

 NISOC	<p>نگهداشت و افزایش تولید میدان نفتی بینک سطح الارض و ابنیه تحت الارض</p> <p>خرید پکیج های کمپرسور گاز (رفت و برگشتی) بینک (قرارداد BK-HD-GCS-CO-0008_03)</p>							 
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طرح نگهداشت و افزایش تولید ۲۷ مخزن

CONTROL PHILOSOPHY

نگهداشت و افزایش تولید میدان نفتی بینک

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 <p>NISOC</p>	<p>نگهداشت و افزایش تولید میدان نفتی بینک سطح الارض و ابنیه تحت الارض</p> <p>خرید پکیج های کمپرسور گاز (رفت و برگشتی) بینک (قرارداد BK-HD-GCS-CO-0008_03)</p>																									
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	<p>نگهداشت و افزایش تولید میدان نفتی بینک سطح الارض و ابنیه تحت الارض</p> <p>خرید پکیج های کمپرسور گاز (رفت و برگشتی) بینک (قرارداد BK-HD-GCS-CO-0008_03)</p>								
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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.

2.0 GENERAL DEFINITION

The following terms shall be used in this document.

CLIENT:	National Iranian South Oilfields Company (NISOC)
PROJECT:	Binak Oilfield Development – General Facilities
EPD/EPC CONTRACTOR (GC):	Petro Iran Development Company (PEDCO)
OWNER:	OWNER is collectively referring to National Iranian South Oil Company (NISOC) and Petro Iran Development Company (PEDCO)
EPC CONTRACTOR:	Joint Venture of: Hirgan Energy – Design & Inspection (D&I) Companies
VENDOR:	HAVAYAR Company
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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3.0 ABBREVIATIONS AND ACRONYMS

PLC	Programmable Logic Controller
UCP	Unit Control Panel
P&ID	Piping and Instrumentation Diagram
DCS	Distributed Control System
LCP	Local Control Panel
HMI	Human Machine Interface
AOP	Auxiliary Oil Pump

4.0 PURPOSE OF THIS DOCUMENT

- The present document outlines the Operating and Control Philosophy (Logics and Sequences) of Hydrocarbon Reciprocating Compressor in the "BINAK Oil Field".
- The purpose of this document is to describe the start/stop, shutdown and operational sequences in normal and emergency conditions of Hydrocarbon Reciprocating Compressor (C-2101/02 A/B/C).

5.0 REFERENCE DOCUMENTS

- This document has to be read with the latest revision of the following documents:
- Piping & Instruments Diagrams (BK-GCS-HY-120-PR-PI-0001)
- I/O List (BK-GCS-HY-120-IN-LI-0005)
- Cause & Effect Charts List (BK-GCS-HY-120-IN-LI-0001)

6.0 BACKGROUND PROCESS INFORMATION

The project has three trains of compressor with the arrangement of 2+1. The process gas with the pressure and temperature of 4.9 barg and 36.8 °C enters to Compressor Suction Drums V-2101 A/B/C to collect any likely entrained liquid droplet and prevent them entering the compressors.

The pressure of process gas is then increased to 18 barg in the first stage of compressor cylinder (C-2101-C1 A/B/C). The hot pressurized gas enters to interstage coolers AE-2101 A/B/C to be cooled from 129 °C to 60 °C. Afterwards, the cooled gas enters to interstage K.O. Drums V-2102 A/B/C to separate condensates. Then the gas enters to second stage of compressor cylinder C-2102-C2 A/B/C and the pressure reaches to 54.8 barg. The pressurized gas cooled down from 147 to 60 °C through after coolers AE-2102 A/B/C and then the probable condensate is separated by discharge K.O. Drum V-2103.

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7.0 CONTROL COMPONENTS

7.1 Unit Control Panel (UCP):

The Unit Control Panel (UCP) with PLC-based control system provided by compressor Vendor is used for the operation of the compressor package.

