	Design Division Engineering Services ISO – 9001:2008	FUNCTIONAL SPECIFICATION FOR "FIRE & GAS DETECTION SYSTEM.	SPEC. No. 3500 Rev. No. 6 Discipline: Instrumentation Page 1 of 35

FUNCTIONAL SPECIFICATION FOR FIRE & GAS DETECTION SYSTEM

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1.0 SCOPE OF THIS DOCUMENT

1.1 This specification defines the minimum requirements for the design, engineering, fabrication, inspection-testing, supply, installation and commissioning of Fire & Gas Detection System for use on offshore platform.

1.2 This specification describes Fire & Gas Detection System with field detectors and the functionality of the system as a whole. It does not cover the detailed specifications of:

a) PLC: Functional Specifications of PLC are addressed in spec. no. MR / OD / INST / FS / C101
b) Pneumatic Panel. Functional Specifications of Pneumatic Panel are addressed in spec. no. MR / OD / INST / FS / 3501.

1.3 Any deviations from the requirements of this specification shall be stated in 'Deviation List' in contractor's proposal. Unless specific deviations are stated, it shall be understood that the Fire & Gas Detection system is in accordance with the specification.

1.4 Contractor's proposal shall also include revision status sheets, which shall show revision status of each page of the proposal / purchase specification for every submission.

1.5 Any ambiguity in this specification and the reference specifications pertaining to the requirements of Fire & Gas Detection System shall be referred to the company for clarification prior to finalization of Purchase Specification.

2.0 REFERENCE DOCUMENTS & SPECIFICATIONS

a) Basic Bid Work
b) Instrumentation Design Criteria
c) Spec. No. MR / OD / INST / FS / C101: Functional specification for PLC.
d) Spec. No. MR / OD / INST / FS / 3501: Functional specification for Shutdown Panel.
e) HSE -5102, OISD-189

3.0 SCOPE OF SUPPLY

3.1 The Fire and Gas Detection System shall include the following equipment:

a) Field Detectors including thermal, smoke, point and open path type Hydrocarbon gas detectors, Hydrogen gas detectors, toxic gas (H2S) detectors, Triple IR (outdoor and GG-PT Enclosure) and UV/IR (indoor) flame detectors, Fire loop system with Fusible plugs, ESD & FSD pull stations (valves), manual alarm stations, flashing and audible alarm beacons etc.

b) Accessories including mounting units, etc to make the system operationally and functionally complete.

c) Interfaces to the field as well as Control Room for Alarm & initiation of Fire Suppression actuating devices including Fire Water Pump control panel, opening of Blow down valve for reducing hydro-carbon inventory, deluge valves and for release of DCP/Clean Agent & other Fire extinguishing agent.

d) Interfaces to other systems of the platform including DCS, ESD system, Package equipment (such as Gas Turbines, Process gas compressors) fire & gas detection system, Paging system, emergency generator, pneumatic panel.

e) Fire and Gas Matrix panel, Critical alarms annunciation.

f) Other items including portable purge calibrators, calibration cylinders, commissioning spares, special tools & tackles.

4.0 FIRE & GAS DETECTION SYTEM

4.1 GENERAL

4.1.1 The Fire & Gas Detection system is required to address the risk associated with imminent or established fire and combustible/ toxic gas release.

4.1.2 Type approval by FM/UL/BASEEFA/CENELEC/CSA/IEC/DGMS/PTB/ CMRI/ATEX for use in Class I, Division I, Group C & D and T3 hazardous area, of all Fire and Gas detectors shall be required.

4.1.3 Unless otherwise specified all contacts shall be volt free contacts which shall be 2 X SPDT or DPDT type, rated 24 VDC – 2 amps.

4.1.4 The Fire & Gas Detection system scheme shall be one out of the following two schemes (refer 'Basic Bid Work' for type of scheme to be followed for the project)-

a) Scheme – A **:** For Well-Head Platform
b) Scheme – B **:** For Process Platform

4.1.5 **Scheme - A :** Fire & Gas Detection system for Well-Head Platform shall constitute the following **:**

a) Field detectors including point and open-path type hydrocarbon gas detectors, Hydrogen gas detectors, H2S gas detectors, Smoke detectors, Triple IR Flame detectors, Thermal detectors, Pneumatic Fire loops with Fusible plugs, FSD & ESD pull stations (valves), Flashing & Audible Alarm Beacons and Clean Agent System for Fire Suppression.
b) Each loop shall generate at least two independently adjustable volt free contact outputs.
c) Accessories including mounting units, etc to make the system operationally and functionally complete.
d) Detectors controller / monitor card mounting unit with relays logics or F&G PLC (SIL 3) (as per basic bid work) which shall be installed in SAFE area.
e) Interface to the Electrical Rooms actuating devices as well as field including ESD/FSD, deluge valve actuation logic, Clean Agent system, Fire Water Pump etc.
f) Interfaces to other systems of the platform including pneumatic shutdown Panel / PLC based SDP/ General Purpose Standalone PLC, RTU etc..
g) Other items including portable purge calibrators, calibration cylinders, commissioning spares, special tools & tackles.

4.1.6 **Scheme – B :** Fire & Gas Detection system for Process Platform shall constitute the following **:**

a) Field devices including thermal, smoke, point and open-path type Hydrocarbon gas detectors, Hydrogen gas detectors, toxic gas (H2S) detectors, Triple-IR (outdoor & GG-PT enclosure) and UV/IR (indoor) flame detectors, Pneumatic Fire loops with Fusible plugs, FSD & ESD pull stations (valves), manual alarm stations, flashing and audible alarm beacons for actuation of Fire suppression system.
b) Accessories including mounting units, etc to make the system operationally and functionally complete.
c) Interfaces to the field as well as Control Room actuating devices including actuation of Clean Agent system, deluge valves & FWP Control Panels, pneumatic solenoid & pilot valves, extinguishant release, Blow-down valve open etc.
d) Interfaces to other systems of the platform including DCS, ESD system, RTU, Package equipment (such as Gas Turbines, Process gas

compressors) Fire & Gas detection system, Paging system, Emergency Generator, Pneumatic Shutdown panels.

e) Fire and Gas Matrix panel, Critical alarms annunciations.

f) Other items including portable purge calibrators, calibration cylinders, commissioning spares, special tools & tackles.

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For enclosed areas like Building Modules, Living Quarters, Control Rooms, Switch Gear Rooms, Stores and Lab rooms etc. Addressable type Smoke and Thermal detectors shall be directly connected to Addressable Fire & Gas Detection System, which shall be then further hardwired to SIL 3 F&G PLC for executive actions.

For open areas either of the following schemes can be considered:

i) F&G detectors (4-20 mA with HART) shall be directly connected to SIL 3 F&G PLC system for voting logic and Executive actions.

ii) 4-20 mA type F&G detectors with addressable interface unit' shall be connected to Addressable Fire and Gas Detection System for voting logic/diagnostics and the system shall further be hardwired to independent SIL 3 PLC for Executive actions.

iii) Addressable type F&G detectors shall be directly connected to Addressable Fire & Gas Detection System for voting logic / diagnostics and the system shall further be hardwired to independent SIL 3 F&G PLC for Executive actions.

Fire and Gas Detection System Vendor shall take Single point responsibility for the complete F&G system including F&G Detectors (both 4-20 mA type and addressable type).

Fire Alarm Aspiration System shall be provided for Control Rooms and Switch Gear Rooms and shall be connected to SIL 3 F&G PLC (for SIL 3 PLC Refer Specification MR / OD / INST / FS / C101).

