# طرح نگهداشت و افزایش تولید 27 مخزن

# SPECIFICATION FOR FIRE & GAS SENSOR AND DEVICES

## نگهداشت و افزایش تولید میدان نفتی بینک

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**AFD: Approved For Design**
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**AFQ:** Approved For Quotation
**IFI: Issued For Information**
**AB-R: As-Built for CLIENT Review**
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## REVISION RECORD SHEET

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## 1.0 INTRODUCTION

Binak oilfield in Bushehr province is a part of the southern oilfields of Iran, is located 20 km northwest of Genaveh city.

With the aim of increasing production of oil from Binak oilfield, an EPC/EPD Project has been defined by NIOC/NISOC and awarded to Petro Iran Development Company (PEDCO). Also PEDCO (as General Contractor) has assigned the EPC-packages of the Project to "Hirgan Energy - Design and Inspection" JV.

**GENERAL DEFINITION**

The following terms shall be used in this document.

| | |
|---|---|
| CLIENT: | National Iranian South Oilfields Company (NISOC) |
| PROJECT: | Binak Oilfield Development – General Facilities |
| EPD/EPC CONTRACTOR (GC): | Petro Iran Development Company (PEDCO) |
| 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 COMPANY rather than by an EPC/EPD CONTRACTOR, supplier or VENDOR. |
| MAY: | Is used where a provision is completely discretionary. |

## 2.0 SCOPE

This document covers minimum necessary requirements for the design, selection, manufacture, inspection, testing and delivery of Fire & Gas Sensors and Devices dedicated to new trains of Binak Compressor station and extension of manifold in Binak Cluster also new launcher/receivers area of pipe line( if required).

It shall be used in conjunction with data/requisition sheets for present document subject.

## 3.0 NORMATIVE REFERENCES

### 3.1 LOCAL CODES AND STANDARDS

| | |
|---|---|
| · IPS-M-IN-220 | Material and Equipment Standard For Control Panel& System Cabinets |
| · IPS-G-IN-270 | General Standard For Instrumentation of Fire and Gas Detection Equipment |
| · IPS-E-GN-100 | Engineering Standards For Units |
| · IPS-E-SF-100 | Engineering Standards For Classification Of Fires And Fire Hazard Properties |
| · IPS-E-EL-110 | Engineering standard For Hazardous Area |
| · IPS-E-SF-260 | Engineering Standard For Automatic Detector and Fire/Gas Alarm System |
| · IPS-G-SF-310 | General Standard For Gas Detection |
| · IPS-M-IN-260 | Material and Equipment standard for Alarm and Protective System |
| · IPS-G-IN-260 | Engineering and installation standard for Indicating Light, Alarm and Protective system |
| · IPS-I-IN-100 | Inspection Standard for General Instrument Systems |
| · IPS-I-IN-115 | Instrumentation |

### 3.2 INTERNATIONAL CODES AND STANDARDS

| | |
|---|---|
| · API 610 | Centrifugal Pumps for Petroleum, Petrochemical And Natural Gas Industries, 11th Edition |
| · ISO 15156 | Petroleum and Natural Gas Industries. Materials for use in H2S Containing Environments in Oil and Gas Production |
| · API RP 505 | Recommended practice for classification of locations for electrical installations at petroleum facilities classified as Class 1, Zone 0, Zone 1 and Zone 2 |
| · API RP 551 | Process measurement |
| · API 552 | Transmission systems |
| · BS EN 60079-7 | Specification for Electrical apparatus for explosive atmospheres. Type of protection ‘e’ |
| · BS 5445 | Components of Automatic fire detection systems-all parts |
| · BS 5839 | Fire detection and alarm systems for buildings-all parts |
| · BS 6667 | Electromagnetic compatibility for industrial process measurement and control equipment-all parts |