The primary control device for the compressor train in this system is a PLC configured for Control Logic Sequencing, and Alarm/Shutdown Protection.

The PLC is designed to provide for Condition Monitoring, Start/Stop Sequencing, Loading & Unloading, Alarm monitoring, and Shutdown protection for the Motor/Compressor trains.

The following main functions are considered as Control Functions in the UCP:

- Measurement data, Normal and Alarm Status Display
- Manual Reset for Maintenance and Restart-up after Abnormal Shut-down
- Display of Alarm and Trip Setpoints on Display Screen
- Adjustment of Alarm and Trip Setpoints on Display Screen
- Individual Start/Stop Functions of the Motors
- Permissive Start Conditions

7.2 Display Screen (HMI):

The display screen is an HMI mounted on UCP cabinet front door that shows following operating parameters of the compressor:

- Process Measurement Signal
- Running Status of Each Motor
- Alarm Set Points
- Trip Set Points
- Permissive Start Conditions

7.3 Local Control Panel (LCP):

The LCP is a machine mounted panel located on the main compressor skid consisting of the following main operating functions (Pushbuttons, Indicating Lights, Key Selector Switch) (The details are in P&ID).

Pushbuttons:

- Emergency Shut down

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- Compressor Start/STOP
- Auxiliary Oil Pump Start/STOP
- Oil Heater ON/OFF
- Lub Heater ON/OFF
- Oil Cooler Motor Start/Stop
- Lubricator Motor Start/Stop
- Main Water Pump Motor Start/Stop
- Auxiliary Water Pump Motor Start/Stop
- Water Heater ON/OFF
- Water Cooler Start/Stop
- Barring Motor Start/Stop
- Reset

Signal Lamps:

- Common Alarm
- Common Shutdown
- Ready for Start (Start Permissive)
- Main Motor Running
- Auxiliary Oil Pump Motor Running
- Lub Heater Running
- Oil Heater Running
- Lubricator Motor Running
- Oil Cooler Motor Running
- Main Water Pump Motor Running
- Auxiliary Water Pump Motor Running
- Water Heater Running
- Water Cooler Running
- Barring Motor Running

Key Selector Switch:

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- Local/Remote
- Lamp Test
- Aux. Oil Pump OFF/ MANU/ AUTO
- Aux. Water Pump OFF/ MANU/ AUTO
- Oil Cooler OFF/ MANU/ AUTO
- Water Cooler OFF/ MANU/ AUTO
- Local Capacity Control 0%-25%-50%-75%-100%

8.0 MODES OF OPERATIONS

This section describes the modes of operation of the compressors.

The compressor would be intended to be operated from the UCP and Local switch board.

Unit operational mode selection shall be performed by means of KEY SELECTOR SWITCH (HSC/L 2239 A/B/C) on the LCP.

LOCAL MODE (LCP):

The device would be operated from controls in the field such as mounted local switch board. Local mode would be intended for functions only and would be the normal operating mode.

REMOTE MODE (PLC/DCS):

The device would be operated from the control system through the operator interface (HMI).

8.1 AUX. OIL PUMP OPERATION MODES

The auxiliary oil pump has three operation modes OFF/MANU/AUTO. Selection of the Operation Method shall be made before the operation.

- MANU MODE:

At "MANU" mode, the auxiliary oil pump is never inhibited from running continuously while the compressor is running. In other words, the auxiliary oil pump shall be stopped manually by the operator after the required oil pressure is developed in the system.

- AUTO MODE:

At "AUTO" mode, the auxiliary oil pump would be controlled by logic. If the compressor is running, the Aux. oil pump is started / stopped by lube oil pressure transmitter.

If the lube oil pressure is lower than the setpoint value, the Auxiliary Oil Pump will be started automatically. If the lube oil pressure is higher than the setpoint value, the Auxiliary Oil Pump will be stopped automatically.