4.2 SYSTEM REQUIREMENTS

The F&G system will be powered from a dedicated 24 VDC battery back-up supply, which will provide stable supply, allowing orderly shutdown and monitoring if power is lost. Power supply sizing shall also consider requirement of installed spares & spare space in F&G system 'Control Devices'. The back-up system capacity shall allow continued monitoring by the F&G system for a nominal period of minimum 24 hours for Process Platform and 7 days for Well-Head Platform powered by Solar/Wind and 48 hours for Well-Head Platforms powered from Process Platform through Sub-sea Cable. This period shall be confirmed by the contractor following project risk assessments and HAZOP. A common power supply fault alarm shall be provided for connection to RTU (for Scheme - A) / DCS (for Scheme - B). Contacts shall be volt free contacts. The complete System shall be G3/GX

compliance with conformal protective coating as a minimum (ref. IDC rev6 Cl. No. 3.6.4.1.2.3). The F&G system shall have floating Ground power supply. The system shall have line monitoring system for all the actuation loops. Peak load demand shall be considered at the time of load calculation of the F&G System.

4.2.1 **DETECTORS AND FIELD DEVICES**

4.2.1.1 **GENERAL**

4.2.1.1.1 The detectors and field devices shall be suitable for the offshore climate including regular monsoonal rains and corrosive marine environment.

4.2.1.1.2 The atmospheric conditions that detectors and field devices will be subject to are in general as per Instrumentation Design Criteria Cl. No. 3.6.4.4.1.

4.2.1.1.3 Detector Location: The Contractor shall specify each type of detector and their locations and mountings, to ensure the earliest response to imminent or established fire or hydrocarbon release or toxic (H2S) gas release and accumulation, with consideration to the following as a minimum:

a) Requirements of referenced standards, particularly API RP 14C, 14G, ISA 12, ISA 92, NFPA 72 and SGDA (Smoke and Gas Dispersion Analysis).

b) Equipment layouts: Placement of detectors shall not interfere with process equipment maintenance.

c) Ease of Maintenance: The fire and gas detectors shall be installed in a location accessible for calibration and maintenance, preferably from deck or fixed platform, but not in frequently used access ways.

d) Certain areas shall be avoided, such as sample stations where spurious alarms would negate the effectiveness of the detection system.

4.2.1.2 **GAS DETECTORS**

4.2.1.2.1 For the purpose of selecting gas detectors following general factors shall be considered-

a) Combustible Gas (HC & H2) Detectors shall be able to perform to the temperature, humidity, air velocity and vibration specification prescribed in ISA S 12.13.01 (Part I). Toxic Gas (H_2S) Detectors shall be able to perform to the specifications prescribed in ISA S 12.15.01 (Part I).

b) **Temperature Effects:** The detectors shall be calibrated at their mean operating temperature. All components, including the sensor, shall be designed for operation within the ambient temperature range for the location of the installation. Where high temperatures are unavoidable, high-temperature rated detectors with remote sensing heads shall be employed.

c) **Effects of Humidity:** The detector housing shall be suitable for offshore salt laden marine environment.

d) **Air Velocity:** Sensors shall be located away from prevailing winds, heating and cooling system. Air circulation patterns and effects of other equipment that affect circulation shall be taken into consideration while finalizing the location of the detectors. Where widely varying wind direction changes are expected, multiple detectors shall be installed to provide the required coverage.

e) **Vibration:** Sensors shall be located away from vibration prone areas. If this is not possible, the sensors shall be mounted on flexible mounts or flexible conduit.

f) Combustible and toxic gas sensors shall be located in accordance with the protection area limitations of the detector manufacturer.

g) Sensors shall be typically located approximately 1 m from the expected emission point, and preferably in the direction of ignition sources and / or populated areas.

h) Special consideration shall be given to the properties of the process gas (refer Process Design Criteria for properties of process fluids), specifically its vapour density and predominant component. For lighter-than-air gases, the detectors shall be placed above the release point. For heavier-than-air gases, the detectors shall be placed 300-450 mm above the floor.

i) Detector locations shall take into account the possible flow pattern of the leaking gas or vapour and ventilation system airflow.

j) The number of detectors shall be based on the number of potential release sources.

k) Perimeter detection of releases shall be considered in areas containing large amounts of light hydrocarbons (e.g. process areas or pressure storage areas) to alert operations to initiate a manual response or to actuate an automatic response (e.g. unit shutdown or firewater spray system). These detectors shall be installed along a unit boundary adjacent to an ignition source.

l) Indoor or partially enclosed installations that may require gas detection (such as turbine enclosures, compressor stations, etc.) shall be protected with open path or point detection system.

m) Where buildings are equipped with HVAC, pressurizing or a ventilation system, a combustible-gas and / or toxic-gas detector shall be located in the inlet to the system and also in air locks.

n) In high-temperature enclosures, such as enclosures for gas turbines, a remote sampling head shall be used, with a standard detector located outside the enclosure and the gas sample aspirated to the detector head.

o) Detectors shall be provided to detect presence of gas into engine air intakes, and presence of gas in enclosure exhaust vents.

p) Sampling in indoor locations shall be accomplished by diffusion and convection air currents.

q) No pump or other means of forced air movement shall be required for normal application.

4.2.1.2.2 **Fixed HC Detectors**

4.2.1.2.2.1 Fixed Hydrocarbon (HC) Gas Detectors shall be based on Infrared Absorption Technology. ***Catalytic HC detectors shall not be used.***

4.2.1.2.2.2 The detecting unit included in the sensor head shall provide adequate sensitivity and stability, under all conditions, with ±5% accuracy (For Range of 100 LEL).

4.2.1.2.2.3 Conventional Detectors with HART shall be powered from 24 V DC supply, with a 4 - 20 mA signal loop to cover the calibrated range. Detector faults shall be signaled by 4 mA signal.

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For addressable Fire & Gas System, Vendor can offer loop powered detection system (power & communication on the same loop). Alternatively Vendor may offer separate power and communication loops type Addressable Fire & Gas detection System.

Note: In Scheme-A, detector shall provide 2 nos. of volt free contact outputs for Non-PLC Panel. These 2 nos. of contact outputs shall be independently adjustable over entire range of gas detection.

4.2.1.2.2.4 **Junction Boxes: E**xplosion proof junction boxes shall be provided with the detectors for cable termination.

4.2.1.2.2.5 Detector system shall initiate responses at two different concentrations: for warning alarms and for initiation of executive action. Typical values of these set-points are:

- 20% and 60% LEL for general process areas
- 15% and 40% LEL for HVAC air intakes
- 5% and 10% LEL for turbine engine air intakes

4.2.1.2.2.6 The alarm condition shall not be resettable until the specific detector reading has dropped below the warning alarm level as applicable (Manual-resettable type).

4.2.1.2.2.7 Operator response shall be required to clear the audible and visual alarms.

4.2.1.2.2.8 HC detectors may be either **Point Detectors**, or **Open Path Detectors** or **a combination of both**.

4.2.1.2.2.9 **Point HC Detectors:** Point HC Detectors shall be calibrated 0-100% LEL (Lower Explosive Limit) of Methane in air. A single point detector may be used for more than one release point, with due consideration to the manufacturer's specification of the sensing area.

4.2.1.2.2.10 **Open Path HC Detectors:** Open Path IR detectors shall be located where the beam will provide a clear view over process equipment. The detectors shall be selected for the correct path length with a separate transmitter and receiver. The installation of transmitter and receiver shall be as per International Codes and Standards. Combined transmitter and receiver with mirrors shall not be used. Units shall not be affected by direct sunlight, fog or mist.

