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| <br><b>NISOC</b> | <b>Development Plan of 28 Reservoirs<br/>/ BIBI HAKIMEH Oilfield (EPC)</b> |                      |                         |                    |                    |                        |                         |                    | <br> |
|  | <b>Specification for Fire &amp; Gas Sensor and Devices</b>                 |                      |                         |                    |                    |                        |                         |                    |   |
| <b>Contract No.:</b><br>053-073-9189   | <b>Project</b><br>BH   | <b>Package</b><br>17 | <b>Contractor</b><br>SM | <b>Fac.</b><br>100 | <b>Disc.</b><br>IN | <b>Doc. Type</b><br>SP | <b>Ser. No.</b><br>0054 | <b>Rev.</b><br>D04 | Page 1 of 23  |

# Specification for Fire & Gas Sensor and Devices

## AFC

APPROVED FOR CONSTRUCTION

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F Number: 709574

| Rev. | Status | Date       | Document Status           | Prepared by: | Checked by:  | Approved by: | Client Approval |
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| D00  | IFC    | 17.08.2021 | IFC                       | S. M/M.H     | S. Mo        | A.R. Ma      |                 |
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Class: A

Status:

- IDC: Inter-Discipline Check
- IFC: Issued For Comment
- IFA: Issued For Approval
- IFR: Issued for Review
- AFD: Approved For Design
- AFC: Approved For Construction
- AFP: Approved For Purchase
- IFI: Issued For Information
- AB-R: As-Built for COMPANY Review
- AB-A: As-Built –Approved



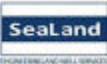

Page 2 of 23

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|---|--|---------------|------------------|-------------|-------------|-----------------|------------------|-------------|---|
| <br>NISOC | Development Plan of 28 Reservoirs<br>/ BIBI HAKIMEH Oilfield (EPC) |               |                  |             |             |                 |                  |             | <br> |
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## Table of Contents

|  |    |
|--|----|
| 1. Introduction .....  | 5  |
| 2. Scope .....   | 5  |
| 3. Definitions .....   | 6  |
| 4. Environmental Conditions .....                              | 6  |
| 4.1. Site Condition .....                                      | 6  |
| 4.2. Tropicalization .....                                     | 6  |
| 4.3. Ingress Protection .....                                  | 7  |
| 5. Conflicts and Deviations .....                              | 7  |
| 6. References .....  | 7  |
| 6.1. Project Documents .....                                   | 7  |
| 6.2. References Standards .....                                | 7  |
| 7. Basic Principles .....                                      | 9  |
| 7.1. Acronyms and Abbreviation .....                           | 9  |
| 7.2. Units of Measurement .....                                | 11 |
| 8. General Requirements .....                                  | 11 |
| 8.1. Vendor Responsibility .....                               | 12 |
| 8.2. Deviations .....  | 13 |
| 8.3. Approvals .....   | 13 |
| 8.4. Spares .....  | 13 |
| 8.5. Special Tools .....                                       | 13 |
| 8.6. Hazardous Area Classification .....                       | 13 |
| 9. Fire and Gas Detectors and Alarm Devices Requirements ..... | 14 |
| 9.1. General .....   | 14 |
| 9.2. Heat Detectors .....                                      | 15 |
| 9.3. Smoke Detectors .....                                     | 16 |
| 9.4. Combustible Gas Detectors .....                           | 16 |
| 9.5. H2 Gas Detector .....                                     | 17 |
| 9.6. Flame Detector .....                                      | 18 |
| 9.7. Toxic Gas Detectors (H2S) .....                           | 19 |
| 9.8. Manual Call Points .....                                  | 19 |
| 9.9. Visual and Audible Alarm .....                            | 20 |
| 10. Inspection and Testing .....                               | 22 |
| 11. Preparation for Shipment .....                             | 22 |

|  |  |               |                  |             |             |                 |                  |             |   |
|--|--|---------------|------------------|-------------|-------------|-----------------|------------------|-------------|---|
|  | Development Plan of 28 Reservoirs<br>/ BIBI HAKIMEH Oilfield (EPC) |               |                  |             |             |                 |                  |             |   |
|  | Specification for Fire & Gas Sensor and Devices                    |               |                  |             |             |                 |                  |             |    |
| Contract No.:<br>053-073-9189  | Project<br>BH  | Package<br>17 | Contractor<br>SM | Fac.<br>100 | Disc.<br>IN | Doc. Type<br>SP | Ser. No.<br>0054 | Rev.<br>D04 | Page 4 of 23  |

## 12. Vendor Documentation .....22

  
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 شماره ثبت: ۴۱۴۵۵

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## 1. INTRODUCTION

National Iranian South Oil Company (NISOC) plans to conduct an integrated project includes several sub-projects to preserve and increase production of Gachsaran oil fields located in south of Iran Khuzestan and Bushehr provinces as follow:



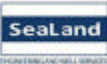

- 1) Revamping of Production and Desalting Units of Bibi Hakimeh 1&2
- 2) Fabrication & Installation a Preheater, Stripping Column and Related Equipment for Nargesi Production Unit

The purposes of first sub-project are equipping and extension of Bibihakime-2 desalting unit to achieve 110,000 SBPD desalted crude oil, and necessary modifications in Bibihakime-2 desalting & production units and Bibihakime-1 production unit so that the new plants will be able to process crude oil with 22% water cut and transfer waste water from Bibihakime-1 production unit to waste water treatment facilities in Bibihakime-1 desalting unit via installation of a none-metal pipe. Therefore, National Iranian South Oil Company (NISOC) has announced this project.

