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TECHNICAL SPECIFICATION

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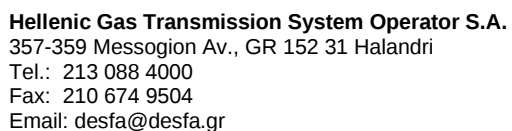
HIGH PRESSURE (HP) TRANSMISSION SYSTEMS

FIRE & GAS DETECTION SYSTEM

JUNE 2021

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1. INTRODUCTION

2. SCOPE AND OBJECTIVES

This Specification covers the minimum requirements for the design, manufacture, inspection, testing and supply of the Fire and Gas Detection Systems for the buildings of the stations and pipelines of the natural gas transmission system.

3. REFERENCES

3.1 Reference Documents

3.2 Reference Codes and Standards

EU DIRECTIVE 2014/34/EU (ATEX 114)	Equipment and Protective Systems intended for use in Potentially Explosive Atmospheres.
EU DIRECTIVE 99/92/EC (ATEX 153)	Minimum requirements for improving the safety and health protection of workers potentially at risk from explosive atmospheres.
EN54 EEUMA	Fire detection and fire detection and fire alarm systems. All parts. Process Plant Control Desks Utilizing Human-Computer Interfaces - A Guide to Design, Operational and Human Interface Issues
EN 60079 EN 60079-0	Electrical Apparatus for Potentially Explosive Atmospheres. Electrical Apparatus for Explosive Gas Atmospheres. General requirements (1983)
EN 60079-1	Electrical Apparatus for Explosive Gas Atmospheres Pt 1: Construction and Verification Test of Flameproof Enclosures of Electrical Apparatus
EN 60079-10	Explosive atmospheres – Part 10: Classification of hazardous areas



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EN 60079-11	Explosive atmospheres – Part 11: Equipment protection by intrinsic safety "i"
EN 60079-14	Electrical Apparatus for Explosive Gas Atmospheres. Electrical installations in hazardous areas.
EN 60079-15	Explosive atmospheres - Part 15: Construction, Test and marking of type of protection 'n'
EN 60079-25	Explosive atmospheres - Part 25: Intrinsically safe electrical systems
EN 60079-26	Explosive atmospheres - Part 26: Equipment with equipment protection level (EPL) Ga
EN 60529	Classification for degree of protection provided by enclosures. (IP rating)
EN 60617	Graphical symbols for diagrams
EN 61000	Electromagnetic compatibility
EN 61000-4-3	Electromagnetic Compatibility for Industrial Process Measurement and Control Equipment
EN 61000-6-2	Electromagnetic compatibility (EMC) - Part 6-2: Generic standards – Immunity for industrial environments
EN 61000-6-4	Electromagnetic compatibility (EMC) - Part 6: Generic standards - Section 4: Emission standard for industrial environments
EN 61508	Functional Safety of Electrical / Electronic / Programmable Electronic Safety-Related Systems
EN-61508-1	Functional Safety of Electrical/Electronic/Programmable Electronic Safety-Related Systems - Part 1: General Requirements
EN-61508-2	Functional Safety of Electrical/Electronic/Programmable Electronic Safety-Related Systems - Part 2: Requirements for Electrical/Electronic/Programmable Electronic Safety-Related Systems