4.2.1.2.2.11 **Combination of Open Path and Point IR Detectors:** If multiple release sources are present in a process unit, then both point and line-of-sight detection may be used.

4.2.1.2.3 **Portable HC Gas Detectors**

4.2.1.2.3.1 The number of Portable HC Gas Detectors required per platform shall be as per the Basic Bid Work.

4.2.1.2.3.2 The portable HC detectors shall be capable of detecting 0 – 100% LEL of HC and shall have an accuracy of ±5% (For Range of 100 LEL).

4.2.1.2.3.3 The portable HC gas detector shall have an integral audio-visual alarm and shall be factory calibrated for 20% and 60% LEL HC. Alarm shall be adjustable over the entire detection range of gas detectors.

4.2.1.2.3.4 The portable HC detectors shall be standard size battery (AA/R6 or C/R14 or D/R20) operated. The batteries shall not be rechargeable type.

4.2.1.2.3.5 The portable HC detector shall be capable of generating a "Battery Low" Alarm.

4.2.1.2.3.6 The portable HC detectors shall also include accessories such as carrying case, aspirator, calibration adaptor, etc.

4.2.1.2.3.7 The portable HC detector shall be suitable for Class I, Div I, Group B, C, D, T3 hazardous area.

4.2.1.2.4 **Fixed H_2S Detectors**

4.2.1.2.4.1 Fixed H_2S Detectors shall be based on Electrochemical cell technology.

4.2.1.2.4.2 Conventional Detectors with HART shall be powered from 24 V DC supply, with a 4 - 20 mA signal loop to cover the calibrated range. Detector faults shall be signaled by 4 mA signal.

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For addressable Fire & Gas System, Vendor can offer loop powered detection system (power & communication on the same loop). Alternatively Vendor may offer separate power and communication loops type Addressable Fire & Gas detection System.

Note: In Scheme-A, detector shall provide 2 nos. of volt free contact outputs for Non-PLC Panel. These 2 nos. of contact outputs shall be independently adjustable to over entire range of H_2S gas detection.

4.2.1.2.4.3 The H_2S detectors shall be capable of detecting 0 – 50 ppm of H_2S and shall have an accuracy of ±3 ppm.

4.2.1.2.4.4 The fixed H_2S detectors shall initiate responses at two different concentrations: for warning alarms and for initiation of executive action.

4.2.1.2.4.5 Nominal system alarm settings shall be 10 ppm for "Alert" Level and 20 ppm for "Danger" Level.

4.2.1.2.4.6 The alarm condition shall not be resettable until the specific detector reading has dropped below the warning alarm level as applicable (Manual-resettable type).

4.2.1.2.4.7 Two H_2S detectors shall be installed at each ventilation air intake of control rooms and normally manned buildings. For Living Quarters and HVAC air intake H2S detectors shall have 0 to 20 ppm range with accuracy ±2 ppm. Nominal system alarm settings shall be 5 ppm for "Alert" Level and 10 ppm for "Danger" Level.

4.2.1.2.4.8 Local display on the sensors and visual alarm indication shall be there.

4.2.1.2.5 **Portable H_2S Detectors**

4.2.1.2.5.1 The number of Portable H_2S Gas Detectors required per platform shall be as per the Basic Bid Work.

4.2.1.2.5.2 The portable H_2S detectors shall be capable of detecting 0 – 20ppm of H_2S

and shall have an accuracy of ±3 ppm.

4.2.1.2.5.3 The portable H_2S gas detector shall have an integral audio-visual alarm for activation upon detection of 5 ppm and 10 ppm of H_2S.

4.2.1.2.5.4 The portable HC detectors shall be standard size battery (AA/R6 or C/R14 or D/R20) operated. The batteries shall not be rechargeable type.

4.2.1.2.5.5 The portable H_2S gas detector shall be capable of generating a "Battery Low" Alarm.

4.2.1.2.5.6 The portable H_2S gas detectors shall also include accessories such as carrying case, aspirator, calibration adaptor, etc.

4.2.1.2.5.7 The portable H_2S detector shall be suitable for Class I, Div I, Group B, C, D, T3 hazardous area.

4.2.1.2.6 **Fixed H_2 Detectors**

4.2.1.2.6.1 Fixed catalytic H_2 Detectors shall be provided in the battery room and process areas, which may see release of H_2 gas. Minimum of two H_2 detectors shall be provided in an area.

4.2.1.2.6.2 Conventional Detectors with HART shall be powered from 24 V DC supply, with a 4 - 20 mA signal loop to cover the calibrated range. Detector faults shall be signaled by 4 mA signal.
For addressable Fire & Gas System, Vendor can offer loop powered detection system (power & communication on the same loop). Alternatively Vendor may offer separate power and communication loops type Addressable Fire & Gas detection System.
Typical set-points values for warning alarms and for initiation of executive action are 20% and 60% LEL respectively.
Note: In Scheme-A, detector shall provide 2 nos. of volt free contacts / outputs for non-PLC Panel. These 2 nos. of contact shall be independently adjustable to over entire range of gas detectors.

4.2.1.2.6.3 The H2 detectors shall be capable of detecting 0 – 100% LEL of H2 and shall have an accuracy of ±5% over the entire detection range.

4.2.1.2.6.4 The catalytic H_2 detectors shall not be located in oxygen enriched or depleted atmospheres.

4.2.1.3 **FIRE DETECTORS**

4.2.1.3.1 **General**

4.2.1.3.1.1 The fire detection system shall comprise a variety of fire detection devices and sensors, including:

- Optical Flame Detectors
- Smoke Detectors
- Thermal Detectors
- Fusible Plug Loops
- Manual Alarm Stations

4.2.1.3.2 **Optical Flame Detectors**

4.2.1.3.2.1 Optical flame detectors shall be the Triple-IR type and shall make use of such sensor, filters, and / or design to reject phenomena such as electric arcs, heaters, artificial light sources, lightning and shall be completely "solar blind".

4.2.1.3.2.2 The detectors shall be able to detect all types of flaming fires.

4.2.1.3.2.3 Conventional Detectors with HART shall be powered from 24 V DC supply, with a 4 - 20 mA signal loop to cover the calibrated range. Detector faults shall be signaled by 4 mA signal.

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For addressable Fire & Gas System, Vendor can offer loop powered detection system (power & communication on the same loop). Alternatively Vendor may offer separate power and communication loops type Addressable Fire & Gas detection System.

Sufficient margin shall be allowed between fault, normal and alarm levels to minimize spurious alarms.

4.2.1.3.2.4 Optical flame detectors shall have automatic, self-diagnostic circuitry that continuously monitors the optical surfaces, sensor sensitivity and electronic circuitry, and shall give fault status. Any detector malfunction shall be alarmed on the Fire and Gas detection system panel and DCS.

4.2.1.3.3 **Smoke Detectors**

4.2.1.3.3.1 Smoke detectors shall be installed indoors in all rooms, including space above false ceiling and below false flooring.

4.2.1.3.3.2 The smoke detectors shall incorporate an integral LED indicator for

confirmation that the unit is active.

4.2.1.3.3.3 Detectors those are not visible, such as above false ceiling or under false flooring, shall be provided with remote LED's located in the room being monitored.

4.2.1.3.3.4 Two independent smoke detector loops in cross – zone concept shall be installed in each area where executive action is required on detection of smoke.

4.2.1.3.3.5 Photoelectric type smoke detectors shall be used to provide early response to smoldering or flaming fires in their incipient stages. A detector base shall be provided for connecting the individual detectors to the Fire and Gas (F&G) control system.

