 | 62.0 | 1.4 | 1.0 | 21.6 | 48717 | 3" | |
| BDV-2110 | V-2105 | 5517.1 | 19.0 | 9.0 | 14.3 | 1.8 | 24.52 | 64222 | 3" | |
| **Flare Load** | | **16606** | | | | | | | | |
| **SPURIOUS BLOWDOWN CASE** | | | | | | | | | | |
| BDV-2134A | V-2102 A | 725.6 | 60.0 | 22.0 | 53.8 | 0.8 | 21.6 | 1267 | 3" | |
| BDV-2134B | V-2102 B | 725.6 | 60.0 | 22.0 | 53.8 | 0.8 | 21.6 | 1282 | 3" | |
| BDV-2132A | AE-2102 A | 1199.0 | 60.0 | 62.0 | 44.0 | 1.2 | 21.6 | 44238 | 1 1/2" | |
| BDV-2132B | AE-2102 B | 1199.0 | 60.0 | 62.0 | 44.0 | 1.1 | 21.6 | 44842 | 1 1/2" | |
| BDV-2141 | V-2103 | 1548.0 | 60.0 | 62.0 | 44.0 | 1.3 | 21.6 | 76164 | 1 1/2" | |
| BDV-2151 | PK-2101 | 4112.0 | 60.0 | 62.0 | 44.0 | 0.9 | 21.6 | 41957 | 3" | |
| BDV-2110 | V-2105 | 5517.1 | 19.0 | 9.0 | 14.3 | 1.8 | 21.6 | 64222 | 3" | |
| **Flare Load** | | **15026** | | | | | | | | |
| **FIRE AREA 1** | | | | | | | | | | |
| PSV-2111/2112 | V-2104 | 37247 | 284.0 | 9.00 | 280.6 | 3.4 | 48.17 | 23634 | 10" | |
| PSV-2113/2114 | V-2105 | 1046 | 182.5 | 9.00 | 148.6 | 3.3 | 18.02 | 9479 | 8" | |
| PSV-2121A | V-2101A | 374 | 227.4 | 22.00 | 179.0 | 3.1 | 18.02 | 1754 | 4" | |
| PSV-2271 | V-2205 | 175 | 182.6 | 9.00 | 148.6 | 3.2 | 18.02 | 1363 | 2" | |
| PSV-2131A | V-2102A | 982 | 208.3 | 22.00 | 203.7 | 3.3 | 24.57 | 7487 | 2" | |
| **Flare Load** | | **39824** | | | | | | | | |
| **FIRE AREA 2** | | | | | | | | | | |
| PSV-2121A | V-2101A | 374 | 227.4 | 22.00 | 179.0 | 0.3 | 18.02 | 6351 | 4" | |
| PSV-2131A | V-2102A | 982 | 208.3 | 22.00 | 203.7 | 0.9 | 24.57 | 25383 | 2" | |
| PSV-2121B | V-2101B | 374 | 227.4 | 22.00 | 179.0 | 0.2 | 18.02 | 6360 | 4" | |
| PSV-2131B | V-2102B | 982 | 208.3 | 22.00 | 203.7 | 1.0 | 24.57 | 27859 | 2" | |
| **Flare Load** | | **2713** | | | | | | | | |
| **FIRE AREA 3** | | | | | | | | | | |
| PSV-2121B | V-2101B | 374 | 227.4 | 22.00 | 179.0 | 0.3 | 18.02 | 6081 | 4" | |
| PSV-2131B | V-2102B | 982 | 208.3 | 22.00 | 203.7 | 1.0 | 24.57 | 24322 | 2" | |
| PSV-2121C | V-2101C | 374 | 227.4 | 22.00 | 179.0 | 0.3 | 18.02 | 6089 | 4" | |
| PSV-2131C | V-2102C | 982 | 208.3 | 22.00 | 203.7 | 1.0 | 24.57 | 26692 | 2" | |
| PSV-2141/2142 | V-2103 | 1826 | 188.0 | 62.00 | 168.9 | 0.6 | 24.59 | 46658 | 8" | |
| **Flare Load** | | **4539** | | | | | | | | |
| **Blocked Outlet PSV-2122/2123** | | | | | | | | | | |
| PSV-2122/2123(A/B/C) | C-2101A/B/C | 8664 | 124.8 | 22.00 | 115.5 | 0.8 | 24.52 | 33895 | 6" | |
| **Flare Load** | | **8664** | | | | | | | | |
| **Blocked Outlet PSV-2132/2133** | | | | | | | | | | |
| PSV-2132/2133 (A/B/C) | C-2102 A/B/C | 8664 | 142.3 | 62.00 | 119.3 | 0.9 | 24.52 | 40209 | 6" | |
| **Flare Load** | | **8664** | | | | | | | | |
| **PV-2152** | | | | | | | | | | |
| PV-2152 | STATION OUTLET | 20605 | 60.0 | 52.90 | 44.0 | 1.7 | 24.52 | 52848 | 6" | |
| **Flare Load** | | **20605** | | | | | | | | |
| **PCV-2135A/B** | | | | | | | | | | |
| PCV-2135A | AE-2102A | 10352 | 60.0 | 54.10 | 44.3 | 1.5 | 24.52 | 56694 | 4" | |
| PCV-2135B | AE-2102B | 10352 | 60.0 | 54.10 | 44.3 | 1.5 | 24.52 | 56694 | 4" | |
| **Flare Load** | | **20703** | | | | | | | | |
| **Blockoutlet PSV-2113/2114** | | | | | | | | | | |
| PSV-2113/2114 | V-2105 | 17833 | 36.9 | 9.00 | 28.6 | 1.3 | 24.52 | 20093 | 8" | |
| **Flare Load** | | **17833** | | | | | | | | |
| **Blockoutlet PSV-2111/2112** | | | | | | | | | | |
| PSV-2111/2112 | V-2104 | 11270 | 32.0 | 9.00 | 25.1 | 0.7 | 23.47 | 43598 | 10" | |
| **Flare Load** | | **11270** | | | | | | | | |
| **Blockoutlet PSV-2121 A/B/C** | | | | | | | | | | |
| PSV-2121 A/B/C | V-2101 A/B/C | 2166 | 60.0 | 22.00 | 48.8 | 0.2 | 24.52 | 4213 | 4" | |
| **Flare Load** | | **2166** | | | | | | | | |
| **Blockoutlet PSV-2141/2142** | | | | | | | | | | |
| PSV-2141/2142 | V-2103 | 17253 | 60.0 | 62.00 | 19.5 | 0.9 | 24.56 | 28638 | 8" | |
| **Flare Load** | | **17253** | | | | | | | | |

## 7.0 SIMULATION REPORT AND SCHEMATIC OF FLARE DISTRIBUTION NETWORK

Please find attachment-01

### ATTACHMENT-01

**Aspen Flare System Analyzer**

Version37.0.0.395

User Name : Undefined
Job Code :
Project : BINAK
Description :
Scenario : PSV-2141/2142 BLOCKED OUTLET
Label : Pressure/Mass flow/Nominal Diameter /(bar_g:kg/hr:)

PFD