The purpose of second sub-project is crude oil sweetening in Nargesi plant by new design and necessary modifications in existing facilities. National Iranian South Oil Company (NISOC), on behalf of the National Iranian Oil Company (NIOC) is responsible to exploit oil and gas from onshore fields in the south district of Iran. According to management of planning & international affairs of National Iranian Oil Company (NIOC) pronouncement, H<sub>2</sub>S content and RVP specification of exported oil shall be in the specified allowable range; Accordingly, NISOC has decided to fulfil a project, investigating and probing required equipment and operational conditions to meet the desired crude oil specifications of sulphur content and RVP for Nargesi production units.

## 2. SCOPE

This specification defines the minimum requirements used for detection devices of fire and gas as well as relevant alarm facilities of “Revamping of Production and Desalting Units of Bibi Hakimeh 1&2” and “Fabrication & Installation a Preheater, Stripping Column and Related Equipment for Nargesi Production Unit” sub-projects.

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|---|--|---------------|------------------|-------------|-------------|-----------------|------------------|-------------|---|
| <br>NISOC | Development Plan of 28 Reservoirs<br>/ BIBI HAKIMEH Oilfield (EPC) |               |                  |             |             |                 |                  |             | <br><br> |
|   | Specification for Fire & Gas Sensor and Devices                    |               |                  |             |             |                 |                  |             |   |
| Contract No.:<br>053-073-9189   | Project<br>BH  | Package<br>17 | Contractor<br>SM | Fac.<br>100 | Disc.<br>IN | Doc. Type<br>SP | Ser. No.<br>0054 | Rev.<br>D04 | Page 6 of 23  |

All the fire and gas detection and alarm devices and components, as far as mechanical characteristics and electrical characteristics and performances are concerned, shall confirm to the present specification.

### 3. DEFINITIONS

Within the context of this document, the following definitions are applicable

|              |  |
|--------------|--|
| Owner/Client | : National Iranian south oil company (NISOC)   |
| Title        | : Development Plan of 28 Reservoirs/ BIBI HAKIMEH Oilfield (EPC)   |
| Contractor   | : Mashin Sazi Arak/ Sealand Engineering and Well Services JV   |
| Consultant   | : <u>Tehran Raymand Consulting Engineers</u>   |
| Will:        | Is normally used in connection with the action by the “Company” rather than by a contractor, supplier or vendor. |
| May:         | Is used where a provision is completely discretionary  |
| Should:      | Is used where a provision is advisory only.  |
| Shall:       | Is used where a provision is mandatory.  |




### 4. ENVIRONMENTAL CONDITIONS

#### 4.1. Site Condition

All the environmental data used in this document and is expected to be considered, shall be obtained from “Process Design Basis for Bibi Hakimeh Production Unit No.1\_BH-17-SM-100-PR-DB-0158”, “Process Design Basis for Bibi Hakimeh No.2\_BH-17-SM-100-PR-DB-0564” and “Process Design Basis for Nargesi\_BH-18-SM-100-PR-DB-0002”.

#### 4.2. Tropicalization

The instruments shall be tropicalized to eliminate mildew, fungi and other detrimental effects of a tropical environment and dust, if needed. Electronic circuit boards shall be suitably protected against corrosion and humidity by applying a protective coating, where deemed necessary. Packaging shall be suitable for shipment and storage under tropical conditions.

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| <br>NISOC | Development Plan of 28 Reservoirs<br>/ BIBI HAKIMEH Oilfield (EPC) |               |                  |             |             |                 |                  |             | <br> |
|   | Specification for Fire & Gas Sensor and Devices                    |               |                  |             |             |                 |                  |             |   |
| Contract No.:<br>053-073-9189   | Project<br>BH  | Package<br>17 | Contractor<br>SM | Fac.<br>100 | Disc.<br>IN | Doc. Type<br>SP | Ser. No.<br>0054 | Rev.<br>D04 | Page 7 of 23  |

#### 4.3. Ingress Protection

All field mounted equipment shall be suitable for the environmental conditions. Particular attention shall be paid to possible effects of corrosion, vibration, humidity, and extremes of temperatures.

### 5. CONFLICTS AND DEVIATIONS

Any conflicts between this specification and other applicable specifications, engineering standards, industry standards, codes, etc., shall be resolved in writing by the Owner or Owner's Representative.