| | | |
|---|---|---|
| · | BS 7671 | Requirements for electrical installations. IET wiring regulations |
| · | BS EN 60529 | Specification for degrees of protection provided by enclosure. |
| · | EN 54 | Fire detection & alarm systems |
| · | BS EN 60079-0 | Explosive atmospheres. Equipment-General requirements |
| · | BS EN 60079-1 | explosive atmospheres. Equipment protection by flame proof enclosure 'd' |
| · | BS EN 50020 | Electrical apparatus for potentially explosive atmospheres. Intrinsic safety "i". |
| · | BS EN 60079-25 | Explosive atmospheres. Intrinsically safe electrical system. |
| · | BS EN 50058 | Electrical apparatus for the detection and measurement of combustible gases. Performance requirements for group ll apparatus indicating up to 100% Lower Explosive Limit. |
| · | BS EN 61000-6 | Electro-magnetic compatibility (EMC), generic standards, immunity for residential, commercial and light- industrial environments. |
| · | EN 55022 | Limits and methods of measurement of radio disturbance Characteristics of information technology equipment |
| · | IEC 60331 | Fire resisting characteristics of electric cables |
| · | IEC 60331-23 | Test for electric cables under fire conditions-circuit integrity-procedures and requirements-electric data cables |
| · | IEC 60801-3 | Electromagnetic compatibility for industrial process measurement and control equipment. Radiated electromagnetic field requirements |
| · | IEC 61131-3 | Programmable logic controllers |
| · | IEC 61508 | Functional safety of electrical/ electronic/ programmable electronic safety related systems |
| · | ISA 5.1 | Instrumentation symbols and identification. |
| · | ISA 5.4 | Instrumentation loop diagrams. |
| · | ISA 18.1 | Annunciators-sequences and specification. |
| · | NFPA 30 | Flammable and combustible liquids code-storage |
| · | NFPA 70 | National Electrical Code |
| · | NFPA 72 | National Fire Alarm and Signalling Code |

## 3.3 THE PROJECT DOCUMENTS

| | | |
|---|---|---|
| · | BK-GENRL-PEDCO-000-PR-BD-0001 | Process Basis of Design |
| · | BK- GENRL-PEDCO-000-IN-SP-0012 | Specification For F&G system |
| · | BK- GENRL-PEDCO-000-SA-SP-0002 | Spec. For Hazardous Area Classification |
| · | BK- PPL-PEDCO-320-IN-BD-0001 | Block Diagram Config. For Control/ESD/F&G |

Sys.

- BK- GCS-PEDCO-120-IN-BD-0001 — Control/ESD/F&G Sys. Block Diagram Configuration.
- BK- W007S-PEDCO-110-IN-BD-0001 — Block Diagram Config. For Control/ESD/F&G Sys. - Extension of Binak B/C Manifold.
- BK- GENRL-PEDCO-000-IN-SP-0001 — Specification For Control System
- BK- GENRL-PEDCO-000-IN-SP-0003 — Specification For ESD System
- BK-SSGRL-PEDCO-110-IN-DC-0002 — Instrument & Control System Design Criteria
- BK-PPL-PEDCO-320-IN-DC-0002 — Instrument & Control System Design Criteria
- BK-GCS-PEDCO-120-IN-DC-0002 — Instrument & Control System Design Criteria
- BK-GNRAL-PEDCO-000-IN-SP-0010 — Specification For Instrument/F&G Cables

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Note: This document shall be used in conjunction with P&IDs and PFDs of each work packages of the Project.

### 3.4 ENVIRONMENTAL DATA

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

## 4.0 ABBREVIATIONS

| | | |
|---|---|---|
| NISOC | : | National Iranian South Oil Company |
| AFC | : | Approved For Construction |
| AFD | : | Approved For Design |
| AC | : | Alternative Current |
| DC | : | Direct Current |
| ER | : | Electrical Room |
| CR | : | Control Room |
| CPU | : | Central Processing Unit |
| ESD | : | Emergency Shut Down System |
| DCS | : | Distributed Control System |
| FAT | : | Factory Acceptance Test |

| | | |
|---|---|---|
| SAT | : | Sat Acceptance Test |
| F&G | : | Fire and Gas |
| GD | : | Gas Detector |
| FGS | : | Fire and Gas System |
| HART | : | Highway Accessible Remote Transducer |
| IP | : | Ingress Protection |
| IS | : | Intrinsically Safe |
| ITR | : | Instrument Technical Room |
| UPS | : | Uninterruptible Power Supply |
| HD | : | Heat Detector |
| SD | : | Smoke Detector |
| TGD | : | Toxic Gas Detector |
| FGD | : | Flammable Gas Detector |
| HGD | : | Hydrogen Gas Detector |
| SN | : | Sounder |
| BC | : | Beacon |
| H2S | : | Hydrogen Sulphide |
| CGD | : | Combustible Gas Detection |
| MAC | : | Manual Call Point |
| LEL | : | Lower Explosive Limit |
| PPM | : | Parts Per Million |
| LCD | : | Liquid Crystal Display |

## 5.0 VENDOR RESPONSIBILITY

VENDOR shall be responsible for the correct design and operation of all the provided equipment, the quality of all materials and workmanship, and in compliance with these specifications. Approval of the test by CONTRACTOR SHALL not relieve the VENDOR of responsibility for conforming with the provisions of this specification when the equipment is installed.