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EN-61508-3	Functional Safety of Electrical/Electronic/Programmable Electronic Safety-Related Systems - Part 3: Software Requirements
EN-61508-4	Functional Safety of Electrical/Electronic/Programmable Electronic Safety-Related Systems - Part 4: Definitions and Abbreviations
EN-61508-5	Functional Safety of Electrical/Electronic/Programmable Electronic Safety-Related Systems - Part 5: Examples of Methods for the Determination of Safety Integrity Levels
EN 61511	Functional Safety of Safety Instrumented Systems for the Process Sector
EN 50575	Power, Control and Communication Cables - Cables for General Applications in Construction Works Subject to Reaction to Fire Requirements
EN 13501-6	Fire Classification of Construction Products and Building Elements - Part 6: Classification Using Data from Reaction to Fire Tests on Electric Cables
EN 50200	Method of Test for Resistance to Fire of Unprotected Small Cables for Use in Emergency Circuits
DIN 14675-1	Fire detection and fire alarm systems - Part 1: Design and operation
ISA-5.5-1985	Graphic Symbols for Process Displays
ISA-TR84.00.02	Safety Instrumented Functions (SIF) - Safety Integrity Level (SIL) Evaluation Techniques Part 1: Introduction
ISA-TR84.00.02	Safety Instrumented Functions (SIF) - Safety Integrity Level (SIL) Evaluation Techniques Part 3: Determining the SIL of a SIF via Fault Tree Analysis
ISA-TR84.00.02	Safety Instrumented Functions (SIF) - Safety Integrity Level (SIL) Evaluation Techniques Part 4: Determining the SIL of a SIF via Markov Analysis



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ISO 1000	SI Units and recommendation for use of their multiples and of certain other units
ISO 9001	Quality Assurance
NFPA 2001	Clean Agent Fire Extinguishing Systems
NFPA 72	National Fire Alarm code
EU DIRECTIVE	Pressure Equipment Directive
2014/68/EU	

4. ACRONYMS

ATEX	ATmosphere EXplosible
ESD	Emergency Shut Down
EMC	Electromagnetic Compatibility
GCC	Gas Control Centre
EN	European Norms
FAT	Factory Acceptance Test
F&G	Fire and Gas
IEC	International Electrotechnical Commission
IP	Ingress Protection
ISA	Instrument Society of America
ISO	International Standards Organization
MAC	Manual Alarm Call Points
M/R station	Metering and Regulating station
MTTR	Mean Time to Recovery
PLC	Programmable Logic Controller
PED	Pressure Equipment Directive
QA	Quality Assurance
RTU	Remote Terminal Unit
SCADA	Supervisory Control and Data Acquisition
SAT	Site Acceptance Test
SCS	Station Control System

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5. TECHNICAL REQUIREMENTS

5.1 General

The overall objective of the Fire and Gas Systems is to protect life, the asset and the environment of the above ground installation. A complete Fire Detection and Gas Detection Systems shall be provided and installed for buildings of the stations and pipelines of the natural gas transmission system.

The systems shall include, but not limited to: fire detection and gas detection control panels, fire detectors, gas detectors, break-glasses push buttons, sirens, conduits, wires and accessories need to complete fully operative systems.

All equipment shall have suitable protection enclosure, in accordance with the applicable zone classification.

The Eex equipment shall be according to ATEX directives and EN 60079.

The Fire & Gas Detection systems are required to address the risk associated with imminent or established fire and presence of flammable gas. Thus, the Fire and Gas systems shall provide:

- Detection and early warning of the outbreak of fire and / or presence of flammable gas.
- Provide alarm facilities to alert personnel and activate Fire Fighting Systems.
- Provide specific automatic response in selected high priority alarm situations.

Items to be supplied under this description shall comply with the requirements of the latest edition of the following Codes and Standards as applicable:

- The Gas and Fire detection systems shall comply with requirements of Greek and IEC standards for protected premises signalling systems except as modified and supplemented by this description. The systems shall be electrically supervised and shall monitor the integrity of all conductors.

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- The Gas and Fire detection systems shall meet all relevant local regulations and all components shall have valid Greek or EU certificates.

All system components shall fulfil the requirements of European norm EN-54.

- NFPA 72
- EN 54 Components of Automatic Fire Detection Systems
- IEC60529 Classification of degree of protection provided by enclosures

5.2 Equipment Rating and Classification

All detectors, enclosures and equipment intended for use in hazardous areas shall be selected in accordance with EN 60079-0, EN 60079-1, EN 60079-11, EU DIRECTIVE 2014/34/EU ATEX, suitable for installation and use in accordance with the area classification, gas group, temperature classification and protection concept.

In no circumstances shall equipment be installed to a lesser classification than that required by the area classification.