### 6. REFERENCES

#### 6.1. Project Documents

Instrument & Control/Safety System Design Criteria\_BH-17-SM-100-IN-DC-0052

HSE Design Criteria\_ BH-17-SM-100-SA-DC-0134

Safety Philosophy\_ BH-17-SM-100-SA-PH-0136

Specification for Fire & Gas Detection\_ BH-17-SM-100-SA-SP-0059

Process Design Basis for Bibi Hakimeh Production Unit No.1\_BH-17-SM-100-PR-DB-0158

Process Design Basis for Bibi Hakimeh No.2\_BH-17-SM-100-PR-DB-0564




Process Design Basis for Nargesi\_BH-18-SM-100-PR-DB-0002

#### 6.2. References Standards

The codes and standards which are listed below shall be followed as applicable:

##### ➤ **International Standards**



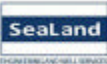
|            |   |
|------------|---|
| API RP 552 | Transmission Systems                                      |
| IEC 60079  | Electrical Apparatus for Explosive Gas Atmosphere         |
| IEC 60092  | General Instrumentation, Control and Communication Cables |

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| Contract No.:<br>053-073-9189   | Project<br>BH  | Package<br>17 | Contractor<br>SM | Fac.<br>100 | Disc.<br>IN | Doc. Type<br>SP | Ser. No.<br>0054 | Rev.<br>D04 | Page 8 of 23  |

|           |  |
|-----------|--|
| IEC 60529 | Degrees of Protection Provided by Enclosures (IP Code)                                       |
| IEC 61000 | Electromagnetic Compatibility (EMC)  |
| IEC 61131 | Programmable Controllers   |
| IEC 61508 | Functional Safety of<br>Electrical/Electronic/Programmable Electronic Safety-Related Systems |
| ISA 84.01 | Application of Safety Instrumented Systems for the Process Industries                        |
| BS 5445   | Specification for Components of Automatic Fire Detectors                                     |
| BS 5839   | Specification for Fire Detection and Alarm Systems for Buildings                             |
| NFPA 72   | National Fire Alarm Code   |

➤ **IPS Standards**

|              |  |
|--------------|--|
| IPS-E-IN-190 | Engineering Standard for transmission Systems                                  |
| IPS-C-IN-190 | Installation and Construction Standard for transmission Systems                |
| IPS-M-IN-190 | Material and Equipment Standard for transmission Systems                       |
| IPS-G-IN-220 | Engineering and Installation Standard for Control Centers                      |
| IPS-M-IN-220 | Material Standard for Control Panels and System Cabinets                       |
| IPS-G-IN-290 | Engineering and Construction Standard for Programmable Logic Controllers (PLC) |

|   |  |               |                  |             |             |                 |                  |             |   |
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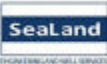

|              |  |
|--------------|--|
| IPS-M-IN-290 | Material and Equipment Standard for Programmable Logic Controllers (PLC) |
| IPS-G-IN-270 | General Standard for Instruments of Fire and Gas Detection Equipment     |
| IPS-E-SF-260 | Engineering Standard for Automatic Detectors and Fire Alarm Systems      |

## 7. BASIC PRINCIPLES




### 7.1. Acronyms and Abbreviation

The following abbreviations are commonly used in this document:

|         |   |
|---------|---|
| AI      | Analog Input                                      |
| AO      | Analog Output                                     |
| ANSI    | American National Standard institute              |
| API     | American Petroleum institute                      |
| ASTM    | American Society for Testing and Material         |
| ATEX    | Atmosphere Explosible                             |
| AWG     | American Wire Gauge                               |
| BMS     | Burner Management System                          |
| BS      | British Standards                                 |
| CENELEC | European Committee for Electrical Standardization |
| CPU     | Central processing Units                          |
| CCR     | Central Control Room                              |
| dBA     | Decibel Absolute                                  |
| DC      | Direct Current                                    |
| DCS     | Distribute Control System                         |
| DI      | Digital Input                                     |
| DO      | Digital Output                                    |
| DPDT    | Double Pole Double Throw                          |

|   |  |               |                  |             |             |                 |                  |             |  |
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|      |   |
|------|---|
| EEX  | Europe Explosion Proof                        |
| EMC  | Electromagnetic compatibility                 |
| EMI  | Electromagnetic Interference                  |
| ESD  | Emergency Shut Down                           |
| EWS  | Engineering Work Station                      |
| FAT  | Factory Acceptance Test                       |
| FGS  | Fire and Gas System                           |
| F.S. | Full Scale                                    |
| HMI  | Human Machine Interface                       |
| I&C  | Instrumentation and Control                   |
| IEC  | International Electrotechnical Commission     |
| I/O  | Input/output                                  |
| IP   | Ingress Protection                            |
| IPC  | Industrial Personal Computer                  |
| IPS  | Iranian Petroleum Standard                    |
| I.S. | Intrinsically Safe                            |
| ISA  | International Society of Automation           |
| ISO  | International Standard Organization           |
| JB   | Junction Box                                  |
| MCC  | Motor Control Center                          |
| MTBF | Mean Time Between Failure                     |
| MTTR | Mean Time to Repair                           |
| NACE | National Association of Corrosion Engineering |
| NEC  | National Electric Code                        |
| NEMA | National Electrical Manufacturers Association |
| NPT  | National Pipe Thread                          |
| OWS  | Operator Work Station                         |
| OD   | Outside Diameter                              |
| LED  | Light Emitting Diode                          |