### 5.1 VENDOR'S COMPLIANCE

Vendor shall submit his bid(s) in full compliance with the requirements of the MR and relevant attachments.

Any exceptions or deviations to/from the MR SHALL be clearly stated and quoted in an optional part of the bid, as an alternative.

If no exceptions are specified, CONTRACTOR will intend that the bid is completely in accordance with the MR and relevant documents.

Vendor shall quote separately and comparatively, the alternatives requested in MR by contractor.

VENDOR is requested to include in his proposal the enclosed form "VENDOR'S CERTIFICATE" duly filled in & signed.

Compliance with this requisition in any instance SHALL not relieve the VENDOR of his responsibility to meet the specified conditions.

VENDOR SHALL include in the bid copies of technical forms that will allow, through the proposed model number, a check of technical characteristics of the instruments including the spare parts.

### 5.2 DATA SHEETS

It is mandatory that project required specification, specified by contractor on project documents, shall be confirmed /filled by the bidders and attached to the bids.

Bids without CONTRACTOR's required specifications, properly completed/ confirmed by vendor, will be considered technically incomplete and therefore, technically unacceptable.

## 6.0 ORDER OF PRECEDENCE

In case of any conflict between the contents of this document or any discrepancy between this document and other project documents or reference standards, this issue must be reported to the CLIENT. The final decision in this situation will be made by CLIENT.

## 7.0 REGULATIONS

Instrument Standards, Codes and References attached to this specification provides the minimum technical standards to be incorporated into the design standards of "Fire & Gas system for the project."

## 8.0 FIRE & GAS SYSTEM OVERVIEW

The Fire & Gas system (FGS) shall provide all functions necessary to monitor and safeguard the plant from hazardous situations arising from the presence of fire or high concentrations of flammable, explosive and toxic gases. It shall support the following functions as a minimum:

- Fire detection
- Gas detection
- Executive control (manual, automatic and isolation)
- Status monitoring and alarm displays
- Initiation of shutdown via the ESD
- Sequence of event recording
- Time synchronisation with DCS via serial link or hardwired
- The fire detection philosophy, which caters for only one major incident at any one time, shall be as follows:
- To detect fires or potential fires rapidly
- To protect personnel, equipment and environment
- To run or shut down the HVAC and CO2 package
- To isolate, shut off and blow down hydrocarbon sources via the ESD
- To control/suppress the fire manually or automatically
- The gas detection philosophy shall be as follows:
- To detect combustible gas accumulations well before they reach a potentially hazardous level
- To isolate residual pressures to minimise accumulations of combustible gas on confirmed gas detection via the ESD.
- To isolate all possible ignition sources on confirmed gas detection via the ESD.

## 9.0 ELECTRICAL SAFETY CERTIFICATION

### 9.1 STANDARDS OF CONSTRUCTION AND PERFORMANCE

Construction and performance of fire, gas and smoke detectors shall comply with the European standards listed below:

- Heat detectors EN 54
- Flame and ionization-type detectors EN 54
- Combustible (flammable) gas detectors EN 50057

### 9.2 STANDARDS OF CERTIFICATION

Electrical certification of fire, gas and smoke detectors shall comply with IEC 60079. The power supply to of the F&G equipment shall be

VDC, derived from the Fire & Gas panel.

All materials and equipment's associated with Fire & Gas detection/control shall be suitable for being used within Zone 1 hazardous area and the prevailing environmental conditions (Refer to Specification for Hazardous Area Classification Doc. No.: BK-00-HD-000-SA-SP-0002).

Field devices shall be certified for electrically hazardous environment Zone 1, Class IIB, T4 as minimum and ingress protection IP65. Battery room devices shall be certified EExd for electrically hazardous environment Zone 1, Class IIC, T4 (Refer to Specification for Hazardous Area Classification Doc. No.: BK-00-HD-000-SA-SP-0002).

## 10.0 DETECTOR REQUIREMENTS

All F&G detectors shall have an illuminated means of status indication (alphanumeric or coloured LED(s), or illuminated LCD screen), visible at minimum 3 m distance, to indicate:

- Safe state
- Tripe state
- Fault state (when available)

The selection of detector types depends on the location and type of the combustible and toxic gas concentration. The criticality of the consequence of a fire shall determine which detection shall be required. Reference shall be made to the HSE concept for detailed selection criteria.

