



نگهداشت و افزایش تولید میدان نفتی بینک  
سطح الارض



احداث ردیف تراکم گاز در ایستگاه جمع آوری بینک

شماره پیمان:

053 - 073 - 9184

# DUTY SPECIFICATION FOR INSTRUMENT/PLANT AIR & NITROGEN PACKAGES

شماره صفحه: 1 از 17

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# DUTY SPECIFICATION FOR INSTRUMENT/PLANT AIR & NITROGEN PACKAGES

نگهداشت و افزایش تولید میدان نفتی بینک

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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  
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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.

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## 2.0 SCOPE

This specification outlines the minimum process requirements for design of Associated Instrument/Plant Air and Nitrogen packages in Binak Plant.

## 3.0 NORMATIVE REFERENCES

### 3.1 LOCAL CODES AND STANDARDS

- IPS-E-PR-905 Engineering Standard for Process Design of Dryers
- IPS-E-PR-330 Engineering Standard for Process Design of Compressed Air Systems

### 3.2 INTERNATIONAL CODES AND STANDARDS

- ASTM American Society for Testing Materials Relevant Parts
- API 610 Engineering Standard for Process Design of Compressed Air Systems
- ISO 15156 Petroleum and Natural Gas Industries. Materials for use in H2S Containing Environments in Oil and Gas Production

### 3.3 THE PROJECT DOSUMENTS

- BK-GNRAL-PEDCO-000-PR-DB-0001 Process Basis Of Design
- BK-GNRAL-PEDCO-000-PR-DC-0001 Process Design Criteria
- BK-GCS-PEDCO-120-PR-UF-0001 Utility Flow Diagrams (UFD)
- BK-GCS-PEDCO-120-PR-PI-0015 P&IDs

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## 4.0 INSTRUMENT/PLANT AIR PACKAGE

### 4.1 BASIS OF DESIGN

#### 4.1.1 General

The Instrument dryer package will produce dry air for instruments air consumption.

The compressed air will feed the related plant air header and two dryer's bed, one are in operation and one in regeneration. One set dryer's shall be considered as stand-by mode.

The package as minimum will include, air inlet filters, air compressors (two identical 100% in parallel- one on duty and one stand by ready to start), air dryers (mole sieve adsorption), air dryer pre/after filters (two identical 100% in parallel - one on duty and one stand by ready to start). Beds are used such that as the one bed becomes water saturated the other one bed is brought into operation and the saturated one is under regeneration procedure. The dry air will continuously feed the air distribution header at specified following condition.

It should be noted that start-up of spare compressor should not exceed 5 minutes after receiving start-up signal. The auxiliary systems shall be kept in continuous operation to minimize the change overtime.

No instrument air available at black start-up. Dedicated provisions have to be taken for the black start of compressor packages.

#### 4.1.2 Design Basis

##### 4.1.2.1 Operating Case and Design Capacity

The final design capacity of package (including regeneration of dryer's beds) shall be finalized by vendor, to fulfill the stable operation of plant under any of the following situations:

- Normal operation (steady state): The total air demand for instrument (excluding regeneration rate of dryers) will be 92.04 Nm<sup>3</sup>/hr for instrument air.
- Maximum demand: In which the total air demand (excluding regeneration rate of dryers) will become 119.7 Nm<sup>3</sup>/hr. (30% Overdesign has been consider on maximum instrument air consumptions).
- For Regeneration of air dryers 20% of maximum consumption has been considered which is equal to 23.9 Nm<sup>3</sup>/hr (To be finalized with vendor).
- Total maximum Demand for dryer package: 143.6 Nm<sup>3</sup>/hr
- 30 Nm<sup>3</sup>/hr will be considered as total consumption of wet plant air
- Total maximum demand for air compressors: 173.6 Nm<sup>3</sup>/hr (Dry basis with sucked air condition which is mentioned at Design Basis/BEDD condition)

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It should be noted that the instrument air consumption for this package shall be excluded from the total instrument air flow rate.

