

طرح نگهداشت و افزایش تولید 27 مخزن

ESD PHILOSOPHY

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نگهداشت و افزایش تولید میدان نفتی بینک
سطح الارض

احداث ردیف تراکم گاز در ایستگاه جمع آوری بینک



شماره پیمان:

053 - 073 - 9184

ESD PHILOSOPHY



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D01	0005	PH	PR	120	PEDCO	GCS	BK

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1.0 INTRODUCTION

Binak oilfield in Bushehr province is a part of the southern oilfields of Iran, is located 25 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 Client (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

The objective of this document is to define the plant emergency shutdown / F&G philosophy dedicated to ensure that safe conditions are created during different emergency situations in Binak new compressor station.

3.0 NORMATIVE REFERENCES

3.1 LOCAL CODES AND STANDARDS

- IPS-E-PR-470 Engineering Standard for Process Design of Emergency Measures
- IPS-G-IN-260 Engineering and Installation Standard for Indicating Lights, Alarms & Protective Systems



3.2 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-GCS-PEDCO-120-IN-DG-0003 ESD Level Hierarchy
- BK-GCS-PEDCO-120-PR-BD-0001 ESD Block Diagram
- BK-GCS-PEDCO-120-PR-CE-0001 Cause & Effect Diagram



3.3 ENVIRONMENTAL DATA

Refer to "Process Basis of Design; Doc. No. BK-GNRAL-PEDCO-000-PR-DB-0001".



3.4 ABBREVIATIONS

BDV: Blow-Down Valve
GCS: Gas Compressor Station
ESD: Emergency Shut Down
ESDV: Emergency Shut- Down Valve
F&G: Fire and Gas
GA/PA: General alarm / Public address
PCS: Process control system
UCP: Unit Control Panel
CCR: Central Control Room
UPS: uninterruptible power supply

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4.0 EMERGENCY SHUTDOWN PROVISION

There is ESD system for Binak GCS area with dedicated ESD hierarchy depend on new added equipment. Connection with existing ESD systems shall be reviewed depend on client request.

In case of uncontrollable upsets of the operating parameters, incorrect operation or failure of critical controls or services, the compression section is provided with an emergency shutdown system (ESD), independent from PCS, both for equipment protection and personnel safety, (whose signals are alarmed on the ESD operator screen) to allow the completion of the safe shutdown procedures or to restart the plant (or the part of the plant) in shutdown phase.

ESD systems shall be provided for all Owner Facilities that process, transport, or otherwise handle combustible, flammable, or potentially toxic materials. This includes all installed equipment in Binak Gas Compressor Station.

ESD systems shall be designed and implemented as separate and independent instrumented protection levels, which, in addition to other mechanical over-pressure protective devices (e.g., safety-relief valves), protect plant personnel, surrounding communities and the environment from potential adverse effects of emergencies (e.g., fires, explosions, and hydrocarbon or toxic gas releases)

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Since the function of the existing and new stage of gas compressor station is completely independent and each one has its own area, utility and system performance. So level of ESD and condition of F&G system in existing system can be sent to the new system for alarm and monitoring but it will be ineffective in logic and system performance.(it should be noted that the ability to send and receive between the two systems is distorted, but alteration in the existing system are not within the scope of this project)

ESD systems consist of a structured logic network of sensors or actuating device ,logic solvers, emergency isolation valves, and “permissive” interlocks (e.g., for rotating equipment). These systems react automatically upon detection of an abnormal process, condition or upset, or manually by operator intervention to do the following:

- Isolate hazardous process streams entering or exiting plant equipment or process units
- depressurizing of the highly pressurized sections
- Shutdown associated rotating equipment
- Electrical power isolation

The ESD system consists of at least 4 hierarchical levels of shutdown and/or isolation, as described in following section.



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5.0 DESCRIPTION OF HIERARCHICAL LEVELS FOR NEW GCS

Binak Oilfield Development – General Facilities consists of process units, offsite area and utilities systems as the followings:

- Gas pipeline pig launcher, gas pipeline pig receiver. (through ESD of GCS)
- Gas Compressor station unit consists of two compression stages. (through ESD of GCS)
- Utilities including dehydration package, lean glycol storage tank, diesel oil system, fuel gas system, instrument and plant air system, closed drain system, corrosion inhibitor package, LP flare and ignition package, oily water sewer, potable and fire water, fuel gas system, nitrogen production package, slug catcher. (Through ESD of GCS).



5.1 LEVEL 0– TOTAL PLANT SHUTDOWN WITH AUTOMATIC DEPRESSURIZING

ESD level 0 is isolates and brings into safe condition, all process and utilities systems throughout the plant along with automatic depressurizing of the highly pressurized sections. It shall be initiated through the below causes:

- Manually from Central Control Room
- Confirmed Flammable Gas in HVAC air in-take (from F&G system).
- UPS failure.