The suggested detector location is indicated on Fire & Gas detectors layout drawings.

All devices shall be accessible and capable of being tested. Suitable test facilities and provision of test and calibration gas shall be form part of Vendor's scope.

VENDOR shall clarify the life time of the sensor under operating conditions.

All detectors shall be Smart Hart Technology.

Detectors are required with the following main characteristics:

- Designed for continuous detection:

  - Ø The sensors shall be able to operate in the whole range of ambient temperature, from +5°C to +85°C.The possible use of infrared gas detectors that cannot meet this requirement shall be checked case by case otherwise they shall be protected by sunshades.
  - Ø The sensor shall not be poisoned by the surrounding atmosphere, and in particular the presence of H2S.

- Ø If located outdoors their susceptibility to ambient humidity should be low.
- Ø The use of physical or chemical filters around sensors shall be accepted only if they do not affect sensitivity or response time. A weather protecting cone shall be supplied to protect outdoors detectors, as applicable.

· Automatic self resetting type

## 10.1 Power Supplies

Available electrical power supplies shall be:

- · Dual 24VDC ±1%, DC Charger and Batteries for F&G System
- · Single 110VAC 50Hz Non-UPS feeder for cabinet accessories/lighting, sockets

Batteries of DC charger shall guarantee providing back up electrical power supply for F&G system, at least for 5 minutes with full load operation after 24 hours of operation with normal load, in case of any interrupt in normal electrical power system.

Regardless of the above, the system shall be unaffected by voltage and frequency variations up to ±5% and power dips up to 50 msec duration. All other voltages (such as 24 Volt DC, etc) required by the ESD system and field instrument shall be derived from within the cabinet by the use of suitable internal power supplies and distribution. Power supplies shall be supplied in redundant configuration and suitable contactors to achieve power fault alarm (if any) to be provided.

## 10.2 Grounding, Lightening Protection and Noise Immunity

Vendor shall fully describe the preferred method for grounding power, signals and signals shields in the system proposal. In particular, the Vendor shall indicate the effect of equipment installation in different locations on the grounding design.

The conductive part of instrumentation equipment installed in the ER and CR building shall be connected to a specific earth loop which is connected to the main earth loop through existing earth dispatchers.

In order to avoid electronic noise and interference, the instrument earth shall remain totally isolated from the electrical protective earth. Instrument earth shall be individually separated for intrinsically safe & Non intrinsically safe instruments. The impedance of the instrument earth shall be less than 0.5 ohm.

Vendor shall describe his philosophy for powering transmitters and insuring good noise immunity. Specifically, the Vendor shall point out the general philosophy on isolated signal reference and galvanic insulation.

The Vendor shall state the performance in terms of common Mode Voltage rejection, normal Mode Voltage rejection, and maximal over voltage protection, maximum common mode voltage, and maximum permanent voltage.

Vendor shall describe how the system will be protected against lightning. Vendor shall clearly detail all of the requirements which need to be followed by others to insure maximum efficiency for the lightning protection.

Noise immunity equipment shall be immune to spurious action or damage due to RFI in accordance with IEC 60801. Hand held personal radio equipment of 5W nominal output may be in operation near the equipment with the cabinet doors in the open position.

Standard limitation for acoustic noise of the devices shall be considered by vendor during design.

Separate earth sumps shall be provided for instrument earth, I.S. Earth and safety earth. Electrical protective earth resistant shall be gathering than Instrument Earth.

The power supply units shall be rated for operation not greater than 70% of capacity under normal load condition for the full I/O capability (used and spare) of the considered controller. Where DC power supplies are derived from the above AC power supply by the VENDOR, an earth fault monitoring device shall be provided. Earth fault alarm shall be reported to the PCS.

Where a VENDOR requires a different supply, then the VENDOR shall provide all necessary equipment, power supplies, AC/DC distribution and protection, fuses, circuit-breakers, earth leakage detection and terminals to interface his equipment with the project electrical distribution equipment. Battery backup, if necessary to ensure safe running shall be included in VENDOR'S scope. All power supplies over 50 volts shall be shrouded and labeled

### 10.3 Electromagnetic Compatibility / Radio frequency interference (RFI)

The design of the equipment shall be such that it is not adversely affected by electromagnetic interference as defined in IEC 61000. The FGS shall conform to IEC 60801" Electromagnetic Compatibility for Industrial-Process Measurement and Control Equipment".