The preferred methods of protection, in order of precedence, are:

Zone 1

- | | | |
|----------|---|------------------------------|
| EEx 'ia' | - | Intrinsically safe (class A) |
| EEx 'e' | - | Increased safety |
| EEx 'd' | - | Flameproof |

Zone 2

As Zone 1 or

- | | | |
|--------|---|--------------------|
| EEx ic | - | Intrinsically safe |
|--------|---|--------------------|

All equipment to be installed in explosion-hazardous area shall be designed for operation in dangerous explosive mixtures IIB class of the T3 (200°C) mixture group.

Certification of IS loop and IS apparatus shall be mandatory. The certification shall be issued after proper testing by a specific for this purpose IS certification body.

5.2.1 Safety Instrumentation - SIL

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Detectors associated with safety systems shall satisfy the minimum SIL requirement according to EN 61508.

Detectors used in safety applications shall have a yellow/black/yellow Traffolyte label sized 150 x 50 mm with 12 mm high characters engraved on both sides stating 'SAFETY INSTRUMENT'.

5.2.2 Environmental Conditions

The Supplier shall provide temperature data for all equipment, identifying limits where there is degradation to the system operational performance.

All equipment supplied shall be robust and constructed for use in an industrial environment. The Supplier shall provide detailed data on environmental requirements of all items, including peripherals, as follows:

- Maximum and minimum operating temperatures
- Recommended operating temperature range for maximum reliability
- Humidity
- Dust (air filtration)
- Vibration
- Heat Generated

5.3 Material Requirements

Detector housing materials shall be the manufacturer's standard unless otherwise specified herein. No Aluminium in its un-anodised form shall be used. No copper or its alloys shall be used except in a plated or tinned condition.

5.3.1 Marking

Requirements for rating plates, name plates and equipment number plates shall conform to EN standards.

Equipment certified for use in hazardous areas shall be marked in accordance with the requirements of EN 60079 and ATEX Directive 2014/34/EU.

Tagging

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All items of equipment shall carry a stamped stainless-steel tag displaying the detector tag number.

Identification Plate

Each item of equipment shall be provided with a standard manufacturer's identification plate, with all data clearly and deeply stamped on a corrosion-resistant plate permanently attached by means of rivets or pins.

Equipment shall be permanently marked with the following information:

- Suppliers name
- Model, type and serial No
- Range
- Date of manufacture
- Hazardous Area Protection Classification

5.3.2 CE Marking

All equipment, associated parts and interconnections shall be new, fit for purpose and shall be suitable for the specified service and environmental conditions. The equipment shall be provided with the "CE" marking suitable for proving the compliance with the electromagnetic compatibility requirements according to the EU DIRECTIVE 2014/30/EU.

5.3.3 Ingress Protection

Unless otherwise specified, the minimum level of equipment ingress protection shall be IP 44 (inside buildings) and IP 65 (outdoors) in accordance with EN 60529 'Classification for degrees of protection provided by enclosures' (IP rating).

6. BASIC DATA AND DESIGN CONSIDERATIONS

The Main Fire Alarm control Panel (FAP) shall be of addressable or conventional type, while the Local Fire Detection & Fire Protection panels (LFEP) shall be of conventional type.

All the aforementioned dedicated Local Fire Detection & Fire Protection panels shall be connected to Main Fire Alarm control Panel (FAP) via the loop cable and dedicated Zone Input /

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Output Modules, which enable the transmission of commands and indication signals between the interconnected equipment.

The Fire Detection System will be designed in accordance with the National Fire Protection Association (NFPA) codes, relevant International Standards and Greek legislation.