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- OFF MODE:

OFF Mode is default mode prior to the compressor start-up. If the Master Selector is in OFF mode, no kind of starting sequence can be run, because the machine is not ready to start and any kind of start command is ignored.

8.2 AUXILIARY WATER PUMP OPERATION MODES:

The auxiliary water pump has three operation modes OFF/MANU/AUTO. Selection of the Operation Method shall be made before the operation.

- MANU MODE:

At "MANU" mode, the auxiliary water pump is never inhibited from running continuously. In other words, the auxiliary water pump shall be stopped manually by the operator after the required water pressure is developed in the system.

- AUTO MODE:

At "AUTO" mode, the auxiliary water pump would be controlled by logic. If the compressor is running, the pump is start / stopped by cooling water pressure transmitter.

If the cooling water pressure is lower than the setpoint value, the Auxiliary Water Pump will be started automatically. If the cooling water pressure is higher than the setpoint value, the Auxiliary Water Pump will be stopped automatically.

- OFF MODE:

OFF Mode is default mode prior to the compressor start-up. If the Master Selector is in OFF mode, no kind of starting sequence can be run, because the machine is not ready to start and any kind of start command is ignored.

9.0 START / STOP SEQUENCE

9.1 PREPARATIONS FOR START

After completion of compressor installation, overhaul, or long stop, and before starting the compressor, the inspections and preparations should be performed based on the instruction specified in the operation manual.

9.2 PREHEATING & PRELUBRICATION

A preheating phase has to be carried out for the cylinder water to prevent gas condensation during operation. This is due to the saturation condition of the process gas.

Two Electric Heaters are installed in the crankcase reservoir and lubricator tank. These heaters shall be energized during standstill and operating periods.

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Lube oil and Lubricator oil Pre-heating phase can be started from LCP's start button.

Pre-lubrication of the cylinder lubricator is done through manual rotating of the lubricator's handwheel.

For the pre-lubrication of the lube oil system, the Auxiliary oil pump shall be started from LCP.

In the case that there is no trip, alarm and emergency stop, the pre-heating and pre-lubrication phase will be completed.

9.3 START PERMISSIONS

The compressor start can be initiated whenever all permissions to start have been satisfied. The status of each compressor start permissions will be indicated on HMI. "READY TO START" will be indicated on LCP.

9.4 START SEQUENCE (MAIN DRIVE)

All conditions as described in section 9.1, 9.2 & 9.3 have to be fulfilled to initiate the start sequence.

From the Selector Switch (Local / Remote) on local control panel (LCP), the mode of operation can be selected.

The compressor main drive motor could be started manually by operator via Main Motor Start Pushbutton on the LCP or PLC (HMI) depending on the selected mode of operation in the LCP.

The lubricator oil pump motor shall be automatically started at the same time with the main compressor motor.

9.5 COMPRESSOR IN OPERATION

After the main motor has been started and a time delay of 20 seconds has been elapsed, the feedback from the MCC "main motor running" is given.

After the main motor startup is finished, the compressor is in operation and ready to be loaded.

9.5.1 SWITCH TO LOAD MODE

The compressor can be loaded up through capacity control selector switch on the LCP. Suction valve unloaders are fitted on both ends of the cylinders (0%-25%-50%-75%-100%; 5 Steps).

Suction valve unloaders are Pneumatic (Air-To-Load Type / Fail Safe). At the starting time, solenoid valve is de-energized, so air is unavailable on the unloader to load the compressor. After running the compressor in operation mode, the compressor can be loaded from 0% to 100% in 5 steps.

9.5.2 STOP AUXILIARY LUBE OIL PUMP

The auxiliary oil pump would be controlled via logic at "AUTO" mode. If the compressor is running, the pump is started / stopped by lube oil pressure transmitter.

9.6 COMPRESSOR NORMAL STOP

In Normal Stop Sequence the compressor is unloaded prior to stopping the Main Drive Motor. From 100% to 0% in 5 steps.