Its effects will be as the followings:

- Activation of ESD Level-1A
- Emergency & Normal Power isolation which will trip all electrical sources.
- UPS Battery isolation by time delay.





5.2 .LEVEL 1– PROCESS EMERGENCY SHUT DOWN WITH/WITHOUT DEPRESSURIZING

ESD level 1A is isolates and brings into safe condition, all process systems with automatic depressurizing.

- ESD level-0
- Confirmed flammable gas in fire zone (from F&G system).
- Activation of ESD-1 by time delay.
- Manually from Central Control Room (CCR)
- ESD 1A Requested from existing system

The effects will be as the followings:

- Activation of ESD Level-1
- Activate and open all depressurizing valves in the plant (After ESDV's close confirmation).

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- Power isolation in process area.
- Activation of ESD level 2A.



ESD level 1 isolates and brings plant into safe condition, all process systems without automatic depressurizing.

It shall be initiated through the below causes:

- Push Button in CCR
- ESD Level 1A
- Flare K.O. Drum Level High High(2 out of 3 voting).
- Nitrogen Header Pressure Low Low.
- Instrument Air header Pressure Low Low (2 out of 3 voting).
- Flare ignition failure.
- Network Power Failure
- PCS Failure
- High high liquid level inlet Knock out drum.
- Low low pressure of transfer gas pipeline.
- High high liquid level slug catcher.
- High high liquid level compression discharge drum.
- High high pressure slug catcher.
- DC charger failure



The effects will be as the followings:

- Activation of ESD Level-2
- Activation of ESD level 1A by time delay
- Activation ESD level-3(All utilities will be tripped except emergency generator, fire water pumps, air system, nitrogen system, flare igniter packages and necessary lighting and ventilation systems).
- Close all shutdown valves in the plant
- Stop/trip methanol injection package

5.3 LEVEL 2- GAS COMPRESSOR TRAIN SHUT DOWN WITH/WITHOUT DEPRESSURIZING

ESD level 2A (for each train) will be activated by the below causes for 2nd and 1st stages compressor in train with automatic depressurizing:

- ESD Level 1A
- Compressor failure signal form compressor package. (Depressurized Shutdown).
- Shut down push button in CCR for each dedicated train of GCS.
- ESD2 with time delay.

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The effects of ESD level 2A will be as the followings:

- Activation of ESD Level-2
- Activate and open all depressurizing valves in the specified train.



ESD level 2(for each train) will be activated by the below causes for 2nd and 1st stages compressor in train without automatic depressurizing:

- ESD Level-1
- ESD Level 2A
- Confirm fire in process area of each train
- Compressor failure signal form compressor package (Pressurized Shutdown).
- High High level in train compressor inlet scrubbers (1st, 2nd stage).
- Low Low pressure in suction of each train compressors (1st, 2nd stage).
- High High pressure in discharge of each train compressors (1st, 2nd stage).
- High High temperature in discharge of each train compressors (1st, 2nd stage).
- Shut down push button in CCR for dedicated GCS train.
- High High temperature in discharge of each train air cooler (1st, 2nd stage).

The effects of ESD level 2 will be as the followings:

- Activation of ESD Level-3 (1st, 2nd stage Air coolers and scrubbers).
- Activation ESD level-2A (by time delay).
- Close all shutdown valves in the dedicated GCS train to isolate them.
- Trip compressors 1st, 2nd stage of train.

5.4 LEVEL 3– EQUIPMENT SHUTDOWN

ESD level 3 are activated by upper ESD levels and brings into safe conditions and isolates one or some process equipment or packaged unit. It is initiated manually or automatically in case of abnormal operating condition.



In this level of shutdown one or some equipment (pump, vessel or/and valve) are shut down due to the upset of a governing variable of the equipment (e.g. LSLI shutting down a pump, closing valve, etc.).

6.0 ESD SYSTEM SEGREGATION

ESD systems, associated logic and alarms shall be designed such that they are segregated from, and totally independent of, other regulatory control and monitoring systems.

6.1 ESD SYSTEM FAILURE MODES

All ESD loops and systems shall have a defined failure or fail-safe state. The fail-safe state shall be the de-energized state. This means that all ESD modules, subsystem components, process

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measuring elements and final control elements shall be designed and implemented in such a manner that there is a defined "de-energized" failure state: fail-open, fail-close, or fail-steady.