The Fire Alarm System shall consist of the following items:

- Main Fire Alarm Control Panel (FAP)
- Local Fire Detection and Fighting Control Panels (LFEP)
- Photoelectric Smoke Detectors
- Multi-sensor Detectors (Photoelectric & Heat with polyparametric settings)
- Manual Fire Alarm Buttons (Manual Break Glass Buttons) – red colour
- Fire Alarm Sirens with red flash light for indoor rooms with low noise
- Fire Alarm Sirens with red flash light for outdoor areas
- Firefighting Devices, including:
 - Manual Break Glass Actuating Buttons – yellow colour
 - Manual Break Glass Deactivating Buttons – blue colour
 - Predischarge Alarm sounder with beacon
 - Illuminated Flashing Sign indicating Fire Fighting System Activation
 - Alarm Siren activated, when the Gas Extinguishing Discharge is being carried out inside this room.
 - Actuating Device, including solenoid for the initiation of the discharge process. This is part of the Fire Fighting System, but receives a command signal for actuation from LFEP or can be operated manually.
 - Pressure Switches of the manifold, cylinders and pilot cylinder (if any). These are parts of the Fire Fighting System, but send verification signals to LFEP.

The Gas Detection System shall consist of the following items:

- Gas Detectors for natural gas, THT and for Hydrogen.
- Gas leakage annunciation devices (sirens with yellow flash indicator and individual yellow flash lights).

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The Gas Detectors and the relevant Annunciation Devices shall be connected to the PLC cabinet.

If the explosion proof items of Fire Detection System and of Gas Detection System are of intrinsically safe type (EExi), dedicated intrinsically safe line barriers shall be used for their connection. The line barriers shall be always installed in safe areas and intrinsically safe cables shall be used to connect the relevant EExi equipment to the line barriers.

The above-mentioned equipment of the system shall be offered completed with any other component and/or accessory requested for the successful operation of the system, also if not specifically mentioned in this specification.

Each Local Fire Alarm and Fighting Control Panel (LFEP) shall be equipped with I/O modules in order to exchange hardwired interconnection signals with other devices (i.e. LV Switchboards for damper operation, air fans shut-down, HVAC units shut-down, etc, in case of gas extinguishant discharge initiation). Control modules and monitor modules will activate the corresponding local audible and visual signals together with shut down the HVAC system. The HVAC system shall be shut down before the firefighting system is energized.

The minimum required aforementioned interconnection signals in case of an alarm are the following:

- Signal for dampers operation in the room, where the discharge process is being initiated.
- Signal for HVAC units shut-down, which serve the room, where the discharge process is being initiated.
- Signal for air fans shut-down, which serve the room, where the discharge process is being initiated.

7. FIRE ALARM DETECTION SYSTEM

The Main Fire Alarm Control Panel shall be installed in the building of Station and shall be connected to the SCADA system through the local PLC(s) / RTU to retransmit all data (i.e. alarms, malfunctions, healthy operation etc.), necessary to monitor the system operation. The communication protocol shall be identical to the existing one, in Owner premises.

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The Main Fire Alarm control Panel (FAP) shall be of addressable or conventional type, while the Local Fire Detection & Fire Protection panels (LFEP) shall be of conventional type.

The control building shall be equipped with one Local Fire Alarm and Fighting Control Panels dedicated for the fire detection and firefighting of the respective area. All the above-mentioned panels shall be connected to Main Fire Alarm Control Panel and dedicated Zone Input / Output Modules, which enable the transmission of commands and indication signals between the interconnected equipment.

The control building shall be protected by a firefighting system using extinguishing gas.

The Main Fire Alarm Control Panel (FAP) and all the Local Fire Detection & Fire Fighting Panels (LFEP) shall have 230V AC, 50Hz power supply from UPS distribution board (or sub-distribution boards) and shall have rechargeable Ni-Cd or sealed lead acid battery (installed inside the relevant panel), 24VDC backup for 12-hour autonomy (in quiescence) plus 30 minutes' autonomy (in alarm status), in case of main power loss. Any malfunction of the battery pack or the charger will be displayed at the control panel.

The Main Fire Alarm Control Panel shall be divided into zones for fire alarm buttons, for detectors, for sirens and for firefighting and alarm panels.