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9.6.1 NORMAL STOP SEQUENCE

Before normal stop initiation, the compressor shall be fully unloaded by the operator in the LCP, e.g., from 100% to 75%, 75% to 50%, 50% to 25%, and then from 25% to 0%.

Stop sequence could be initiated after the compressor is unloaded as follows:

- Manually, by the operator from the LCP with Main Motor Stop Push Button
- By Compressor Stop Push Button signal from PLC (HMI)

When the Main Drive Motor Stop command is sent, the shaft driven oil pump no longer can cover the required pressure in the lube oil system. At this condition, the Auxiliary Oil Pump (AOP) Start Command will be automatically energized to start the AOP.

The lubricator oil pump motor shall be automatically stopped after the main compressor motor is stopped. The auxiliary lube oil pump and all electrical heaters are kept in operation.

The Normal Stop Sequence is now completed. The Compressor may be restarted if the 'READY TO START' is established as described earlier in this document.

9.7 COMPRESSOR SHUTDOWN / TRIP

A Shutdown is an abnormal condition that requires an immediate trip of the compressor train without delay of unloading. When a Shutdown condition is detected, the following actions will be occurred:

1. The PLC will initiate a Shutdown and display the "Common Shutdown" message on the HMI.
2. At the same time, the Main Drive Motor Stop signal to the Switchgear is deenergized to open the circuit breaker and stop the Motor.
3. When the Main Drive Motor Stop command is sent, if the AOP selector switch is in Auto position, the AOP Start Command will be energized (based on the logic defined above) to start the AOP. If the switch is in Manual mode, the pump will continue to run until the operator switches the switch to the OFF position.
4. Cylinder lubrication pump is stopped with time delay. The time will be adjusted during commissioning.
5. The Shutdown Sequence is now completed.
6. The condition which caused the Shutdown should be investigated and corrective action taken as required.

10.0 COMPRESSOR CONTROL

The purpose of the Compressor control system is to pressurize the hydrocarbon while protecting the compressor from low suction and extreme conditions in discharge.

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There is controller associated with the compressor control scheme, as follows:

Suction Pressure Transmitter – PT-2121 A/B/C

Discharge Pressure Switch – PS-2195 A/B/C

Discharge Temperature Switch - TS-9194 A/B/C

The output of the PT-2121 A/B/C is sent to spill-back valve PCV-2123 A/B/C. The purpose of the suction pressure controller, PT-2121 A/B/C, is to protect the compressor from abnormally low suction pressure. For a low suction pressure condition, the suction pressure controller will open the spillback valve to maintain the compressor suction pressure. The set point of this pressure controller is set lower than the normal suction pressure.

The purpose of controlling the compressor discharge pressure, PS-2195 A/B/C, is to protect the compressor from an abnormally high discharge pressure. For a high discharge pressure condition, the discharge pressure switch will trip the compressor. The set point of this pressure switch is set higher than the highest expected normal operating pressure. As long as the discharge pressure is normal, it will be lower than the pressure switch set point.

The purpose of controlling the compressor discharge temperature, PS-2194 A/B/C, is to protect the compressor from an abnormally high discharge temperature. For a high discharge temperature condition, the discharge temperature switch will trip the compressor. The set point of this temperature switch is set higher than the highest expected normal operating temperature. As long as the discharge temperature is normal, it will be lower than the temperature switch set point.

10.1 CAPACITY CONTROL

Depending on operating conditions, step-up or step-down of the compressor capacity through unloading valves shall be done manually by operator through LCP (See 9.5.1).

0% capacity mode is only used for start-up of the compressor. By turning the embedded Capacity Control Hand Switch on the LCP from 0% to 25%, 50%, 75%, and 100% the load step would change to a higher level. It is done in reverse as well.

There should be 10 seconds delay following any load step in either direction before any subsequent load step is allowed. This will allow the motor current and the process gas flow to stabilize.