#### 4.1.2.2 Air Consumption Calculation

Instrument Air Consumption;

Control valve: 0.64 Nm<sup>3</sup>/hr

On/Off valve: 0.64 Nm<sup>3</sup>/hr

Air coolers: 21 Nm<sup>3</sup>/hr

Each gas compressor train: 6 Nm<sup>3</sup>/hr

Dehydration package: 14 Nm<sup>3</sup>/hr (Based on vendor data)

Dryer regeneration: 20%

Over Design: 30%

29 control valves X 0.64 Nm<sup>3</sup>/hr = 18.56 Nm<sup>3</sup>/hr

32\* On/Off valves X 0.64 Nm<sup>3</sup>/hr = 20.48 Nm<sup>3</sup>/hr

**Note\*: BDVs do not use instrument air during operation.**

Gas compressor train = 3 \* 6 Nm<sup>3</sup>/hr = 18 Nm<sup>3</sup>/hr

Total instrument air for plant = 18.56 + 20.48 + 21 + 14 + 18 = 92.04 Nm<sup>3</sup>/hr

Total continuous air required (Peak Load) = 92.04 Nm<sup>3</sup>/hr X 30% (Over Design) = 119.7 Nm<sup>3</sup>/hr

Total instrument air = 119.7 Nm<sup>3</sup>/hr X 20% (Regeneration Factor) = 143.6 Nm<sup>3</sup>/hr

Plant air Consumption: 30 Nm<sup>3</sup>/hr

Total air requirement = 143.6 Nm<sup>3</sup>/hr + 30 Nm<sup>3</sup>/hr = 173.6 Nm<sup>3</sup>/hr

Based on Design Basis/BEDD 10% over design should be considered = 191 Nm<sup>3</sup>/hr

#### 4.1.2.3 Design and Operating Condition

The air supply to the package will have the specifications outlined in Design Basis of Project.

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#### 4.1.2.4 Product Requirement

The produced dry air shall have following condition and quality at B.L:

**Table No. 4.1: Operating Conditions at Producer's Battery limit**

System	Temperature (°C)			Pressure (bar g)		
	Min	Norm.	Max	Min	Norm.	Max
Instrument Air	-	60	65	-	9	-
Plant Air	-	60	65	-	4.5	-

**Table No. 4.2: Operating Conditions at User's Battery limit**

System	Temperature (°C)			Pressure (bar g)		
	Min	Norm.	Max	Min	Norm.	Max
Instrument Air	-	60	65	4.5	-	8
Plant Air	-	60	65	4.5	-	9

**Table No. 4.3: Mechanical Design Conditions**

System	Temperature (°C)	Pressure (bar g)
Instrument Air	85	12.5
Plant Air	85	12.5

#### 4.1.2.5 Package Control System



Package control type is "Package type C" (Refer to Project Specifications for Instrumentation of Package Units) .

PLC based UCPs (one for each compressor) shall be considered to be mounted in control room and one of them shall be authorized as master logic controller of complete air package. UCPs shall be connected to the PCS, ESD, for required monitoring, control functions and shutdowns as per P&ID.

Local control panel (LCP) mounted on the each compressor platform and a local control panel



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(LCP) mounted on the each dryer shall be supplied by the vendor, completely enclosed and sealed and suitable for pressurizing to keep out dust.

#### 4.1.3 Site Condition

For site condition, refer to “Design Basis or BEDD of Project”.

#### 4.1.4 Available Utilities

The available utilities for the packages and their conditions are listed in Design Basis. Further to the design basis followings shall be deemed in design:

- Air cooling to be utilized.
- Steam/Cooling water is not available.

#### 4.1.5 Specific Design Requirements

The air production unit shall be complete self-contained unit requiring only utility supplies with the following design considerations:

- The produced dried air shall be analyzed for humidity.
- Interconnecting piping and valving shall be designed for continuous operation.

### 4.2 SCOPE OF ENGINEERING AND SUPPLY SERVICES

The VENDOR is responsible for all engineering, design, fabrication, assembly, testing, delivery, and documentation of the complete integrated package.