4.2.1.3.3.6 Smoke detectors shall remain in alarm state until reset by the fire and gas control system.

4.2.1.3.4 **Thermal Detectors (Rate of rise & Fixed Heat Detectors)**

4.2.1.3.4.1 Thermal detectors shall be used in all indoor spaces including all rooms and equipment enclosures, including concealed floor and ceilings voids.

4.2.1.3.4.2 Rate of rise thermal detectors shall be used where an early warning of smoldering fires is required, such as storerooms and equipment rooms where air flow or high humidity may inhibit the response of smoke detectors.

4.2.1.3.4.3 Fixed temperature or rate compensated type heat detectors shall be used within areas unsuitable for smoke detection where a rapidly achieved high temperature can be expected, such as machinery rooms or equipment enclosures. These shall be set at approximately 12°C above maximum ambient temperature within the area.

4.2.1.3.4.4 Thermal detectors shall remain in alarm state until reset by the fire and gas control system.

4.2.1.3.4.5 All visible detectors shall incorporate an LED indicator as an integral part of the detector head or its mounting base. Concealed thermal detectors shall be provided with an LED "repeater" that is located in a visible location. Normally, unmanned equipment rooms or offices shall have indicators in the corridor. The detector circuitry shall cause the LED to remain illuminated while the detector is the alarm condition.

4.2.1.3.5 **Fusible Plug Loops, FSD (Fire Shutdown) valves & ESD (Emergency Shutdown) valves.**

4.2.1.3.5.1 Pneumatic Fire loop having Fusible plug shall be provided to initiate alarm in F&G System and initiate opening of deluge valve and FSD system. The Fire loop shall be laid out and segregated according to the fire zones.

4.2.1.3.5.2 Fusible plugs shall be selected to melt at 85°C. Each area covered shall have independent loop.

4.2.1.3.5.3 Pneumatic Fire loops having fusible plug shall also be provided with manually operated FSD valves installed at strategic locations all over the platform as per API-RP-14C. FSD valves shall be RED in color. PSL shall be provided to pick up the signal from each loop and communicate to F&G PLC for further necessary action as per Cause and Effect diagram.

4.2.1.3.5.4 Each Fire loops having fusible plug and FSD valve loops shall be originated from a field mounted Pneumatic Master Shutdown panel / Pneumatic Charging Panel. Functional specifications of pneumatic panel are addressed in Spec. no.- MR / OD / INST / FS / 3501.

4.2.1.3.5.5 Fusible plug / FSD valve loops shall be divided into independent group for each deck corresponding to each fire water deluge networks. These sub-groups of Fusible plug loops shall be provided with independent loop charging facility.

4.2.1.3.5.6 Manually operated ESD valves shall be provided on the pneumatic loop generated from Pneumatic Shutdown Panel (Refer Spec. no.- MR / OD / INST / FS / 3501). ESD valves shall be installed at strategic locations all over the platform adjacent to each FSD valves. ESD valves shall be BLACK in color.

4.2.1.4 **MANUAL ALARM STATIONS**

4.2.1.4.1 Manual alarm stations shall be provided for following functions:

a) Fire alarm.
b) Platform Abandonment.

4.2.1.4.2 Manual alarm stations for Fire alarm shall be located throughout all areas of the platform, especially at exits and in the main equipment rooms. These stations shall be located at easily accessible, well lighted, conspicuous areas and located no more than 30 meters apart.

4.2.1.4.3 Manual alarm stations for Platform Abandonment shall be located in Control Room and adjacent to each survival craft (exit Point).

4.2.1.4.4 All manual alarm stations shall require a double action to activate the alarm. They shall be the break-glass, pushbutton type.

4.2.1.4.5 Each unit shall be surface mounted at a height of 1.4 meters and shall be provided with a striker connected to the station by a chain.

4.2.1.4.6 Each unit shall be wired to the F&G control system in the Control Room.

4.2.1.4.7 The manual alarm stations- Fire alarm shall be red in colour & manual alarm stations- Platform abandonment shall be black in colour.

4.2.1.4.8 Addressable type Manual Alarm Stations shall be provided.

4.2.1.5 **OTHER ASSOCIATED FIELD DEVICES**

4.2.1.5.1 **Flashing Alarm Beacons**

4.2.1.5.1.1 The Flashing alarm beacons shall be direct ignition, Xenon type. Flashing alarm beacons shall be powered from 24 V DC, supply.

4.2.1.5.1.2 The Flashing alarm beacons shall have flashing speed of 60 flashes per minute.

4.2.1.5.1.3 For Scheme- A, following shall be considered-

a) Separate flashing alarm beacons shall be provided for visual indication of confirmed HC-H_2 gas release & H_2S gas release.
b) Flashing alarm beacons shall be located at Helideck and Mezzanine Deck for visibility to personnel approaching the platform via Helicopter or sea.

4.2.1.5.1.4 For Scheme – B, following shall be considered-

a) Separate flashing alarm beacons shall be provided for visual indication of confirmed Fire detection, HC-H_2 gas release & H_2S gas release. Flashing alarm beacons shall be located at each deck covering all the areas of the platform. In addition these beacons shall also be located inside enclosures (such as Enclosure building of Gas Turbines, etc) with high noise environment and shall be visible 360^0.

4.2.1.5.2 **Field Sounder**

4.2.1.5.2.1 **For Scheme- A :**

4.2.1.5.2.1.1 Field sounder shall be electronic type, and shall be powered from a 24 V DC, supply.

4.2.1.5.2.1.2 Field sounder shall be provided for audible alarm for confirmed HC-H2 / H2S gas release.

4.2.1.5.2.1.3 Field sounder shall be located near personnel rest room on Main deck of the platform.

4.2.1.5.2.1.4 Power Isolation switch for the Field Sounder & Flashing Alarm Beacons and Remote Alarm Acknowledgement facility shall be provided to save Power.

4.2.1.5.2.2 **For Scheme - B : Tone Generator**

Different types of distinct tone for Fire, Gas, ESD, Abandon Platform and all clear shall be provided with Fire & Gas System. Interfacing between Paging system and F&G System shall be provided for alarm tone generation in public address system during exigencies.

4.2.1.5.3 **Portable Calibration Kit**

4.2.1.5.3.1 Complete calibration kit including Portable purge calibrators/calibration cylinders with all accessories like pressure regulator, flexible hose, adaptor cap (to fit on sensing heads) etc., as applicable shall be supplied to enable calibration of the sensors in the field without dismantling them.

4.2.1.5.3.2 Methane, Hydrogen and Hydrogen Sulphide Calibration gas shall be supplied. Sufficient quantity of calibration gas shall be supplied to enable complete calibration, testing, inspection of all sensing heads during commissioning and successive two time's complete calibration during post-commissioning period.

4.2.1.5.4 **Extinguishant**

4.2.1.5.4.1 Areas protected by extinguishant shall have warning lights and alarms, both on the inside and outside of the enclosure that will be activated prior to and during the release of extinguishant.

4.2.1.5.4.2 Two lights shall be provided apart from a blue flashing strobe. One of the lights shall be used to indicate "Extinguishant release imminent" and the other to indicate "Do Not Enter – Extinguishant Released".

4.2.1.5.4.3 The release of the extinguishant shall be indicated on the F&G panel and the DCS.

4.2.1.5.4.4 A manual release station and a lockable inhibit valve shall be provided at the entrance to the protected area.