F&G System shall be immune to signal strength of 10 volts/m with the door open and 15 volts/m with the door closed, over a frequency range of 20MHz through 1 GHz at 1-meter distance.

### 10.4 Electrical transients and electromagnetic interference (EMI)

The F&G System shall be supplied with provision for protection against system error and hardware damage resulting from electrical transients on power or signal. These transients include those generated by switching large electrical loads, by power line fault due to lightning strikes and lightning surges on power or signal cables.

Transient protection shall meet IEC 60801-2 (level 3; 8 kV).

### 10.5 FLAMMABLE GAS DETECTION

Different types of FGD are required, according to their location:

- Outside and HVAC Inlet: Infra Red Gas Detectors for point detection, with the sensor and transmitter integrated.
- In the battery rooms: Catalytic Gas Detector for Hydrogen detection.
- At the boundaries of the process units: infrared Beam linear Gas Detectors (open path type), with separate transmitter and receiver units (if required)

The detector shall meet the following specifications as a minimum:

- Detector type: Infra-red type
- Output Signal: Analogue 4~20 mA
- Detection range: 0 to 100% LEL with 2 digital Auxiliary switch for L/H alarm signals
- Input power supply: 24VDC nominal
- Enclosure material: Epoxy coated die cast aluminum (copper free)
- Cable entries: ISO M20 x 1.5
- Certification: CENELEC (BASEEFA) EExi, IIB,T4 as minimum
- Ingress protection: IP 65
- Accuracy : < +/-3% FULL SCALE
- Availability :< ± 2% full scale
- Response Time: <5 Sec
- Accessories: Junction box, cable glands

The VENDOR shall provide the following characteristics which will become part of the performance requirements:

- The temperature of the filaments in fresh air (for Catalytic GD),
- The zero stability and the drift of the full-scale sensitivity, in % LFL (for Catalytic GD), per month and year,
- The life time of the sensor under operating conditions,
- Maximum cable length between sensor and transmitter,
- Maximum cable length between transmitter and F&G module according to cable core section.

The VENDOR shall provide a complete set of calibration and test accessories including at least:

- Pressure regulator,
- Replacement cylinder containing a mixture air/methane,
- Flexible tubing and sensor adapter, flow indicator and cone.

All devices for mounting and installation shall be supplied and shall allow gas detector calibration from grade level. If special tools are required, they shall be provided by VENDOR. Protection accessories (splashguard, filter, sun shade, etc.) are required.

All beam detectors shall incorporate swivel mounts for adjustment of alignment, automatic compensation for optical fouling, and adjustable time delay to eliminate nuisance alarms/trips.

Note: for HVAC intake Flammable gas detector for 2003 voting logic to be considered.

### 10.6 TOXIC GAS DETECTION

Toxic Gas detectors shall be selected to give the fastest practical response with minimal cross sensitivity to other gases expected to be present.

The detector shall meet the following specifications as a minimum:

- Detector type: electrochemical type
- Gas detected: Hydrogen Sulphide (H2S)
- Output Signal: Analogue 4~20 mA
- Detection range: 0-50 ppm with 2 digital Auxiliary switches for L/H alarm signals
- Enclosure material: Epoxy coated die cast aluminum (copper free)
- Operating voltage: 24VDC nominal
- Zero stability: ±2 ppm
- Cable entries: ISO M20 x 1.5
- Certification CENELEC (BASEEFA): EExi, IIB, T4 as minimum
- Ingress protection: IP 65
- With High Accuracy and High Availability
- Accuracy : ± 2% of full scale
- Availability :< ± 2% full scale
- Response Time: <5 Sec
- Accessories: Junction box, cable glands

The sensor shall have a linear output signal and be capable of remote calibration.

The VENDOR shall provide a complete set of calibration and test accessories including at least:

- Pressure regulator,
- Replacement cylinder containing a mixture air/H2S,
- Flexible tubing and sensor adapter, flow indicator and cone.

All devices for mounting and installation shall be supplied and shall allow gas detector calibration from grade level, if special tools are required, they shall be provided by VENDOR. Protection accessories (splashguard, filter, sun shade) are required.

Note: for HVAC intake Toxic gas detector for 2003 voting logic to be considered.