The equipment shall be delivered to site as complete as possible. The minimum amount of disassembly shall be performed to minimize reassembly on site.

The scope of supply includes but is not limited to the following equipment:

#### 1. AIR COMPRESSOR

The major items of equipment furnished by the Supplier for air compressor packages shall include, but not be limited to the following:

- Inlet filter (auto cleaning type)
- Inlet silencer
- Inlet IGV
- Inter-stage air cooler
- Inter-stage water separator and water trap
- After cooler(Air cooler)

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- Outlet water separator(at downstream of after cooler) with water trap
- Max oil content: oil free
- Compressor auxiliary equipment
- Blow off silencer
- Outlet FT for surge control
- PSV at discharge of each compressor
- All required instrumentations for safe operation of compressors
- All piping interconnections
- Relevant equipment for compressor control and safety.
- PT,TT & FT on common discharge header of compressors for load sharing and load management
- PDT for inlet Air Filters
- LT for water separators
- PT& TT for inlet and out let of each stage of compressor
- First filling of consumables such as lube oil and ... is in vendor scope of supply
- UCP and LCP for each compressor .All signals shall transferred to UCS for operator monitoring purpose and UCP shall be connected to plant DCS/ESD
- Package running status /common alarms/faults to be transferred to UCP
- Anti-surge controller for each compressor shall be considered.
- Spare compressor shall be provided.



## 2. AIR DRYER PACKAGES

The major items of equipment furnished by the Supplier for air dryer packages shall include, but not be limited to the following:

- Air dryers beds (mole sieve adsorption type) (for each package one bed in adsorption and one bed in regeneration mode)
- Silencer for air regeneration discharge line
- All required instrumentations for safe operation of compressors
- All piping interconnections
- Manual globe valve and FT for regeneration line
- Dual-pre-filters & dual-after-filters(Cartridge Element) with spares filters
- Dew point meter at discharge of each air dryers(at downstream of after filters)
- PSV for each beds
- All required sequencing valves for adsorption and regeneration of beds
- LCP for each dryer. All signals shall transferred from LCP to Air compressor master UCP for operator monitoring purpose( if any)
- The life time of Air dryer's adsorbent shall be minimum 3 years
- Water trap for dual filters
- PDT for inlet and outlet filters and Air Dryer beds



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	BK	GCS	PEDCO	120	PR	SP	0002	D05	



- First filling of mole sieves are in vendor scope of supply
- Automatic starting of standby Dryer in case of shutdown of running air dryer to be considered.

The instrument air at the outlet of the dryer package shall conform to the following specifications:

- Dew point at operating pressure: -40°C maximum at 8 barg
- Filtration degree: 99% solid particle > 3 micron
- Drier allowable Pressure drop: 0.5 bar

### 3. OTHER SPECIFICATION

Each dryer shall have separate and independent LCP.

#### 4.3 DOCUMENT REQUIREMENT FROM VENDOR

- Process description
- Utility Flow Diagram
- Heat and Material Balance for all operating and design cases
- Equipment Datasheet
- Utility Consumption List
- Equipment List
- Instrument Datasheet
- Operating and Maintenance Manual
- Alarm and Trip Set Point List
- Piping and Instrumentation Diagram
- Control Philosophy and Complex Loop Description
- Performance Curves
- Start-up and shutdown procedure

#### 4.4 GUARANTEES

The VENDOR shall guarantee:

- Air Compressor Design Capacity and delivery pressure at wet air receiver inlet flange
- Air Dryer Design Capacity and delivery pressure at Air dryer outlet common header.
- Air Dryer regeneration rate
- Maximum outlet instrument air temperature
- Maximum Utility consumption at design capacity
- Maximum Impurity content of the produced air
- Maximum pressure drop (1 Bar) for air dryer package with dirty pre& after filters
- Sound pressure level (SPL)(maximum 85 dB at 1 meter distance)
- Air dryer outlet dew point at design capacity

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- Maximum particle size (3 micrometers ) at air dryer outlet
- The life Time for air dryers and carbon mole sieve bed shall not less than 3 years

#### 4.5 DESIGN REVIEW RESPONSIBILITY OF VENDOR

VENDOR shall have Attendance at design (including design for constructability), coordination. VENDOR shall have overall responsibility for the proper design and safety of the equipment supplied. Any items required as a result of the HAZOP actions are to be fully implemented by VENDOR.