4.2.2 CONTROL DEVICES

4.2.2.1 GENERAL

4.2.2.1.1 The F&G Control components shall be located in safe area on the platform.

4.2.2.2 FIRE & GAS DETECTION SYSTEM PANEL

4.2.2.2.1 The Fire & Gas detection system panel for Scheme - A shall constitute the following:

a) Controller / Monitor Cards, Control & other auxiliary components like logic relays, auxiliary relays, power distribution for detectors-flashing alarm beacons-sounders, etc. or F&G SIL 3 PLC (as per Basic Bid Work) shall be installed in the SAFE area and housed in Electrical / RTU/Telemetry Interface Cabinet (TIC) Room. [PLC shall be provided as per Functional Specification No. MR / OD / INST / FS / C101.]

b) For confirmed HC, H2 & H2S gas release separate SPDT volt free contacts shall be provided for RTU connection.

c) Fire & Gas system panel shall be interfaced with Pneumatic Shutdown panel to confirm to SAFE chart requirements.

d) Hooter shall be provided for alarms only.

e) The front panel mounted Gas/Fire detection controllers/monitors shall be installed in mating cases or mounting bins recommended and supplied by the manufacturer for panel mounting. All wiring to these controllers shall be terminated on terminal blocks and/or multipin connectors provided as an integral part of the case. Routing calibration adjustments shall be accessible from the front of the panel without

having to remove any wiring or causing loss of the instrument function. In addition total removal of the instrument and replacement with a spare shall be possible from the front of the panel.

f) The modules shall be plug-in type permitting the removal of the modules without disturbing the system wiring. Each module shall have a maximum of 4 channels (one detector per channel) per modules. Gas/Fire circuit shall be so designed that any channel can be put out of service for repair, without affecting the other.

g) Each module shall have the following:
   (i) Reset Button to acknowledge / reset alarm
   (ii) Test button for Operation Check
   (iii) Calibration switch, which when put in calibration mode shall inhibit operation of alarm output, enable checks for alarm LED's and reference level and also permit access to meter fine zero, meter span and alarm level contacts.
   (iv) Automatic malfunction detection in case of open circuit (sensor element and line breaking), over range, short circuit and earth fault.
   (v) Indicator LEDs for the following: Malfunction warning for each channel, Power on, Calibration mode, Test mode, Low alarm for each channel, High alarm / trip for each channel.
   (vi) Alarm Contact: For each detector, module shall be able to generate minimum 2 independently adjustable (adjustable over entire range of detection) SPDT relays for each alarm level for the purpose of alarming & logic solving.

4.2.2.2.2 The Fire & Gas detection system panel for Scheme- B shall constitute the following:

a) Fire & Gas detection system panel for Scheme- B shall be SIL-3 PLC-based providing independent automatic control. PLC shall be provided as per Functional Specification No. MR / OD / INST / FS / C101.

b) Fire & Gas detection system panel shall be interfaced with the following systems of the platform and confirm to Safety requirements:
   - ESD system.
   - Pneumatic Shutdown Panel / Charging Panel
   - Central Control Panels for package items (such as Gas Turbines, Process gas compressors, etc)
   - Paging system for alarm tones
   - Flashing Beacons & Sounders

- Extinguishant systems
- HVAC System
- Deluge panel
- Diesel and electric fire water pumps
- DCS for graphic displays

c) Besides PLC related cabinets other main components of Fire & Gas Detection system panel shall be:
   (i) Critical Annunciator Panel.
   (ii) Matrix panel.
   (iii) Common Facilities.

d) Critical Annunciator Panel: Annunciator Panel shall be provided for critical alarms. The annunciation sequence shall be as per ISA-S18.1, 'Annunciator sequences and specifications'. The annunciation lamps shall be capable of removal and replacement from the panel front via individual snap out windows or a swing out hinged door on which all windows are mounted. Minimum critical alarms to be provided are given below:

   (i) Line monitoring fault.
   (ii) Gas detection malfunction.
   (iii) Fire detection malfunction.
   (iv) Fire Water Pump (FWP) common alarm.
   (v) FWP- Start.
   (vi) FWP- Failed to Start.
   (vii) FWP- Off.
   (viii) FWP- Shutdown.
   (ix) FWP- On Manual.
   (x) Fire water header Pressure- Low.
   (xi) Diesel Generator- Running.
   (xii) Diesel Generator- Fault.
   (xiii) Diesel Centrifuge- Running.
   (xiv) Diesel supply valve- Close.
   (xv) Diesel supply valve- Open.
   (xvi) Diesel storage tank level- Hi Hi.
   (xvii) Gas Fault- Compressor.
   (xviii) Instrument Air Pressure- Low Low.
   (xix) FSD
   (xx) ESD
   (xxi) Confirmed H2S detection.

(xxii) Confirmed HC-H2 detection.
(xxiii) Confirmed Fire detection.

e) Matrix Panel: Matrix panel shall provide graphic status of Fire & Gas Detection system & Fire suppression system area-wise for the entire platform.

(i) Area-wise status indication shall include the following as minimum:
- Low HC
- High HC
- Low H2S
- High H2S
- Low H2
- High H2
- Flame
- Heat
- Smoke
- Manual Alarm Call point- Fire Alarm.
- Manual Alarm Call point- Platform abandonment.
- Fusible Plug
- Extinguishant- Inhibited.
- Extinguishant- Auto.
- Extinguishant- Manual.
- Extinguishant- Initiated.
- Extinguishant- Released.
- Extinguishant- Pressure & Weight loss.
- Deluge- Valve open.
- Deluge- Valve closed.
- Deluge- Pressure.
- System Fault.

(ii) Area-wise control devices shall include the following:
- Extinguishant Auto-Manual-Inhibit 3-way selector switch.
- Extinguishant Manual release Pushbutton.
- Reset Pushbutton.
- Deluge- Open valve.
- Deluge- Close valve.

f) Common Facilities: This shall include F&G system related Shutdown-alarm switches, Annunciator Pushbuttons, etc.

(i) Alarm & shutdown Pushbuttons shall include the following:
- Abandon platform.
- Gas alarm.
- Fire alarm.

- Manual ESD.
- Manual FSD (Separate for 'Cellar' deck and 'Main' deck).
- FWP: Start.
- FWP: Stop.
- Diesel Transfer Pump: Start.
- Diesel Transfer Pump: Stop.
- Diesel supply valve: Open.
- Diesel supply valve: Close.

(ii) Selector switches shall include the following:

- Auto / test
- On-Off-Manual (3-way selector switch)
- Lead / Lag (FWP selection sw)

(iii) Annunciator components shall include the following:

- Pushbutton- Lamp Test.
- Pushbutton- Mute.
- Pushbutton- Accept.
- Pushbutton- Reset.
- Buzzer.

(iv) All annunciator components except the alarm horn and auxiliary contact relays shall be mounted integrally in a protective enclosure.

Mounting clamps which present a flat surface to the front panel face shall be provided for panel mounting the assembly. All connections (i.e. trouble contact, speaker, test, acknowledge and test-push-buttons) shall be made on screw type terminals. Sufficient spares terminals shall be provided to accommodate all spares/future alarm point in the display. Access shall be provided to allow checking and/or changing the wiring to these terminal strips.

4.2.2.2.3 The Fire & Gas detection system panel shall be freestanding, self-supporting cubicle type, fully enclosed construction made of CRCA sheet. The contractor shall be responsible for matching this panel with the other panels of Control room.

