CONTENTS

1.0 INTRODUCTION

1.1 PROJECT DESCRIPTION

BZ34-1 oil field is located at the southern area of Bohai Bay，including the principal part field, the west block and the north block of BZ34-1 oil field. The east longitude of oil field is from 119° 27' to 119° 37' and the north latitude of oil field is 38° 06' to 38°10' .The oil field is adjacent with BZ34-2/4 oil field in south, approximately 90 km southeast from Longkou Shandong, 35km northwest from BZ25-1 oil field and 22km northeast from BZ28-2s oil and gas field. The mean water depth in this area is about 20.5 m and the temperature in this area is from -17.2℃ to 34.6℃.

1.2 PURPOSE OF DOCUMENT

This philosophy describes in general terms the Fire & Gas system requirements for BZ34-1 WHPE platform located in BZ34-1 OIL FIELD DEVELOPMENT ADJUSTING.

Any conflict between this specification and the requirements of current standards, codes of practice or other related engineering specification shall be referred to Client for clarification in writing.

1.3 DEFINITIONS

Project	BZ34-1 OIL FIELD DEVELOPMENT ADJUSTING
Client	CNOOC Tianjin Ltd.
Vendor	Suppliers of Control System or Instrument Component

2.0 STANDARDS, CODES, TERMINOLOGIES AND REFERENCE

System designs, materials, equipment, and services shall conform to the provisions of the codes or standards required by Chinese laws or ordinances, as identified in Section 2.1. Vendor shall follow ANSI, API, CSA, FM, IEC, IEEE, ISA, NEMA, NFPA, NEC, SAMA, TUV, UL, local codes and other industry standards whenever applicable and appropriate.

The order of priority, by the Client to the Vendor, shall be as follows:

- Purchase order or written contract issued by Client.
- This written specification.
- Any code, standard, regulation or specification.

2.1 CODES AND STANDARDS

The latest revisions of following organizations related codes and standards shall be used for the design, selection and installation of the Fire & Gas System:

- Safety Rules for Offshore Fixed Platforms (2000)

- NFPA 70-National Electrical Code

- NFPA 72-National Fire Alarm Code

- NFPA 111-Standard on Stored Electrical Energy Emergency and Standby Power Systems

- API RP14C-Recommended Practice for Analysis, Design, Installation and Testing of Basic Surface Safety Systems on Offshore Production Platforms

- API RP14F-Recommended Practice for Design and Installation of Electrical Systems for Offshore Production Platforms

- API RP14G-Recommended Practice for Fire Prevention and Control on Open Type Offshore Production Platforms

- API RP500-Classification of Locations for Electrical Installations at Petroleum Facilities Classified as Class I. Division 1 and Division 2 .

- SY/T 6137-Recommended Practice for Oil and Gas Producing and Gas Processing Plant Operations Involving Hydrogen Sulfide(2005)

- SY/T 6277-Specification of Hydrogen Sulfide Monitoring and Protecting for Operation Personnel In Oil and Gas Field Involving Hydrogen Sulfide(2005)

- SY/T 5087-Recommended Practice for Safe Drilling Operations Involving Hydrogen Sulfide(2005)

- ISA 12.13-Performance Requirements for Combustible Gas Detectors

- ISA-92.0.01-Performance Requirements for Toxic Gas-Detection Instruments: Hydrogen Sulfide (Part I-1998)

- ISA S18.1-Annunciator Sequences and Specifications.

- IEC 60331-Fire resistance cable tests

- IEC 61131.2-Programmable Controllers: Equipment Requirements

- IEC 61131.3-Programmable Controllers: Programming Languages

- IEC 60529-Degrees of Protection for Electrical and Electronic Equipment Enclosures

- IEC 61508-Functional Safety of Electrical/Electronic/Programmable Electronic safety-related systems

- IEC 61511-Functional Safety - Safety Instrumented Systems for the Process Industry Sector

- EEMUA 191-Alarm Systems, A Guide to Design, Management and Procurement

2.2 TERMMINOLOGIES

The following terminology or abbreviations are commonly used in this document:

- APS - Abandon Platform Station
- CCER - Central Control Equipment Room
- CCR - Central Control Room
- CCS - Central Control System
- DCS - Distribute Control System
- EEMUA - Engineering Equipment and Material User's Association
- EMI - Electro Magnetic Interference
- ESD - Emergency Shutdown System
- FAP - Addressable Fire Alarm Panel
- FAT - Factory Acceptance Test
- FGS - Fire & Gas System
- FM200 - Heptafluoropropane
- HMI - Human Machine Interface (e.g. Operator Workstation)
- HVAC - Heating Ventilation and Air Conditioning
- HWC - Hardwired Console
- I/O - Input / Output
- WR - Workover Rig
- IS - Intrinsically Safe
- LQ - Living Quarter
- MCC - Motor Control Centre
- MFS - Manual Fire Alarm Station
- MTBF - Mean Time Between Failures
- MTTR - Mean Time to Repair
- PCS - Process Control System
- PLC - Programmable Logic Controller
- SAT - Site Acceptance Test
- SDV - Shutdown Valve
- BDV - Blowdown Valve
- SER - Sequence of Events Recorder
- SIL - Safety Integrity Level

- WCP - Wellhead Control Panel
- ASD - Aspiration Smoke Detector

2.3 REFERENCE DOCUMENTS

2.3.1 Specification

BD-SPC-WHPE-IN-0001	Specification For Instrument Control Philosophy
BD-SPC-WHPE-IN-0004	Specification For Emergency Shutdown System
BD-SPC-WHPE-SA-0001	General Safety Philosophy

2.3.2 Drawings

BD-DWG-WHPE-IN-0001	Overview Control System Block Diagram
BD-DWG-WHPE-IN-0002	ESD System Hierarchy Block Diagram
BD-DWG-WHPE-IN-0003	Fire & Gas System Logic Block Diagram
BD-DWG-WHPE-IN-0005	ESD System Cause & Effect Charts
BD-DWG-WHPE-IN-0006	Fire & Gas System Cause & Effect Charts
BD-DWG-WHPE-IN-0007	Pushbutton And Alarm Lamp Arrangement Diagram
BD-DWG-WHPE-IN-0009	Fire & Gas Detection/Alarm Devices Layout Drawing

2.4 CLASSIFICATION

The design, drawings, and other documents must meet Certification Authority requirements.

3.0 ENVIRONMENT DESIGN CRITERIA

Consideration of the ambient environmental conditions are vital, both to provide reliable operation and to avoid triggering of detectors due to environmental conditions. This shall involve evaluation of wind, rain, temperature, solar radiation, salinity, humidity, contaminants, and also industrial conditions such as mist, fog, oily atmosphere and vibration. These conditions shall impose restrictions in the choice and effectiveness of the detectors and also in the operation and maintenance requirements.

Environment Conditions:

Temperature	Maximum:	34.6℃
	Minimum:	-17.2℃
Relative humidity	Maximum:	90%
	Minimum:	24.2%

CCR Under HVAC:

Temperature	Maximum:	25℃
	Minimum:	20℃
Relative humidity	Maximum:	60%
	Minimum:	35%

However, during construction, commissioning, shutdown or periods of Heating, Ventilating and Air Conditioning (HVAC) failure, the FGS may be subjected to the environmental conditions given above. The FGS shall therefore operate satisfactorily at these more arduous conditions.

4.0 FIRE & GAS SYSTEM DESCRIPTION

4.1 GENERAL

The Fire & Gas system of WHPE shall include the following items:

- The main Point-to-Point FGS in CCR on LQ.
- The addressable FGS on Living Quarter.
- The self-contained F&G on Workover Rig.

The main Point-to-Point FGS shall be based on dedicated controller or Programmable Logic Controller (PLC) technology, and shall use Vendor standard special safety equipment that has been proven by offshore platforms. And it shall be a proprietary system and interface with the platform's Process Control System (PCS) and Emergency Shutdown System (ESD).

The logic controller of FGS shall comply with the requirements of IEC61508 and IEC61511 to SIL 2 as minimum.

4.1.1 Redundancy

100% Redundancy shall be provided, including but not limit central processor, power supply, I/O module, communication module, data communication bus and any specific hardware, which will be unique to the proposed system. The system shall have the highest possible level of reliability, security, availability and maintainability. Common mode failure point shall be avoided, whenever possible.