VENDOR shall ensure the relevant personnel are available during the course of the HAZOP sessions. Client/Consultant may ask vendor to participate to further reviews such as Constructability and Maintainability for the equipment to be supplied.

The VENDOR shall include in the package cost, the cost of him and his instruments/ controls SUB-VENDOR(S) participation in the HAZOP & HAZID Study which will be conducted by the client/Consultant.

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## 5.0 NITROGEN PACKAGE

### 5.1 BASIS OF DESIGN

#### 5.1.1 General

The nitrogen package will produce gaseous nitrogen only. The nitrogen production should be based on pressure swing adsorption (PSA) system, in which the nitrogen content of air will be separated from oxygen by using adsorption beds.

The compressed wet air will feed nitrogen generation section.

Water vapor and oxygen will be adsorbed in two individual beds, in which parallel beds are used such that as the one bed becomes oxygen/water saturated the other one bed is brought into operation and the saturated one is under regeneration procedure.

The gaseous nitrogen continuously feeds the nitrogen distribution header under pressure control.

The produced nitrogen is used as:

- Purging of system and equipment at start up and shutdown.
- Blanketing gas in storage tanks, vessels, etc.
- Buffer gas for dry seals of reciprocating compressors.
- Mechanical seal system of pumps (if any)

#### 5.1.2 Design Basis

The nitrogen production package shall operate under any of the following situations:

- Normal operation as seal and buffer gas for compressors and blanket gas for storage tanks.
- Purging activities.

The normal demand of nitrogen consisted of continuous and intermittent consumption is 30.9 Nm<sup>3</sup>/hr and maximum nitrogen demand will be 34 Nm<sup>3</sup>/hr, which has been considered as design capacity of nitrogen generation package (10% over design on normal demand including regeneration rate).

Vendor shall provide the maximum turndown flexibility that can be offered without any additional cost.

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The nitrogen at the outlet of this package shall conform to the nitrogen specification of compressor vendor but as a minimum is as the following specifications:



- Nitrogen content: 99.9% vol max
- Dew point at 1 atm: -70°C
- Oxygen content: 0.1% vol max
- Carbon dioxide content: 1 ppm vol max
- Carbon monoxide content: 10 ppm vol max
- Water content: 1 ppm vol max
- Oil content: oil free

#### 5.1.2.1 Nitrogen Consumption Calculation

Each gas compressor train: 6 Nm<sup>3</sup>/hr

TK-2102 Blanketing: 9.34 Nm<sup>3</sup>/hr

V-2107 Blanketing: 0.59 Nm<sup>3</sup>/hr

3 x 6 Nm<sup>3</sup>/hr = 18 Nm<sup>3</sup>/hr

(9.34 Nm<sup>3</sup>/hr + 0.59 Nm<sup>3</sup>/hr) x 30% Over Design = 12.9 Nm<sup>3</sup>/hr

Total Nitrogen Consumption: 12.9 Nm<sup>3</sup>/hr + 18 Nm<sup>3</sup>/hr = 30.9 Nm<sup>3</sup>/hr

Maximum nitrogen demand with considering 10% over design = 34 Nm<sup>3</sup>/hr

Plant air demand for nitrogen production: 34 Nm<sup>3</sup>/hr x 4 = 124 Nm<sup>3</sup>/hr

#### 5.1.2.2 Design and Operating Condition

The air supply to the package will have the specifications outlined in "PROCESS BASIS OF DESIGN".