The Main Fire Alarm Control Panel will support the following functions:

- Visual and sound alarm devices (sirens for indoor low noise rooms shall be loop powered with 24 VDC, while sirens for outdoor or noisy areas shall have a separate power supply 230 VAC from UPS).
- Manual break glass buttons red colour (if EExi, then via dedicated intrinsically safe line barriers).
- Fire detectors of the rooms, where no firefighting system is foreseen (if EExi, then via dedicated intrinsically safe line barriers).
- Zone indication and identification of the detector(s) at the display unit.
- Indications of fault in case of detector malfunction.
- Monitoring of the fire protection system cabling for faults (e.g., missing detector, broken wire, short circuit, etc.) with separate visual indication of system status.
- Ability to test the detection system.
- Receiving and recording of fire alarms from all areas with automatic and manual operated (push button) detectors.

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- Local fire detection and firefighting panels (LFEP) via dedicated zone input / output module. Where required these panels (IS-LFEP) shall include intrinsically safe line barriers for EExi devices.

The local fire detection and firefighting panels (LFEP & IS-LFEP) are of conventional type and are connected with the following conventional devices:

- fire detectors of the rooms, where firefighting system is foreseen (if EExi, then via dedicated intrinsically safe line barriers).
- manual break glass actuation buttons yellow colour (if EExi, then via dedicated intrinsically safe line barriers).
- manual break glass deactivation buttons blue colour (if EExi, then via dedicated intrinsically safe line barriers).
- Visual and sound alarm devices.
- Actuating devices (including solenoid) of the firefighting systems.
- Pressure switches of the firefighting systems.

Inside each room protected by LFEP at least two (2) fire detection zones shall be installed.

Fire detectors shall be chosen on the basis of the most rapid and reliable detection suitable for the type and location of fire. Accordingly, the fire detectors must be of high integrity and should wherever necessary be voted 1ooN for alarm signalling actions and 2ooN for firefighting system activation and shutdown actions to prevent spurious operation.

Detection in two zones (second stage alarm) shall be required in order to initiate an executive action; detection in one zone (first stage alarm) shall alarm only.

The aforementioned zones and interconnection signals shall be finalized during the detail engineering design phase.

In locating the fire detectors, environmental factors shall be taken into account (sunrise, sunset, dust, humidity, vibrations and alignment).

The FAP shall be certified as meeting the requirements of EN54-2 and EN54-4 by a suitable, notified body. A certificate and test report shall be made available for inspection as evidence of certification.



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7.1 Main Fire Alarm Control Panel (FAP)

- Mains Voltage 230 V - AC
- Mains Frequency 50 Hz
- Power Consumption (1)
- Nominal Operating Voltage 24 V DC (1)
- Power Supply module incorporating relevant battery charger
 230V AC / 24V DC (1)
- Rechargeable Ni-Cd or Sealed Lead Acid Battery
 Set for 30 minutes autonomy
 (system energized) AH (1)
 Set for 12 hours autonomy
 (system de-energized) AH (1)
- Lamp annunciators Equipped with descriptive labels to identify the various
 detection zones. (1)
- Cabinet Structure Suitable frame to hold the necessary racks.
- Modules Structure Rack in mounted modular units. (1)
- Input - Output Wiring Connection In Pre-Wired terminal Board (1)
- Hardwired Input / Output modules for
 interconnection with the ESD cabinetREQUIRED
- ETHERNET port for interconnection with the Station Control System LAN
 (1 Gbps) REQUIRED
- Cabinet Installation Wall Mounted * - Floor Installation * (1)
- Enclosure Protection IP 31 (1)
- Dimensions in mm (W x H x D) (1)
- Applied Standards EN 54, DIN 14675-1



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Note 1: To be specified by the bidders