## 10.7 SMOKE DETECTION

These detectors shall be installed in building in safe area. The detector shall meet following specification as minimum:

- Detector type: Optical type(scattered-light type or transmitted-light type detectors)
- Ingress Protection: IP 54
- Integral LED Required
- Working temperature: -10 ºC to 60 ºC
- Enclosure material: Epoxy coated die cast aluminum (copper free)
- Smoke detector sensitivity: m = 0.11 ÷ 0.13 dB/m pursuant to EN 14604:2005
- Cable entries: ISO M20 x 1.5
- Accessories: End of line resistor, base & mounting kits

The VENDOR shall provide a complete set of calibration and test accessories. All devices for mounting and installation shall be supplied. If special tools are required, they shall be provided by the VENDOR.

The VEDNOR shall provide the following characteristics which will become part of the performance requirements:

- The zero stability and the drift of the full-scale, under operating conditions
- The response time
- The maximum admissible ambient dust concentration,
- Maximum number of pipes per scanner.
- Maximum surface coverage.

The VENDOR shall provide a complete set of calibration and test accessories including at least:

- Test applicator
- Smoke canister

## 10.8 FLAME DETECTION

Flame Detectors shall be designed for continues detection of fire with 120° (Horizontal/ Vertical) cone of vision as a maximum.

Flame Detectors shall be UV/IR flame detector (Automatic self-resetting type) or IR type (IR flame detectors shall be used in enclosed areas where the smoke and heat detector limitations do not permit their application)

The detectors shall meet following specifications:

- Detector type: UV/IR flame detector or IR3
- Input power supply: 24VDC nominal
- Output Signal: 4-20 mA DC
- Enclosure material: Epoxy coated die cast aluminum (copper free)
- Cable entries: ISO M20 x 1.5
- Certification: CENELEC (BASEEFA) EExia/EExd IIB, T4 as minimum
- Ingress protection: IP 65
- Response Time: less than 5 sec @ 50 feet.
- Accessories: Junction box, cable gland

The VENDOR shall provide a complete set of calibration and test accessories including at least:

- UV/IR test lamp,
- AC/DC charger for lamp.

The flame detectors shall be immune to false alarms sources including arc welding, fluorescent lighting and sunlight.

False alarm check circuit shall be incorporated to prevent false alarm due to intermittent flash or lightning.

Flame UV/IR detectors, shall be equipped with an automatic optical testing system to verify the integrity of the optical system (including the transparency of the lens) that shall be checked on an automatic and regular basis. Detectors shall be provided with UV/IR and/or IR test lamp, which shall be certified as per Directive 94/9/EC – ATEX with the same use as the detectors.

Flame detectors shall be protected against solar radiation, dirt and water from rain and deluge with a weather protection.

It shall be required to prove the insensitivity of the IR detectors to light sources at a flicker frequency of 10 Hz and higher.

All devices for mounting and installation shall be supplied. If special tools are required, they shall be provided by the VENDOR. Protection accessories (sun shade) and devices to eliminate the possibility of fire alarms from transient conditions such as lighting, lightening, welding, and illumination shall be provided if necessary.

### 10.9 HEAT DETECTION

The detectors shall meet following specifications as a minimum:

- Detector type: fixed temperature & rate of rise type

- Ingress protection: IP54(indoor)
- Enclosure material: Epoxy coated die cast aluminum (copper free)
- Working temperature: -10 ºC to 60 ºC
- Cable entries: ISO M20x1.5
- Certification: CENELEC (BASEEFA) EEXd, IIB, T4 as minimum in hazardous area and non-certified in safe area
- Accessory: cable gland, base & mounting kit

- The VENDOR shall provide a complete set of calibration and test accessories. All devices for mounting and installation shall be supplied. If special tools are required, they shall be provided by the VENDOR.

Heat sensors in field areas shall be of the LHD.

Linear heat detector is a line-type device whose sensing element comprises two-current carrying wires separated by heat-sensitive insulation that softens at the rated temperature, thus allowing the wires to make electrical contact.

Linear heat detector shall be provided with IP65 (for outdoors) rating as minimum.

### 10.10 HYDROGEN GAS DETECTION

H2 gas detectors shall be located at Battery Room to or any other place where Hydrogen is being handled. HGD in battery rooms will require gas group II C.

HGDs at Battery Room shall be intrinsically safe (IS).

The transmitters shall be smart type and communication protocols shall be approved by the CLIENT.

HGDs Enclosure material shall be considered Epoxy coated die cast aluminium (copper free).

The transmitter signal shall be 4-20 mA and their accuracy shall be better than ±0.1% of span.

Fan of battery room shall not be working continuously, shall be turned on with the first level 5% of the Lower Explosive Limit (LEL) of H2 gas detector.