6.2 ESD SHUTDOWN AND RESET SWITCHES

ESD Shutdown – Push/Pull Button Switches:



- Push or pull button switches shall be used to manually initiate a shutdown, and shall be readily accessible to operations personnel, either within an operator's console/MMI, in a strategic location inside the CCR, or within the process facility itself, outside of a fire-hazardous zone.
- ESD push buttons shall be provided with an extended guard, shroud or similar feature to reduce the risk of accidental actuation. Pull buttons do not require a physical protective guard or shroud.
- Bypasses shall not be permitted for manual ESD push/pull buttons.
- ESD logic shall be configured such that actuation of the ESD push/pull button shall initiate a shutdown immediately.
- The re-energization of ESD system logic and output devices shall only be permitted by separate manual reset action. Automatic reset action for ESD logic manipulating final shutdown elements shall not be permitted.
- Actuation of a manual ESD push/pull button or software-configured switch in an electronic system shall initiate an event log/histogram, to time-tag the initiation of the event with its specific tag number and descriptor.

ESD Reset Pushbutton:

- ESD circuitry and/or logic shall be designed such that if it is de-energized for any reason, it can only be reset (i.e., re-energized) by deliberate actuation of a reset push button. If an ESD system has been reset or is in its normal operating state, the actuation of its reset button shall not cause any abnormal transient or change of state within the ESD logic.
- ESD reset push buttons shall be located in proximity to ESD push/pull buttons, readily accessible to operations personnel, i.e., within an operator's console/MMI. As an option to manual hardwired switches, software-implemented reset buttons may be configured within an operator's workstation graphic display.
- Actuation of a manual reset push button switch in an electronic system shall also initiate an event histogram, to time-tag the actuation of the switch with its specific tag number and descriptor.

6.3 PROCESS CAUSE AND EFFECTS DIAGRAMS

All causes and effects mentioned in this document including , all shut-down commands resulting to actions such as trip of rotating equipment and packages, closing the ESDVs and permissive/opening of blow-down valves interlocks and resulting actions will be identified on the cause and

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effects diagrams.

7.0 FIRE AND GAS SYSTEM PROVISION

The prime objective of the F&G system is to monitor the sites to protect personnel and plant from the effects of flammable and toxic gases, smoke and fire.

The F&G functions shall be carried out by dedicated processors which is designed to be authorized to send alarm, take automat action and monitor fire and gas status in whole the plant. Automat actions shall be performed directly by F&G system (ex. Deluge valves opening) or shall be handed over to ESD (ex. shutdown/ blow down request).

The F&G system shall employ a PLC Based Monitoring and safety system with an architecture complying with the requirements of IEC 61508 to achieve SIL 3 requirements, and shall be certified by TUV.

For cases which voting is required, 2oo3 shall be implemented. The F&G system shall be fully redundant.

The F&G systems will be installed in the CCR of the process area that they are protecting. A dedicated Operator Work Station (OWS) and an Engineering Work Station (EWS) to be considered for authorized person taking adequate actions.

The F&G systems will be connected to control room local network to provide overview information on the monitoring station.

Where the VENDOR has as part of their standard product range a number of system architectures that are each capable of achieving the availability and reliability requirements of this specification, each architecture shall be offered.



Where gas detectors are provided within buildings, F&G system shall generate all necessary protective action, such as HVAC closure.

Refer to Fire & Gas Cause and Effect Diagram, for detail of F&G automate actions.

The primary objectives of the Fire & Gas are to:

- Provide early detection of the presence of fires or flammable gas releases.
- Communicate detection information to personnel so that response measures can be initiated.
- Initiate automatic executive actions as required appropriate to the level of emergency to minimize the likelihood of escalation.
- These objectives should be pursued as far as reasonably practicable through the provision of the following measures in the design:
 - Awareness of potential high-risk leak areas and a corresponding concentration of coverage with suitable type detectors consistent with the manning and workgroup distribution levels.
 - Prompt detection of fire and gas leaks through links to initiate alarms and automatic executive actions for safeguarding.

The Fire & Gas system shall be supported by manual call points to enable personnel to raise the alarm on discovery of a hazardous condition.

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7.1 FIRE & GAS CAUSE AND EFFECT

F&G logic shall be shown schematically in a cause and effect diagram. Each cause shown in this diagram shall cause an alarm, activate fire-fighting devices or initiate shut down.

System suitable rooting logic is to be considered for causes which lead process system to shut down.

As minimum the following action shall be implemented in F&G system logic:

- Total shut down & automatic depressurizing (level 0) to be initiated in case of activation of confirmed gas detection in HVAC air in-take.
- Unit Shut down and automatic depressurizing (level 1A per process unit area) to be initiated in case of activation of confirmed toxic gas detection in each process unit area.
- Total shut down & depressurize (level 1A) to be initiated in case of activation of confirmed Flammable gas in process unit area.in additionally power sources to process area shall be isolated.