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| Contract No.:<br>053-073-9189   | Project<br>BH  | Package<br>17 | Contractor<br>SM | Fac.<br>100 | Disc.<br>IN | Doc. Type<br>SP | Ser. No.<br>0054 | Rev.<br>D04 | Page 11 of 23   |

|      |                                    |
|------|------------------------------------|
| P&ID | Piping and Instrumentation Drawing |
| PCS  | Process Control System             |
| PLC  | Programming Logic Controller       |
| RFI  | Radio Frequency Interference       |
| RTD  | Resistance Temperature Detector    |
| SI   | System International of Units      |
| SPDT | Single Pole Double Throw           |
| UCP  | Unit Control Panel                 |
| UPS  | Uninterruptible Power Supply       |
| UV   | Ultra Violet                       |




## 7.2. Units of Measurement

Generally, International System of units (SI) shall be used. All dimensions and ratings shall be metric. Except for the temperature, which shall be in degrees Celsius instead of Kelvin, and for pipes and fittings threads, which shall be in inches of NPT.

| Variable           | Units  |
|--------------------|--|
| Temperature        | Celsius degree (°C)  |
| Pressure Relative  | Psig or Barg   |
| Pressure Absolute  | PsiA or barA   |
| Level              | m or mm, % of range  |
| Flow               | Liquid<br>Gas or vapor<br>Air or nitrogen                            |
|                    | kg/h or m /h<br>m3/h or Sm3/h(l) or kg/h<br>m3/h or Sm3/h(l) or kg/h |
| Analysers          | pH, molar%, ppm % LEL  |
| Density Liquid Gas | Kg/m3 kg/m3.Or.kg/Sm3(l)   |

## 8. GENERAL REQUIREMENTS

Fire and gas detection and alarm devices shall be selected to ensure the safety of personnel, safeguard the environment and to provide for the protection of the plant and its associated facilities, and to permit the continuity of production.

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|---|--|---------------|------------------|-------------|-------------|-----------------|------------------|-------------|---|
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### 8.1. Vendor Responsibility




The Vendor shall be totally responsible for the design, selection, manufacturing, etc. of the goods, including all materials used in its manufacture, performance, construction, inspection and testing, all of which shall fully comply with the performance and other requirements as detailed in this specification and associated documentation.

In addition, the Vendor shall ensure that the devices and all components comply with all relevant codes, standards and regulations whether specifically referred to or not.

The Vendor shall submit a timetable for periodic maintenance, calibration and cleaning of the system and its components.

The Vendor shall provide the following services:

- Project Management/Planning/Reporting,
- Supply of the devices and all auxiliaries and accessories,
- Test and Certification,
- Packing and Shipment,
- Spare Part (Commissioning/Start-up and two years operation) and Consumables,
- Training (Including fundamental, operation, engineering and configuration, programming, Hardware/software maintenance, maintenance and external systems interface),
- Onsite services (System SAT, Installation, Commissioning and Start-up assistance),
- Special Equipment or tools for installation, commissioning, testing, calibration and maintenance,
- Device configuration,
- Factory acceptance test,
- Documentation,
- Guarantee,
- Quality management requirements

|   |  |               |                  |             |             |                 |                  |             |  |
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## 8.2. Deviations

All deviations from the requirements of any of the Data sheets, Specifications, Codes, Standards, Regulations, Guidance Notes, etc, shall be agreed with Client before proceeding.

In the absence of such a statement, it shall be understood that all listed requirements are accepted. Any costs associated with re-engineering and/or provision of additional materials subsequently identified as being required together with re-inspection and re-testing shall be done by the Vendor and the changes incorporated with slippage to neither schedule nor delay in commissioning.

## 8.3. Approvals

The supplied items shall have approval from international recognized agencies such as UL, FM, BASEEFA, PTB, etc., if applicable.

## 8.4. Spares




The Vendor shall supply spare parts for Pre-commissioning, commissioning, and two years of operation. Moreover, the Vendor shall guarantee that he will supply spare parts for his system or instruments whenever required by the Client, up to 10 years.

## 8.5. Special Tools

The vendor shall supply all special tools necessary for the main and auxiliary equipment for installation, pre-commissioning, commissioning and maintenance.