### 10.11 MANUAL ALARM CALL POINT

The manual call points shall be located on exit routes, floor landings, exits to open air and possibly other areas depending upon the layout of the buildings and along roads in the plant at intervals exceeding 60 m.

Manual Call Points shall be located on outdoors and indoors area

The complete housing of manual call points installed outdoors shall be constructed in accordance with requirements for the classified areas based on Specification for F&G devices be corrosion-resistant and fully weather- proofed.

Outdoor MCP's shall be at the heavy duty type with bodies of stainless steel or carbon steel,.. if suitably protected, and be corrosion free, UV resistant with IP65 rating as minimum.

The Manual alarm call points shall meet following specifications as a minimum:

- Device type: resettable type with single pole change over switch (equipped with opening key for test, maintenance and reset)
- Mounting type: surface
- Certification: CENELEC (BASEEFA) EEXd, IIB, T4 as minimum in hazardous area and non-certified in safe area
- Ingress protection: IP 65 for outdoor/IP 54 indoor
- Enclosure material: Epoxy coated die cast aluminum (copper free)
- Device color : RED
- Cable entries : ISO M20 x 1.5
- Accessories: cable glands & End of Line Resistors.

## 10.12 AUDIBLE AND VISUAL ALARMS

Audible and visual alarms shall be provided at strategic locations throughout the plant to cover the total plant area as shown on the Fire & Gas detector layout.

The Fire & Gas system audible alarm shall be broadcasted through the plant. The visible alarm shall consist of a xenon-flashing beacon that shall be of high intensity to be seen in the ambient sunlight.

For Audible and visual installation location: A single zone on the alarm panel should not cover an area exceeding 2000 m2. (IPS-E-SF-260).

### 10.12.1 BEACONS AND SOUNDERS

The optical beacons shall be of the xenon stroboscopic type with color glass dome.

D04

The beacons consist of ~~paired~~ red, yellow and blue warning lights.

The beacon colours shall be as follows:

- Red for fire detection
- Yellow for flammable gas detection
- Blue for toxic gas detection

The beacon shall be high quality, reliable, field proven device suitable for industrial application, selected for high visibility in intense direct sunlight.

The quantity and type of the beacons shall be as specified on the datasheet. Unless otherwise specified, the cable entry shall be ISO M20 x 1.5.

The beacon shall be rated for Zone 1, Class IIB and Temperature Class T4 in hazardous area and non-certified in safe area

The power supply to the beacon shall be derived from the Fire & Gas panel. Beacons shall be located so that they shall be visible in the area for which they are to provide a warning, but they should be accessible for maintenance.

The sounder shall be of variable tones type. The tones and sound levels shall be selectable based on alarm type e.g. for flammable gas, toxic gas leakage warning, evacuation etc. The device shall be provided with multiple terminal connections for each type of alarm threshold required.

The siren sound level shall be minimum 117 dB (80 dB for indoor) at 1 meter distance suitable for personnel warning in industrial environment where other machinery noises are already present. The siren shall be with provisions to alarm different sound levels. The multiple wire cable shall be terminated in the sounder terminals. The terminals shall be housed in an explosion proof enclosure as part of the sounder. The sound level for the sounder shall not exceed 120dB (A) at 1 meter distance on the main axis. The number of sounders shall be specified accordingly.

In accommodation places where people are asleep, the sound level at behead should be minimally 75 dBA with doors closed. The maximum sound level shall not be in excess of 100 dBA.

Bells or sirens shall be of adjustable type.

Bells or sirens shall be as follows:

Bells for buildings

Sirens for open areas (at least 117 dB (A) at 1m) with two different tones:

D04

- non-continuous for flammable and toxic gas low alarm detection
- Continuous for fire detection and also flammable/toxic gas high alarm detection

Siren alarms shall have a range of at least 1.5 km in still air.

Audible and visual alarms shall be provided with IP65 (for outdoors)/IP 54 (for indoors) rating as minimum.

Bells or sirens Enclosure material shall be considered Epoxy coated die cast aluminium (copper free).