Changes in voting regime due to equipment failure shall not interrupt the detection and protection facilities.

Any changeover shall be signaled by an appropriate diagnostic alarm.

Each input/output circuit shall be individually isolated and individually protected by fuse.

4.1.2 Spare

Redundant capacity shall not be considered spare capacity. The FGS shall be designed with 30% of installed spare capacity for each kind of I/O, power supply, controller etc. In addition, at least 30% spare space shall be available at each

equipment cabinet to allow for undefined future expansion. The installed spare shall be wired up to the card image terminal blocks.

4.1.3 Response time

The system shall in all cases respond to any alarm input that requires control action by computing the logic and tripping associated outputs (that are not subject to an intentional sequencing delay) within 250 milliseconds. This requirement shall be independent of any other considerations, such as number of inputs simultaneously tripping or operator access to the system.

4.1.4 Status Indication, Alarm Management and Reporting

Status of every input/output, inhibit, override, healthy, faulty, etc, shall be displayed at all operator stations through the High Speed Ethernet.

Status indication, alarm generation and reporting shall have no impact on the protection system response to trips. Alarm management and report generation will be done by the respective FGS operator stations.

An alarm recording printer shall be available which will record events, in the exact sequence, with time stamping. The time stamping shall not be less than the controller scan time and related to real time clock.

Alarm suppression and/or filtering shall be possible on individual alarms, pre defined groups of tags or initiated by logic (e.g. suppression of alarm for equipment that is under maintenance or not in service).

All alarms from FGS detectors shall raise alarm and printouts.

4.1.5 Logic Configuration

The FGS logic shall be structured in a modular format and permitting subsequent modification/expansion.

The FGS shall be configured to perform logic operations detailed in the Vendor furnished documents. Functional logic diagrams shall be generated by Vendor and shall be approved by Client before construction.

4.1.6 Overrides

It shall be possible to test FGS logic without degrading the platform safety and affecting the production rate. Maintenance overrides shall be provided on input signals, which shall be authorized by providing a permissive signal for override. Only one single input in a fire zone at any given time shall be overridden. An alarm shall be raised and printed in respective operator station and printer whenever an input is overridden. A timer shall be set to record the period of overridden input.

Override shall not be provided on outputs.

4.1.7 SER

Sequence of events recording functionality shall be built to monitor status of maintenance and operation override status, system status alarms, supervisor/operator interface functions and other nominated inputs. The SER shall

monitor change of status of all inputs assigned to it with a resolution of one (1) millisecond. All such time stamped events recorded data shall be transferred, via block transfer, to the PCS for operator viewing and printing.

All events recorded by the system shall be made available to respective operator station for monitoring and printing reports of SER.

The following functions shall be available for SER, as a minimum:

- Daily report.
- List of maintenance overrides.
- List of alarms/events.
- List of forced I/O.
- Selective playback of events i.e. on selected time frames.

The SER reports shall be saved through operator workstations and printed whenever required.

4.1.8 Diagnostics / Testing

All system hardware shall regularly utilize automatic complete self-testing diagnostics. Software based system shall also employ automatic testing including the application program, to ensure the system's ability to meet a demand.

As a minimum this shall include testing of all input and output circuits, I/O modules, logic processing modules, memory tests, logic solve tests, and communications facilities. Testing shall be comprehensive testing all paths in the system.

Test programs shall be in firmware and the use of application software based test programs shall be avoided. Vendor's FDS (Functional Design Specification) shall detail the basis of the design including a statement on how test software will be generated to match revised application logic.

Vendor shall state the optimum frequency for the automatic self-test routine necessary to maintain the requirements of system availability and reliability. It shall be possible to manually initiate the self-test routines. Self-test routines shall include line monitoring (to check continuity of wires), earth fault detection, etc.

The result (fault) of the self-test shall be reported to operator station.

On receipt of any trip demand, the auto-test routine shall not inhibit the processing and implementation of the logic function required.

Should a fault be detected, and where there is redundancy of design, the system shall automatically adopt to maintain its ability to meet a demand.

No fault condition shall remain undetected.

Vendor's FDS (Functional Design Specification) shall describe in detail the software and hardware about self-testing routines.