## 8.6. Hazardous Area Classification

Electrical and electronic equipment for installation in hazardous area zones shall be selected and designed in compliance with the defined hazardous area classification. And shall be certified in accordance with the definitions given in IEC 60079 'Electrical Apparatus for Explosive Gas Atmospheres' ATEX European Directives shall be followed.

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## 9. FIRE AND GAS DETECTORS AND ALARM DEVICES REQUIREMENTS




### 9.1. General

All detectors from field and buildings shall be connected, via marshalling cabinet to input cards of the FGS or FACP. The Vendor shall guarantee the full compatibility and good functionality with the selected FGS or FACP.

Indoor and outdoor detectors will be considered respectively addressable and conventional.

The characteristics of Fire and Gas detectors shall be as follows:

- Smart technology shall be selected, as possible.
- Analogue signal 4-20 mA, two wires or three wires shall be provided as necessary,
- Operating voltage 16V...26VDC,
- Detector shall be preferably powered by the FGS or FACP,
- Electrical and protection classification (Zone, Gas Group, Temperature Class...) shall be according to Hazardous area classification.
- Toxic Gas Detector and detectors installed in battery room (Hydrogen Gas Detector...) shall be EEx ia.
- The body material of all gas detectors, flame detectors and manual call points located in hazardous area shall be stainless steel or aluminum.
- Operating conditions: the sensors shall be able to operate in the ambient conditions
- The selection and installation of FGS sensors shall ensure that mal-operation caused by heat, wind, humidity and solar radiation etc. does not occur. Housings for field sensors shall be of stainless steel, carbon steel if suitably protected, or of aluminum stated in individual data sheets and subject to Owner approval.
- All devices shall be accessible and capable of being tested. Suitable test facilities and provision of test and calibration gas shall form part of Vendor's scope.
- Detectors shall be equipped with LED indication to show detector status, if possible.
- All detectors which are installed in areas normally not visible shall be equipped with remote indicators, as is declared by Safety department in devices location layout.
- Test means shall be supplied for all detector types.

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|--|--|---------------|------------------|-------------|-------------|-----------------|------------------|-------------|---|
|  | Development Plan of 28 Reservoirs<br>/ BIBI HAKIMEH Oilfield (EPC) |               |                  |             |             |                 |                  |             | <br> |
|  | Specification for Fire & Gas Sensor and Devices                    |               |                  |             |             |                 |                  |             |   |
| Contract No.:<br>053-073-9189  | Project<br>BH  | Package<br>17 | Contractor<br>SM | Fac.<br>100 | Disc.<br>IN | Doc. Type<br>SP | Ser. No.<br>0054 | Rev.<br>D04 | Page 15 of 23   |

- All detectors shall be shock and vibration resistant.
- Detectors shall be protected against insects in special areas.
- Fire detectors shall conform to the requirements of NFPA 72.
- For buildings, Addressable detectors for Smoke, Heat and indoor Manual Alarm Call points shall be considered.
- Failure or repairment of a detector shall not be affected on the operation of the other detectors.
- The minimum ingress protection for outdoor use shall be IP65.
- The minimum ingress protection for indoor use shall be IP42, but IP54 is preferred if is practicable.




## 9.2. Heat Detectors

Rate of rise detectors, in general, shall be used in enclosed areas for fire confirmation or where they offer a better response to the type of fire anticipated. Rate compensated fixed temperature heat detectors shall be used in harsh environments.

Heat detectors shall be resettable and return to normal condition after activation without replacing of any parts.

Heat detectors, are required with the following main characteristics:

- Bodies and bases enclosure with anti-static treatment.
- Vibration proof mounting base equipped with screw type terminal and integral visual alarm indicator.
- Operation voltage 24 VDC.
- Remote light indicator shall be provided for detectors located in none permanently visible spaces, as is declared by Safety department in devices location layout.
- Automatic self-resetting type.
- Addressable type
- response time as minimum as possible (i.e., < 1 sec)
- The Vendor shall provide the following characteristics which will become part of the performance requirements:

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|---|--|---------------|------------------|-------------|-------------|-----------------|------------------|-------------|---|
| <br>NISOC | Development Plan of 28 Reservoirs<br>/ BIBI HAKIMEH Oilfield (EPC) |               |                  |             |             |                 |                  |             | <br> |
|   | Specification for Fire & Gas Sensor and Devices                    |               |                  |             |             |                 |                  |             |   |
| Contract No.:<br>053-073-9189   | Project<br>BH  | Package<br>17 | Contractor<br>SM | Fac.<br>100 | Disc.<br>IN | Doc. Type<br>SP | Ser. No.<br>0054 | Rev.<br>D04 | Page 16 of 23   |

- The zero stability and the drift of the full-scale, under operating conditions.
- The life time of the sensor under operating conditions.
- Maximum number of detectors per loop.

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 Vendor.

### 9.3. Smoke Detectors

Smoke detector shall be optical or other types such as Multi sensor type.

Detectors shall be suitable for installation in a 2–wire loop. Vendor shall advise on maximum number of detectors per loop.