#### 5.1.2.3 Product Requirement

The produced nitrogen shall have following condition and quality:

**Table No. 5.1: Operating Conditions at Producer's Battery limit**

System	Temperature (°C)			Pressure (bar g)		
	Min	Norm.	Max	Min	Norm.	Max
Nitrogen	-	60	-	-	8	-

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**Table No. 5.2: Operating Conditions at User's Battery limit**

System	Temperature (°C)			Pressure (bar g)		
	Min	Norm.	Max	Min	Norm.	Max
Nitrogen	-	60	-	-	7.5	-

**Table No. 5.3: Mechanical Design Conditions**

System	Temperature (°C)	Pressure (bar g)
Nitrogen	85	12.5

#### 5.1.2.4 Package Control System

Package control type is “Package type C” (Refer to Project Specifications for Instrumentation of Package Units) .

PLC based UCP shall be considered to be mounted in control room UCPs shall be connected to the PCS, ESD, for required monitoring, control functions and shutdowns as per P&ID.

Local control panel (LCP) mounted on package skid shall be supplied by the vendor, completely enclosed and sealed and suitable for pressurizing to keep out dust.

#### 5.1.3 Site Condition

For site condition, refer to “PROCESS BASIS OF DESIGN”.

#### 5.1.4 Available Utilities

The available utilities for the packages and their conditions are listed in Design Basis.

Further to the design basis followings shall be deemed in design:

- Air cooling to be utilized.
- Steam/Cooling water is not available.

#### 5.1.5 Specific Design Requirements

The Nitrogen production package shall be complete self-contained unit requiring only utility supplies with the following design considerations:

- The package shall operate in a safe and reliable condition at plant turndown.
- The produced nitrogen shall be analyzed for humidity and oxygen content.

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- Interconnecting piping and valving designed for continuous operation.
- Instrumentation for all control, alarm and safety functions.

## 5.2 SCOPE OF SUPPLY

The VENDOR is responsible for all engineering, design, fabrication, assembly, testing, delivery, and documentation of the complete integrated package.

The equipment shall be delivered to site as complete as possible. The minimum amount of disassembly shall be performed to minimize reassembly on site.

The scope of supply includes but is not limited to the following equipment:



- 1) Air K.O. drum
- 2) Air compressors (As per P&ID - Nitrogen Generation System Doc N.o: BK-GCS-PEDCO-120-PR-PI-0016-D06)
- 3) Air cooler
- 4) Inlet silencer
- 5) Outlet water separator
- 6) Chiller for cooling of inlet wet air(if required)
- 7) Silencer for air regeneration discharge line
- 8) Dual-pre-filters & dual-after-filters(Cartridge Element)
- 9) N<sub>2</sub> Generator
- 10) Dual Particulate Filters(Cartridge Element) (if required)
- 11) O<sub>2</sub> analyzer at discharge of air N<sub>2</sub> Generator(at downstream of particulate filters)
- 12) H<sub>2</sub>O analyzer at discharge of air N<sub>2</sub> Generator(at downstream of particulate filters)
- 13) PDI for Filters and beds
- 14) UV(on-off valve) for temperature control, TT, check valve for Nitrogen Gaseous discharge line.
- 15) All required TSV,PSV and on/off valves for gaseous nitrogen lines for safe operation
- 16) UCP and LCP as per project Spec.

## 5.3 DOCUMENT REQUIRED FROM VENDOR

- Process description
- Utility Flow Diagram
- Heat and Material Balance for all operating and design cases
- Equipment Datasheet
- Utility Consumption List
- Equipment List
- Instrument Datasheet
- Operating and Maintenance Manual
- Alarm and Trip Set Point List
- Piping and Instrumentation Diagram
- Control Philosophy and Complex Loop Description



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- Performance Curves
- Start-up and shutdown procedure

#### 5.4 GUARANTEES

The vendor shall guarantee:

- The production capacity
- The nitrogen purity and impurities.
- Pressure and Temperature of nitrogen at battery limit.
- The maximum pressure drop across the package.
- Utility consumption at design capacity.
- The life Time for adsorption beds shall not less than 3 years
- Noise limit level as per project specification(Maximum allowable noise level produced by each individual unit in operation shall be less than 85 dB at 1 meter from the involved equipment.)

#### 5.5 DESIGN REVIEW RESPONSIBILITY OF VENDOR

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