4.2.2.2.4 Plates shall be cut on Squaring shear to ensure tight flush joints when bolted together. All sharp edges and corners shall be smoothened off to protect personnel. The final assembly shall be free of buckles, warps, dents or blemishes. Steel strips stock shall be edge welded to the back of the panel from face above and below the cut-outs as required to ensure a rigid, self supporting structure. In order to reduce the loading on the panel face, channel or equivalent support shall be run horizontally beneath the module cases/shelves to provide rear support. The finished panel frame work shall be of sufficient strength to allow

transportation and lifting by a crane, with all instrumentation installed without causing buckling or deflection. Each panel section shall have four (4) removable lifting lugs at the top of facilitate handling.

4.2.2.2.5 Hinges shall be full-length type. Doorframes shall be formed in the enclosure to ensure that the doors fit tightly all around. Doors latches shall be the flush-mounted, 3-point type with recessed chrome-plated handles. An installed clearance will be maintained inside the panels to allow for door opening and access the equipment. Doors shall open outwards of the panel.

4.2.2.2.6 The enclosure and its internal equipment arrangement shall be designed to provide adequate cooling of panel hardware by natural convection alone. Louvers shall be provided on the top of enclosures for air circulation purposes along with exhaust fans, as required.

4.2.2.2.7 All sheet and structural steel shall be vapour degreased after shearing, cutting and forming and prior to welding. Welded construction shall be used throughout, except where specifically noted otherwise. All welds shall be continuous on the pieces being joined. Skip welding is not acceptable.

4.2.2.2.8 Proper precautions shall be taken to prevent material wreckage during the welding process. All welded surfaces shall be thoroughly brushed chipped and ground to provide a clean, smooth surface.

4.2.2.2.9 The entire steel structure is to be sand blasted, phosphatized and painted with two coats of sealing primer on surfaces. The final finish shall be a minimum of three coats of non-glossy Admiralty Grey epoxy paint on exterior surface and pale cream on interior surface. The fabricator shall supply separately one (1) Kilogram of paint for touch up.

4.2.2.2.10 Panel cutout sizes, instrument supports and stabilizers and panel reinforcements shall be strictly in accordance with the instrument manufacturer's recommendations. Cutouts shall not be made with flame production devices.

4.2.2.2.11 Sufficient access shall be provided for all instruments via cable duct/trays to allow checking and/or changes to the wiring to the instrument case.

4.2.2.2.12 Auxiliary Equipment: All rear of panel equipment (terminal blocks, auxiliary relays, solid state logic cards, etc.) shall be physically located off the exterior walls of the panel by means of suitable mounting brackets/plates welded to the wall prior to finishing and painting. Drilling and tapping the outside walls of the

enclosure for mounting internal equipment is prohibited. The auxiliary equipment shall be located and arranged for easy access, for calibration and maintenance. It shall not be necessary to remove any item in order to gain access to check or remove any other item. All cable runs shall be grouped, routed and secured to provide a neat appearance and prevent interference with the operation and maintenance of auxiliary equipment. Auxiliary relays, if used shall be of the plug-in enclosed type.

4.2.2.2.13 Electrical Construction: The installed electrical equipment component parts and associated wiring in the panel shall be in accordance with the practices outlined in NEC, latest edition, for non-hazardous area. The panel itself shall meet the requirement for NEMA-1 (General purpose in door) electrical enclosure.

4.2.2.2.14 Cables from field shall enter through bottom of the panel through multi-cable transits.

4.2.2.2.15 Cable glands are to be provided in panel to clamp the incoming/outgoing cables. Glands shall be of Double Compression type and nickel-plated brass. Gland plates shall be provided to facilitate cable gland installation.

4.2.2.2.16 The 24V DC main power supply feeder to the box shall be protected by a suitably sized circuit breaker with manual trip lever. The breaker shall be housed in a suitable surface mounted enclosure. All components shall be suitable for 24V DC ± 10%. Power distribution to controllers and associated group of auxiliary relays circuits shall be via fused terminals with a blown fuse indicator, and input/output fuse status alarm.

4.2.2.2.17 Panel Ground and signal ground shall be separate. Signal ground shall be provided for circuit grounds of Electronic instruments, Detector Circuit shields, Drain wire of cable shields, I.S. Barrier earth etc. For this purpose an insulated ground bus bar 25 mm wide x 6 mm thick of copper material shall be provided which shall run along the entire panel length. Ground wiring shall be directly connected to the ground bus bar by means of suitable wire lugs. Intermediate terminals are not allowed. This ground bus bar shall be provided with grounding terminals at both ends. Terminals shall be compression type suitable for AWG No. 4 copper ground cable. The same shall be provided on each panel structure for panel grounding.

4.2.2.2.18 The panel shall be designed such that field wiring from remote sensing head for Fire & Gas may be terminated directly on the associated detection controller input terminals, rather than interposing field wiring terminal blocks. All gas and fire

detection circuits shall be grounded as per recommendations of the manufacturer and good engineering practices. All the detector circuit shields shall be grounded at the same point as the signal circuit.

4.2.2.2.19 Terminals in a terminal block to be identified by their individual numbers located integral with the terminal itself. Wiring at terminals shall be identified by the terminal number and termination service at the other end of the wire. Wiring at Instr. & accessories such as relays, push-buttons etc. shall be identified by item tag no. and terminal service at the other end of wire.

4.2.2.2.20 Suitably sized Terminals shall be provided for terminating main power supply cable. The size shall be decided by the Contractor.

4.2.2.2.21 Internal Fluorescent lighting, working on 110V AC, 50 Hz shall be installed within the panel to provide adequate lighting for maintenance of equipments. An On/Off control switch shall be provided for this purpose in a surface mounted enclosure near both the panel doors. The lighting fixtures must not interfere with doors or other equipment, which must be accessible and space shall be provided for Fluorescent lamp replacement. Thermal insulation must be provided, if necessary to prevent excessive temperature rise in the panel surface of mounted equipment.

4.2.2.2.22 All major shut down alarms shall be repeated for output to a remote telemetry unit (RTU). These outputs shall be in the form of SPDT volt free contacts and shall be terminated separately in the panel at a convenient central location for further connection.

4.3 FUNCTIONAL REQUIREMENTS

4.3.1 CONTROL PHILOSOPHY

4.3.1.1 General

4.3.1.1.1 The Contractor shall produce a set of Cause and Effect diagrams during the design stage reflecting the proposed location / action for review by the Company. Cause and Effect diagram diagrams shall be as per API RP 14C requirements together with the requirements of this specification.

4.3.1.1.2 All shutdown interlock and alarm circuits shall be designed to operate in a fail-safe mode.

4.3.1.1.3 Fire & Gas logics shall be designed to de-energize to actuate gas / fire shutdown interlock.

4.3.1.1.4 Alarms-

a) In addition to signaling on the F&G matrix and alarm annunciator, fire and gas detection shall result in separate and distinct audible and visual alarms at Control room / equipment enclosure room / field area. (Scheme- B)
b) Visual alarms shall be colour coded to the company's requirements to distinguish between fire, combustible gas release, and toxic gas. (All Schemes).
c) For gas detection, distinct visual and audible alarms in the Control room shall be provided for the two levels of detection. (Scheme- B)
d) Silencing of audible alarms shall not deactivate visual alarms until detection falls below the alarm level.
e) Fire & Gas Detection system shall be suitably interfaced with platform DCS. DCS shall have an over view graphic for each F&G zone. The graphic shall display individual detector analogue value, alarm and fault status, and deluge valve and extinguishant release status. A separate graphic will display the fire water pumps run and fault status and fire water pressure. (Scheme- B)

4.3.1.1.5 Detector Voting: Confirmed fire or gas-release shall be indicated by the following:

(i) 2ooN flame detector ($N \geq 2$)
(ii) 1ooN thermal detector ($N \geq 2$)
(iii) 2ooN gas detector 60% LEL ($N \geq 2$)
(iv) 2ooN smoke detector in Cross Zone ($N \geq 2$)

'N' denotes the quantity of detectors required for covering an area as per the requirements of this specification in general and clauses 4.2.1.1.3, 4.2.1.2 and 4.2.1.3 of this specification in particular. Each area, viz., each process component area, each equipment area, each building module area, shall be covered individually.