Detectors shall have built–in logic to minimize false alarms.

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

- Test applicator,
- Smoke canister,
- Extender probe

All devices for mounting and installation shall be supplied. If special tools are required, they shall be provided by Vendor.




### 9.4. Combustible Gas Detectors

The detectors shall be based on the IR principle and they shall be suitable for 4 – 20mA operation. The detectors shall consist of two elements; one being active and sensitive to the gas to be detected and the other effectively being passive and acting as an environmental compensatory. The devices shall be capable of calibration, within the range 0 – 100% of the LEL and shall be equipped with out-of-range fault and calibration indication, both treated by the FGS. All such alarms shall be visible at the processor cabinet, and shall be displayed and recorded by the PCS.

The gas monitor or input circuit shall generate an alarm output if the following occurs:

- Detector fault
- Output signal above or below normal range

Detectors shall be poison resistant.

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|---|--|---------------|------------------|-------------|-------------|-----------------|------------------|-------------|---|
| <br>NISOC | Development Plan of 28 Reservoirs<br>/ BIBI HAKIMEH Oilfield (EPC) |               |                  |             |             |                 |                  |             | <br> |
|   | Specification for Fire & Gas Sensor and Devices                    |               |                  |             |             |                 |                  |             |   |
| Contract No.:<br>053-073-9189   | Project<br>BH  | Package<br>17 | Contractor<br>SM | Fac.<br>100 | Disc.<br>IN | Doc. Type<br>SP | Ser. No.<br>0054 | Rev.<br>D04 | Page 17 of 23   |

The sensor shall be capable of remote calibration.

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

- The temperature of the filaments in fresh air,
- The zero stability and the drift of the full-scale, in % LEL per year,
- The life time of the sensor under operating conditions.
- Maximum cable length between sensor and transmitter.

Maximum cable length between transmitter and FGS module according to cable core cross section.

The Vendor shall provide a complete set of calibration and test accessories.




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 the Vendor. Protection accessories (sun shade, splashguard, etc.) are required.

#### 9.5. H2 Gas Detector

H2 Gas detection sensors shall be utilized for some room such as battery room.

H2 Gas detections are required with the following main characteristics:

- Catalytic Gas Detector (CGD),
- Designed for continues detection,
- The sensors shall be able to operate in the whole range of ambient temperature, from minimum to 85°C.
- Automatic self-resetting type,
- Response time:
  - Less than 10 seconds for 50% LEL,
  - Less than 20 seconds for 90% LFL.
- Equipped with automatic self-testing features (electronic test...),
- Engraved stainless-steel tag number plate,
- Give an output 0-100% directly proportional to the % LEL at their location,
- 3 wires signal transmission,

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|---|--|---------------|------------------|-------------|-------------|-----------------|------------------|-------------|---|
| <br>NISOC | Development Plan of 28 Reservoirs<br>/ BIBI HAKIMEH Oilfield (EPC) |               |                  |             |             |                 |                  |             | <br> |
|   | Specification for Fire & Gas Sensor and Devices                    |               |                  |             |             |                 |                  |             |   |
| Contract No.:<br>053-073-9189   | Project<br>BH  | Package<br>17 | Contractor<br>SM | Fac.<br>100 | Disc.<br>IN | Doc. Type<br>SP | Ser. No.<br>0054 | Rev.<br>D04 | Page 18 of 23   |

- Junction box included.
- All mounting accessories shall be supplied by Vendor.

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

- The temperature of the filaments in fresh air,
- The zero stability and the drift of the full-scale, in % LEL per year,
- The life time of the sensor under operating conditions.

#### 9.6. Flame Detector

Combined UV/ IR flame detectors shall be used in general area where flames are expected to be one of the prime indications of fire, such as open outdoor areas, hydrocarbon areas, and fuel areas.




Detectors shall consist of:

- An Ultra-Violet responding to high energy radiation (wave lengths to be stated by the Vendor) in order to detect radiations from sources such as a fire without being sensitive to radiation from the sun or other black body radiation. In addition to sensitivity to fire, this sensor may also be sensitive to radiation from arc welding, X rays and gamma rays (to which the associated infra-red detector is not).
- An Infra-Red sensor sensitive to IR (wave length to be stated by the Vendor) and not sensitive to arc welding, gamma rays or X rays. IR3 flame detector uses 3 distinct IR wavelengths to detect fires, and will only sound when those three wavelengths have been satisfied.
- Nominal cone of vision: 120 degrees with highest spot sensitivity at center point at a distance of 15m for a gasoline fire of 1 ft<sup>2</sup>.
- Response time: 1 to 5 seconds as a maximum.
- Self-test, diagnostic, setting, Auto/ Man. inhabitation.
- Mounting bracket C/W bolts, nuts, screw, U-bolt, etc.

The detectors shall be equipped with LEDs for local indication.

Power supply consumption shall be 24 V DC which is supplied by the Control Unit.

Ingress protection shall be IP 65.