4.1.9 Communication

The High Speed Ethernet shall be capable of supporting all the shutdown, control

and monitoring functions relating to the FGS system.

The Ethernet cable shall be flame retardant to IEC 60332.

The FGS network utilization shall not exceed 50% of total I/O capacity, considering installed I/O spares and future I/O expansion, and under the worst operating conditions. Two sets of cables shall be supplied for redundancy.

4.1.10 Processor Loading

The overall system and all individual devices comprising the FGS shall not be loaded by more than 50% of their rated capacities when all I/O (including installed spares) are taken into consideration. The Vendor shall demonstrate loadings by means of calculations. These shall be estimated at the FDS (Functional Design Specification) stage and formally submitted prior to the system's Factory Acceptance Test (FAT), complete with associated source data. The Vendor shall also confirm the effect on all devices if future expansion is to be implemented.

4.1.11 Historical Data Retention

The history data collection and retention will be done by respective operator station. The Vendor shall ensure that all necessary data are communicated to PCS and shall coordinate with PCS Vendor for effective communication requirements between the systems. Necessary I/O mapping shall be provided. Details of historical data retention shall refer to Specification of Process Control System.

4.2 SYSTEM FEATURES

As a minimum, the system shall provide the following features:

- The FGS shall continuously monitor all offshore facilities and in response to the detection of a fire condition or leakage of hydrocarbon gas, initiate the appropriate fire fighting and shutdown also alert personnel audibly and visually.

- The FGS shall receive signals from flame detectors, gas detectors, smoke detectors, heat detectors, MFS and instrument devices directly related to the control and operation of active protection systems and display and record the fire alarms, gas alarms, HVAC systems and fire fighting system equipment status. This shall include the location of detectors, MFS, the real-time concentration of gas detected by any gas detector, fault annunciation (open/short circuit, grounding, etc) and normal operating status from flame detector, gas detector, heat detector, smoke detector, MFS.

- The FGS shall be completed with all necessary facilities to carry out the specified functions and also indicate the state of the logic and provide specified test, reset, silence/acknowledge, override/inhibit facilities.

- The FGS shall be able to monitor the earth fault for each I/O card, and open/short circuit for each normally open channel from I/O card to field devices continuously so that any short circuit, open circuit and earth fault shall be displayed as fault alarms.

- All signals, which are sent from Fire & Gas detection/alarm devices, shall be

identified and accepted by the FGS.

- Built-in self-testing/checking facilities shall be provided for input and output circuit, plus system hardware and software. Also the system shall have the function of self-diagnostic.

- The FGS shall process and distribute all the input signals and output signals so as to activate alarm system, fire fighting system and shutdown system.

- The FGS shall allow online testing of detectors without shutting down the facilities.

- The FGS shall be integrated together with the PCS, ESD system such that they can share the operator stations, printers and data communication system. The FGS will be independent and self-reliant, but it can share the same database and realize real-time communication with PCS and ESD. Each operator workstation must have the same HMI capabilities and should operation and monitoring every I/O of the FGS.

- The operator interface for the FGS shall share the same operator stations with PCS. The operator stations are located in the Central Control Room (CCR).

- All FGS alarms and other associated data shall be continuously transmitted to all operator stations by Ethernet bus.

4.3 SYSTEM COMPOSITION

The FGS shall be a PLC based system and shall support the fail-safe as well as the non fail-safe circuits.

Equipment shall be rugged and reliable as it is expected to work in the offshore environment with minimum maintenance.

System memories and clock shall be protected from power loss. An alarm shall occur when this battery is low.

The FGS shall utilize a modular structure with the common equipment modules and plant interfaces arranged in suitable rack mounting shelves. All internal shelf and panel wiring shall be accessible.

Control and display equipment are located in the CCR.

The FGS shall consist of the following devices, but not limited.

4.3.1 Field Devices

Field devices include heat detectors, smoke detectors, flame detectors, combustible gas detectors, H_2 detectors, manual fire alarm station, Abandon platform station, FM200 manual release pushbutton, FM200 manual inhibit pushbutton, FM200 release alarm strobe and bell, and platform status lights.

4.3.2 Controllers

100% redundant controllers shall be installed in the main chassis. Each controller shall independently communicate with FGS I/O modules.