4.3.1.1.6 Distinct platform audio-alarm shall be provided for confirmed HC-H2 gas release, confirmed H_2S gas release, confirmed fire through paging system. Dry volt Free Contacts shall be provided for the input signals.

4.3.1.1.7 Fire alarm shall be actuated by any of the following:

(i) Activation of Fire Detectors as defined above in 'Detector voting'.
(ii) FSD loop activated pressure switch
(iii) Manual activation of extinguishant from Extinguishant Control cubicles / stations.
(iv) Deluge valve activation push-button

4.3.1.1.8 All remote gas/fire alarm outputs shall be provided through paging system.

4.3.1.2 Control Philosophy on Wellhead Platform (for Scheme - A)

4.3.1.2.1 The control actions to be initiated upon fire and / or gas detection on wellhead- platform are as follows:

Location	Fire Or Gas Detection	Action (See Below)
Process area	Confirmed Fire (Fusible plugs)	1 & 4
Process area	Confirmed Gas release (HC or H2S detector)	2 & 3
Battery room	Confirmed Gas release (H2 detector)	2
RTU/Sw.Gr./VFD Room	Confirmed Fire (Smoke, Thermal etc.)	1 & 4
Transformer Area	Confirmed Fire (Thermal, Triple- IR etc.)	1 & 4

1. Alarm- Field Sounder.
2. Alarm- Flashing & Field Sounder
3. Initiate ESD.
4. Initiate FSD, open deluge.

Note: **FSD (Fire Shut down)** shall close all Shutdown valves including SSSV and open deluge valves & activate fire water network.

ESD (Emergency Shut down) shall close all Shutdown valves.

4.3.1.3 Control Philosophy on Process Platform (for scheme- B)

4.3.1.3.1 The control actions to be initiated upon fire and / or gas detection on process platform are as follows:

Location	Fire Or Gas Detection	Action (See Below)
Process area	Confirmed Fire (Flame detectors or Fusible plugs)	1 & 5
Process area	Confirmed Gas release. (HC detector or H2 detector or H2S detector)	1 & 4
Generator enclosure	Confirmed Fire. (Flame detector or Thermal detector or Smoke detector)	1 & 6
Generator enclosure	Confirmed Gas release. (HC detector or H2 detector or H2S detector)	1 & 4

Turbo Compressor	Confirmed Fire. (Flame detector or Thermal detector or Fusible Plugs)	1 & 7
Turbo Compressor	Confirmed Gas release. (HC detector or H2 detector or H2S detector)	1 & 8
Living rooms, Galley & kitchen, Store rooms (LQ)	Confirmed Fire. (Smoke detector or Thermal- fixed detector or fusible sprinkler)	1 & 2
Emergency generator room	Confirmed Fire. (Smoke or Thermal-fixed or Flame detector)	1 & 9
Switchgear rooms	Confirmed Fire. (Smoke or Thermal- Fixed detector)	1 & 6
Battery room	Confirmed Gas release. (H2 detector)	1 & 3
Battery room	Confirmed Fire. (Smoke or Thermal- rate of rise detector)	1 & 2
Control room / TG Control Room / Lab	Confirmed Fire. (Smoke or Thermal- rate of rise detector)	1 & 10
Labs & Process store rooms	Confirmed Fire / Gas (Smoke or Thermal or HC/H2S gas)	1 & 11
Switchgear rooms/ Control room / TG Control Room	Smoke/Fumes Detected (Aspiration Detection System)	1

1. Alarm on DCS, Annuciators and Paging system, Indication on Fire & Gas matrix.
2. Shutdown Power to Living Quarters, trip ventilation system and automatic actuation of Fire Water spray system / Extinguishant system.
3. Shutdown Power to the concern area, trip ventilation system.
4. Initiate ESD and trip unit.
5. Initiate FSD and open deluge valve of the detected zone/area
6. Initiate FSD, trip unit, release extinguishant instantly.
7. Initiate FSD, Trip unit in ventilation mode, trip ventilation system, release extinguishant instantly (GG-PT Enclosure) / open deluge valve (Compressor area).

8. Initiate ESD, Trip unit in ventilation mode and trip ventilation system.
9. Trip unit and ventilation system and release extinguishant instantly.
10. Initiate FSD, trip unit and release extinguishant after some time delay.
11. Shutdown Power to the concern area release extinguishant after some time delay.

Note: i) FSD (Fire Shut Down) shall close all Shut Down Valves, shall open blow down valves, shall start firewater pumps and open deluge valves / Release extinguishant.

ii) ESD (Emergency Shut Down) shall close all Shut Down valves, trip the main generator set and start the emergency generator.

4.4 SPARES PHILOSOPHY

This clause shall be read in conjunction with the IDC clause no. 3.6.4.8 (Instrument Spare Philosophy).

4.4.1 In Scheme- B, installed spares for PLC shall be as per Spec. no. MR / OD / INST / FS / C101, 'Functional specification for PLC'.

4.4.2 For installation, testing, commissioning of Fire & Gas detection system vendor shall recommend and provide all the necessary spares. These spares shall be properly & separately packaged with clear marking- 'Commissioning Spares'.

4.4.3 Vendor shall include along with the proposal a separate priced list of recommended spare parts for one year normal operation and maintenance. This list should take into account related factors of 'Fire & Gas detection system' reliability, effect of downtime upon normal operation & safety and availability of servicing facilities.

4.5 Material

4.5.1 **Fire & Gas Detectors**

4.5.1.2 The Fire & Gas detectors shall have SS 316 sensor body housing material.

4.5.1.3 Enclosure for sensor electronics shall be copper-free marine grade Aluminum suitable for offshore marine environment.

4.5.2 For panels refer to 4.2.2.2 clause of this specifications.

5. EQUIPMENT PROTECTION

5.1 The protection requirements for the components of the Fire and Gas Detection System shall in general be as per clause no. 3.6.4.4 of Instrumentation Design Criteria.

5.2 The fixed gas detectors shall be provided with manufacturer-approved rain hoods. Shop fabricated rain hoods shall not be used.

6.0 INSTALLATION REQUIREMENTS

6.1 The installation requirements for the components of the Fire and Gas Detection System shall in general be according to clause 3.6.4.6 of Instrumentation Design Criteria.

6.2 All detectors shall be installed such that they are easily accessible from a walkway or access platform for calibration and maintenance. Where this is not possible, test tube connections for detector calibration shall be provided.

6.3 All field equipment shall be readily accessible without the need to move other items or equipment, except ceiling and floor tiles in the case of concealed detectors.

6.4 All components of the fire & gas detection system panel, which require regular maintenance and / or monitoring, shall be easily accessible to the operations and maintenance personnel with minimum wiring removal and no special tools.

6.5 Maintenance space requirement shall be kept to a minimum without compromising ease of maintenance.

7.0 TESTING & INSPECTION

7.1 Inspection category of Fire & Gas detection system is **B**. Equipment / items shall be inspected by company representative only at final stages as per project finalized documents viz. Purchase specification (s), applicable project documents, vendor documents at vendor's works, in addition to stage inspection by contractor and / or third party inspection agency.