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|---|--|---------------|------------------|-------------|-------------|-----------------|------------------|-------------|---|
| <br>NISOC | Development Plan of 28 Reservoirs<br>/ BIBI HAKIMEH Oilfield (EPC) |               |                  |             |             |                 |                  |             | <br> |
|   | Specification for Fire & Gas Sensor and Devices                    |               |                  |             |             |                 |                  |             |   |
| Contract No.:<br>053-073-9189   | Project<br>BH  | Package<br>17 | Contractor<br>SM | Fac.<br>100 | Disc.<br>IN | Doc. Type<br>SP | Ser. No.<br>0054 | Rev.<br>D04 | Page 19 of 23   |

Sunshade shall be provided for detectors which exposed to direct sunlight.

#### 9.7. Toxic Gas Detectors (H2S)

H2S gas detectors shall be selected to give the fastest practical response with minimal cross sensitivity to other gases expected to be present.




Detectors shall detect and alarm the presence of H2S gas before it reaches to predetermined toxic level.

#### 9.8. Manual Call Points

Manual call points are required with the following main characteristics:

- Bodies with anti-static treatment.
- Contact shall be normally closed, Opening on alarm.
- The supply of all MCP equipment shall include end of line resistor for line monitoring.
- Automatic self-resetting type.
- Resettable push-button.
- Engraved stainless-steel tag number plate.
- Suitable for installation in a 2-wire loop with shield continuity plate
- Outdoor MCP shall be of heavy-duty type with bodies of stainless steel or aluminum.
- The minimum ingress protection for outdoor use shall be IP65 and for indoor use shall be IP42.
- The location shall afford high visibility and accessibility.
- Call points shall be furnished with two (2) sets of single pole double throw SPDT switches as inputs to the central Fire and Gas Detection and Monitoring Systems.
- Call points shall be suitable for surface or flush mounting as specified on the data sheets and provided with flap guards to avoid accidental operation.
- Fire call point enclosures shall be red colored.
- Manual call points shall be break glass type with indication LED.

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

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|---|--|---------------|------------------|-------------|-------------|-----------------|------------------|-------------|---|
| <br>NISOC | Development Plan of 28 Reservoirs<br>/ BIBI HAKIMEH Oilfield (EPC) |               |                  |             |             |                 |                  |             | <br> |
|   | Specification for Fire & Gas Sensor and Devices                    |               |                  |             |             |                 |                  |             |   |
| Contract No.:<br>053-073-9189   | Project<br>BH  | Package<br>17 | Contractor<br>SM | Fac.<br>100 | Disc.<br>IN | Doc. Type<br>SP | Ser. No.<br>0054 | Rev.<br>D04 | Page 20 of 23   |

### 9.9. Visual and Audible Alarm

Visual and audible alarms shall be prepared for different areas at field to warn the personnel against any fire and gas hazard.

Visual alarms shall be of the Xenon self-contained flashing beacon type, with 360 degrees of vision. The lens shall be manufactured from impact resistant polycarbonate or toughened glass.

Flash frequency shall be adjustable.

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.

Alarm sounders of open areas shall have minimum sound level 117 dBA at 1 meter. 120 dBA is the maximum allowed at a particular point.

Audible alarms shall be at least 5 dB higher than noise and ambient sound.

The minimum ingress protection for Alarm Sounders and Beacon Lights shall be IP 65.





Contact outputs additionally required to initiate audible/visual alarms in order to alert operators in specifically related areas.

## 10. INSPECTION AND TESTING

In addition to the quality assurance requirements referred to in this specification, the following may also be complied with:

- All detector shall be inspected and tested by the Vendor in accordance with relevant standards/ specifications as a minimum.
- All tests and corrective work shall be recorded to the Owner's approval.
- The Vendor shall ensure that all inspection and tests are completed and satisfactory.
- The Owner reserves the right to any additional inspection work if Vendor's preparations are found to be unsatisfactory.

Necessity for the inspection and tests as well as extent and details of the inspection and tests of the devices will be decided in the stage of vendor proposal evaluation. Vendor shall prepare and submit his Inspection Test Plan for buyer review and approval.

|   |  |               |                  |             |             |                 |                  |             |   |
|---|--|---------------|------------------|-------------|-------------|-----------------|------------------|-------------|---|
| <br>NISOC | Development Plan of 28 Reservoirs<br>/ BIBI HAKIMEH Oilfield (EPC) |               |                  |             |             |                 |                  |             | <br><br> |
|   | Specification for Fire & Gas Sensor and Devices                    |               |                  |             |             |                 |                  |             |   |
| Contract No.:<br>053-073-9189   | Project<br>BH  | Package<br>17 | Contractor<br>SM | Fac.<br>100 | Disc.<br>IN | Doc. Type<br>SP | Ser. No.<br>0054 | Rev.<br>D04 | Page 21 of 23   |

This specification is concerned with final inspection and testing of equipment prior to dispatch. Preliminary inspection will be performed as necessary and recorded separately.