## 11.0 DETECTION LAYOUT

Location of Fire & Gas Sensors and Devices shall be in accordance to standards: IPS-E-SF-260 & IPS-G-IN-270

## 12.0 INSPECTION & TESTING

### 12.1 GENERAL

FAT procedure shall be approved by CLIENT /CONSULTANT representative to inspection & testing. Inspection and testing procedure of those instruments covered by this technical specification shall be submitted by the VENDOR at least 6 weeks prior to inspection and testing to the PC CONTRACTOR/CLIENT for review and approval. Without imposing any limitation on the above requirements, as minimum, the contractor following tests and inspections shall be made by the VENDOR.

a) Calibration check
b) Hydrostatic
c) Specification/dimension check

The CONTRACTOR/CLIENT representative reserves the right to send his inspectors to the VENDOR's shop and his SUB-VENDORS shop to check, whether their design and manufacturing schedule is being maintained. The inspectors shall have the right to access to the areas involved for the construction of the equipment’s ordered under this specification, and the VENDOR shall give them the necessary co-operation. Any special test requirements shall be specified on the individual data sheet. Each instrument shall be calibrated by the VENDOR to meet the requirements stated on the individual data sheets.

### 12.2 FACTORY ACCEPTANCE TEST (FAT)

Two weeks before the time that the equipment is ready for the Factory Acceptance Test (FAT), CONTRACTOR/CLIENT shall be notified. The VENDOR shall have completed his own internal tests. These tests shall test all systems and shall include a full 100% in-house test of each system. On successful completion of this, the VENDOR shall then undertake the Factory Acceptance Test (FAT). The CONTRACTOR will wish to witness a Factory Acceptance Test prior to releasing the equipment for shipment. The VENDOR shall be responsible for conducting the test and providing all necessary facilities, equipment and personnel. CLIENT representative is necessary for Factory Acceptance Test (FAT).

The full scope of the test will be defined in the "Factory Acceptance Test Procedure", which shall be approved by CLIENT. All instrument certification shall be according to ISO 10204/3.11.

## 13.0 SPARE PARTS AND SPECIAL TOOLS

### 13.1 SPARE PARTS

The VENDOR shall provide lists of recommended spare parts, which shall include the original part numbers with prices for commissioning, start-up and two years operation. All spare parts shall be identified individually.

Spare parts for commissioning and start-up; a qualified and complete list based on PROJECT SPARE PART SUPPLY PROCEDURE (Doc. No. E&D-QC-SP-1).

Spare parts for two years operation; a qualified and complete list based on PROJECT SPARE PART SUPPLY PROCEDURE (Doc. No. E&D-QC-SP-1).

Vendor shall be able to provide spares back up and support for the plant life for at least 15 years.

SPIR form shall be approved by CLIENT prior to procurement.

### 13.2 SPECIAL TOOLS

Special Tools (as option / if any; to be recommended by Vendor)

## 14.0 TRAINING

Training shall be prepared to provide suitable personnel as required for the following:

- Design configuration assistance to CONTRACTOR
- Operator training courses
- Maintenance training courses
- Site installation and commissioning support.

VENDOR shall provide detailed information of factory and onsite training courses in his proposal.

VENDOR shall furnish UNIT RATES for providing training in English for three groups of employees (at least 8 persons):

- Engineering
- Operators
- Maintenance

Training shall be for Control System, especially on Ethernet TCP/IP data highway communication protocol and shall be arranged to be held before FAT test.

As an additional option, VENDOR shall provide an instructor to conduct operator training before

the start-up of plant operations. The training will be specific to the specific facility systems, graphics, control, etc. The instructor shall be required to provide a training manual based on compilation of all configuration work done on the facility systems.

## 15.0 PACKING AND SHIPPING

Supplier shall be responsible for packing and protection of all devices adequately for shipment to the job site in accordance with the Purchase Order Specification. All crating and boxes shall be clearly labelled on three sides with description and equipment numbers. Supplier shall prepare detailed packing list by box and crate number.

The package shall be properly protected from damage during sea freight. Each item shall be clearly identified with Purchaser's Name, Purchaser's Order Number and Equipment Tag Number prior to shipment. Supplier shall be responsible for the proper protection and the timely and correct delivery of all equipment to the location specified in the purchase order.

During preparation for shipment, the following factors shall be considered:

No equipment or materials shall be released for shipment without approval of the Purchaser and/or his inspection representative.

All slot mounted or plug-in instruments (e.g. computers) shall be removed and packed in their original protective packing and shipped separately from the cabinets.

All relays, connectors and interconnecting wires shall be secured by cable ties or tapes to prevent loosening due to vibration during shipment and transportation.

All equipment and materials shall be properly crated to prevent damage during transportation, handling and shipment. The preparation for shipment shall be subjected to the approval of the Inspector.

Supplier shall wrap and tag all small items being shipped loose. All items shall be properly tagged with the tag containing the Item Tag Number, Purchaser Order Number, service and other relevant details.