7.2 Calibration, inspection and testing requirements shall in general be as per clause 3.6.4.7 of Instrumentation Design Criteria. However, for specific requirements this specification shall also be followed.

7.3 Prior to shipment from vendor's works vendor shall carry out 100 percent testing of hardware and software of Fire & Gas detection system in the presence of company representative / Third Party Inspection Agency-representative .

7.4 After finalisation of testing procedures Vendor / Contractor shall notify to the company one month before the scheduled date of testing of Fire & Gas detection system.

7.5 Vendor / contractor shall provide complete documentation and facilities including consumables to allow testing of Fire & Gas detection system.

7.6 The minimum requirements for testing of Fire & Gas detection system shall be:

a) Visual, dimensional, workmanship checks.
b) Internal inspection reports verification.
c) Test certificates, Material test certificates, Statutory certificates verification.
d) Verification of components of Fire & Gas detection system (type, size, configuration, ratings, etc).
e) Wiring check- visual check (type, size, segregation ferruling, etc), continuity test, and insulation test.
f) Functional check: Gas detectors- Each detector shall be subjected to calibration check. Inject test gas and check analogue readout and alarms as per this spec requirement. Test filters shall be used wherever required.
g) Functional check: Heat detectors- Each detector shall be subjected to calibration check.
h) Functional check: Flame detectors- Each detector shall be subjected to testing and shall be powered for a minimum of 2 hrs before testing.
i) Functional check: Smoke detectors- Apply manufacturer approved test fluid to each detector for testing.
j) Other field devices including Flashing beacons, sounder, etc shall be tested for their functions.
k) Test all shutdowns in accordance with the 'Cause and Effects diagrams'.
l) For 'Loop testing / acceptance' testing, 'Panel' inspection / testing, etc refer to 'Design Criteria- Instrumentation'.
m) Fire & Gas detection system shall be subjected to elaborate 'Factory Acceptance Test' (FAT) at vendor's works. After successful installation system shall under-go 'Site Acceptance Test'. For 'Scheme- III' vendor / contractor shall also refer to Spec. no. MR / OD / INST / FS / C101, 'Functional Specifications for PLC'.
n) The Vendor shall demonstrate the design life and overall system

availability. Full details of the operating design life of all major components that will be subjected to planned maintenance / replacement during the life of the package, shall be provided by the Vendor.

7.7 Responsibility of proper installation, site testing, commissioning of Fire & Gas detection system shall be with the contractor. However, Fire & Gas detection system vendor shall provide all the necessary assistance, supervision services, etc for successful installation, site testing, commissioning of the system.

7.8 **Gas Detector Calibration- general considerations.**

a) All fixed gas sensors shall be capable of direct calibration at the sensor head from deck level or from a fixed platform, without the need to open the detector enclosure.

b) A kit shall be provided for detector calibration and testing. Tubing to conduct sample to the sensor head shall be provided.

c) Test filters shall be supplied for calibrating open-path detectors to 1, 3 and 5 LELm.

d) Calibration of all detectors shall be possible either from remote location or via hand-held calibration tool, without disconnection of any equipment or cables. On-line calibration of detectors shall be possible. Methane calibration gas shall be supplied in sufficient quantity for calibration of all sensing heads.

e) Gas detectors installed inside HVAC ducts shall be provided with collecting cones and a facility to calibrate the gas detectors externally from the ducts without disturbing the installation.

7.9 **Fire / Heat / Flame Detectors**

a) Kits for testing and calibrating the fire detectors shall be provided.

b) All fire sensors shall be capable of direct calibration at the sensor head by one person from deck level or from a fixed platform.

8.0 QUALITY ASSURANCE

8.1 The Contractor shall submit complete QA / QC plans for the proposed Fire &

Gas detection system for Company's review.

8.2 The vendor, and his sub-vendor, shall operate a quality system satisfying the applicable provisions of ISO 9000 (series). A detailed quality plan shall be provided with the bid.

8.3 The company reserves the right to carry out quality and technical review at both vendor's and sub-vendor's works.

9.0 DOCUMENTATION

9.1 The documentation requirements shall in general be according to clause 3.6.6.2 of Instrumentation Design Criteria.

9.2 Specifically for Fire & Gas Detection system following minimum documents shall be submitted:

S.N.	Document Name	Type of Document
Following documents shall be generated by the contractor and shall be included in main DCI of the project. These documents shall be provided to the vendor to aid design & engineering of Fire & Gas detection system.		
1	F & G detectors, other field devices layouts.	FR
2	Cause & Effect diagrams.	FR
3	System I / O listing / point configuration database	FI
4	Information for displaying all displays and reports (For Scheme- III only)	FI
5	F & G Cable schedule	FI
6	Control room layout- F&G system details	FR
Following documents shall be generated by the vendor. Before submitting the documents for review / information to the company contractor shall verify & confirm the documents in respect of approved PS requirements.		
7	Package Schedule	FI
8	Document index & schedule	FI
9	System configuration drawings	FR
10	Logic print-outs / diagrams	FR

11	Operator / Engg. station print-outs (Scheme- III only)	FI
12	Specifications & General Arrangement – Internal Arrangement drawings of Panels / consoles	FI
13	Power distribution plan	FI
14	Grounding plan	FI
15	Power consumption & heat dissipation details	FI
16	PLC nest loading (Scheme- III only)	FI
17	PLC wiring drawings (Scheme- III only)	FI
18	Loop schematics	FI
19	Factory test procedure	FR
20	Site test procedure	FR
21	PLC instruction manual (Scheme- III only)	FI
22	Miscellaneous items catalogs / manual	FI
23	Operation, Installation & Maintenance Manual	FI
Following documents shall be sent along with the shipment of Fire & Gas detection system.		
24	Packaging list of Fire & Gas components	FI
25	Factory test reports	FR
26	Quality certificates.	FR

Notes:

FR For ONGC Review
FI For ONGC Information

9.3 For other PLC related documents refer to Spec .no. MR / OD / INST / FS / C101

9.4 Purchase specification shall cover all the details as indicated in 'Design Criteria- Instrumentation'. Beside these details indicative formats of the documents 6, 7, 9, & 18 (typical only for each type of detector, field devices, etc.) shall also be incorporated in the proposal / purchase specification.

10.0 TAGGING & NAMEPLATES

10.1 Tagging & Nameplate requirements shall in general be according to clause 3.6.6.1 of Instrumentation Design Criteria.

10.2 For the purpose of tagging field devices including detectors, manual alarm stations, flashing beacons, sounders, etc following philosophy shall be used:

AAA – BBB – CCC

AAA :Type of Field Device.
BBB :Zone no.
CCC :Device Serial no. in the zone.

11.0 REVIEW & APPROVAL

11.1 Review and approval of purchase specification shall in general be according to clause 3.6.6.3 of Instrumentation Design Criteria.

11.2 F & G detection system related detail engineering documents categorization shall be as per Cl. No. 9 (including its sub-clauses) of this specifications.

12.0 VENDOR PRE-QUALIFICATION REQUIREMENTS

12.1 The Vendor pre-qualification requirements shall in general be according to clause 3.6.6.4 of Instrumentation Design Criteria. Also, refer to Spec. no. MR / OD / INST / FS / C101

13.0 PREPARATION FOR SHIPMENT

13.1 The components of the Fire and Gas Detection System shall be prepared for shipment in accordance to clause 3.6.6.5 of Instrumentation Design Criteria.

14.0 RECEIPT & STORAGE

14.1 Receipt and storage of the components of the Fire and Gas Detection System shall be in accordance to clause 3.6.6.6 of Instrumentation Design Criteria.