Vendor shall not offer the equipment for testing until he has carried out his own shop tests to the latest approved drawings and documents and has ensured that the equipment is functioning satisfactorily and is complete in all respects. Certificates and completed test dossiers shall be available as evidence of this work.

The Vendor shall demonstrate that the equipment fully meets all requisition requirements in accordance with the requirements of this specification, related and referenced documents. Owner / Owner's inspector(s) may be present throughout the demonstration, and deviations from this specification may occur only with the Owner's agreement. Such deviations shall be recorded.

For the demonstration, Vendor shall provide:

- Two complete sets of the latest reviewed drawings, specifications and data sheets for the system(s), and operation / maintenance procedures,
- All necessary personnel with relevant equipment to perform the tests,
- A test plan, procedure and test record dossier for all tests to be carried out.

Faults discovered during inspection and testing shall be rectified as work proceeds and all previously tested circuits affected by the repair work shall be retested. Vendor shall mark up and retain one set of drawings and data sheet for the subsequent production of AS-BUILT information.

The equipment shall be tested as a fully assembled equipment.




Where an assembly or circuit is incomplete for any reason or where temporary wiring is installed, then the inspector's agreement must be obtained, and details shall be recorded.

A report and completed test dossier shall be produced by the inspector on completion of all inspection and testing, or at intervals as testing proceeds. A release certificate will be issued by the inspector when all testing has been completed to his satisfaction, and equipment may then be dispatched to site.

Owner's inspection shall include but not be limited to:

- Visual inspection
- Functional testing

  
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|---|--|---------------|------------------|-------------|-------------|-----------------|------------------|-------------|---|
| <br>NISOC | Development Plan of 28 Reservoirs<br>/ BIBI HAKIMEH Oilfield (EPC) |               |                  |             |             |                 |                  |             | <br> |
|   | Specification for Fire & Gas Sensor and Devices                    |               |                  |             |             |                 |                  |             |   |
| Contract No.:<br>053-073-9189   | Project<br>BH  | Package<br>17 | Contractor<br>SM | Fac.<br>100 | Disc.<br>IN | Doc. Type<br>SP | Ser. No.<br>0054 | Rev.<br>D04 | Page 22 of 23   |

Vendor shall formally submit an Owner's inspection and test procedure for the acceptance tests to Owner for review at last 4 weeks prior to presenting the system for test. The content of this procedure shall be discussed in detail with Owner prior to formal submission.

If a component failure occurs, all tests shall be repeated so that all components have undergone the minimum testing specified.

## 11. PREPARATION FOR SHIPMENT

The Vendor and any sub-Vendor shall comply with the preservation and packing specification and the marking.

Documentation and dispatch instructions shall be provided after satisfactory completion of all tests and inspections.

The Vendor shall take all precautions deemed necessary for protection during shipment and additionally during storage in a marine environment including the following:

- A desiccant shall be provided inside all enclosures to prevent damage by high humidity.
- The Vendor shall supply a recommended procedure for long term storage (up to 12 months) with the quotation.
- Equipment shall be suitably packed including any dismantling, transit fastening and bracing necessary to prevent distortion or damage during shipment.
- Each individual carton or box shall be marked with the instrument tag number on the top and side of the carton.

Vendor shall submit the packing specification and the Owner's prior approval.




No items of equipment shall be shipped without the Owner's prior approval.

## 12. VENDOR DOCUMENTATION

Vendor shall prepare and supply the following technical documentation as a minimum, but are not limited to:

- Bill of materials including quantity and manufacturer,
- Overall dimensional drawing of each equipment,

  
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 شماره ثبت: ۴۱۴۵۵۰

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|--|--|---------------|------------------|-------------|-------------|-----------------|------------------|-------------|---|
|  | Development Plan of 28 Reservoirs<br>/ BIBI HAKIMEH Oilfield (EPC) |               |                  |             |             |                 |                  |             | <br> |
|  | Specification for Fire & Gas Sensor and Devices                    |               |                  |             |             |                 |                  |             |   |
| Contract No.:<br>053-073-9189  | Project<br>BH  | Package<br>17 | Contractor<br>SM | Fac.<br>100 | Disc.<br>IN | Doc. Type<br>SP | Ser. No.<br>0054 | Rev.<br>D04 | Page 23 of 23   |

- Equipment fixing details to other items of equipment and wall,
- Documentation required from authorities to obtain export licenses to destination country,
- Reference manuals of all the items,
- User and maintenance manuals of configuration tools,
- Device configuration,
- Installation recommendation – documents to take into consideration local conditions,
- Operating and maintenance manuals,
- Susceptibility of RFI and EMI,
- Acceptance test procedures (FAT, SAT), if applicable,
- Spare Parts list (including parts for Commissioning/Start-up and two years operation and Consumables),
- Special tools list, if required,
- All relevant and necessary certification i.e. hazardous area/IS certificates,
- As-built drawings after commissioning,