7.2 Local Fire Detection and Extinguishing Control Panels (LFEP & IS_LFEP)

- Mains Voltage 230 V - AC
- Mains Frequency 50 Hz
- Power Consumption (1)
- Nominal Operating Voltage 24 V DC (1)
- Power Supply module incorporating relevant battery charger 230V AC / 24V DC (1)
- Rechargeable Ni-Cd or Sealed Lead Acid Battery
- Set for 10 minutes autonomy
- (system energized) AH (1)
- Set for 12 hours autonomy
- (system de-energized) AH (1)
- Lamp annunciators Equipped with descriptive labels to identify the various detection zones. (1)
- Cabinet Structure Suitable frame to hold the necessary racks.
- Modules Structure Rack in mounted modular units. (1)
- Input -Output Wiring Connection In Pre-Wired terminal Board (1)
- Hardwired Input / Output modules for interconnection with the ESD cabinet REQUIRED
- ETHERNET port for interconnection with the Station Control System LAN (1 Gbps) REQUIRED
- Cabinet Installation Wall Mounted * Floor Installation * (1)
- Enclosure Protection IP 31 (1)
- Dimensions in mm (W x H x D) (1)
- Applied Standards EN 54, DIN 14675-1

Note 1: To be specified by the bidders

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7.3 Fire Detectors

All fire detectors provided shall be intelligent and conventional and shall form zones according to the design of the buildings, suitable for use in a hazardous area and in accordance with its classification study. The appropriate number and location of fire detectors for each area shall comply with reference Standards. The spacing of the fire detectors shall be in accordance with the Supplier's recommendation for the particular model of detector used.

Detectors circuits shall be protected from electrical transient phenomena or electro-magnetic interference. Detectors shall be two-wire, with nominal operating voltage of 24 VDC. Minimum certification for Hazardous Areas shall be EEx IIB T3.

The following detector types shall be used:

7.3.1 Smoke Detectors

Point photo optical type smoke detectors shall be used in all applications requiring smoke detection.

In the most common type of photoelectric detector, light is scattered by smoke particles onto a photocell, initiating an alarm. In this type of detector there is a T-shaped chamber with a light-emitting diode (LED) that shoots a beam of light across the horizontal bar of the T. A photocell, positioned at the bottom of the vertical base of the T, generates a current when it is exposed to light. When smoke is present, the light is scattered by smoke particles, and some of the light is directed down the vertical part of the T to strike the photocell. When sufficient light hits the cell, the current triggers the alarm.

Detectors shall be two-wire, with nominal operating voltage of 24 VDC.

- Material of enclosure: Metallic or plastic die-cast case.
- Enclosure protection: IP 67 / Explosion proof (in Hazardous Areas).

IP 44 min (in Safe Areas).

- Protected area per detector: min 60 m².
- Alarm indicator in the base: LED.
- Colour: white.

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- Applied Standard: DIN EN54.

7.3.2 Multi-sensor Fire Detectors

Multi-Sensor Fire Detector is the combination of optical and heat technology which allows detection of clear burning fire products which hitherto could only be easily detected by ion-chamber detectors. For normal ambient conditions, the Multi-Sensor Fire Detector behaves as a normal detector. Only when a rapid rise in temperature is detected, does the sensitivity of the detector increase and the presence of smoke will confirm a fire condition which shall be transmitted as an alarm level. These detectors shall be used together with photoelectric detectors in control building and in metallic cabinet / skid.

Minimum certification for Hazardous Areas shall be EEx IIB T3.

Detectors shall be two-wire, with nominal operating voltage of 24 VDC.

- Material of enclosure: Metallic or plastic die-cast case.
- Enclosure protection: IP 67 / Explosion proof (in Hazardous Areas).
IP 44 min (in Safe Areas).
- Protected area per detector: min 50 m².
- Alarm indicator in the base: LED.
- Colour: white.
- Applied Standard: DIN EN54.

7.3.3 Rate of Rise Temperature Detectors

Rate of Rise Temperature Detectors shall respond to a specific rate of rise of temperature. Their operation shall not be influenced by dust, dirt or humidity. False alarms shall be prevented. Design of detectors shall facilitate cleaning and maintenance. Rate of Rise Temperature Detectors circuits shall be protected from electrical transient phenomena or electro-magnetic interference. Detectors shall be two-wire, with nominal operating voltage of 24 VDC. Their enclosure may be moulded plastic or painted stainless steel.

Detector heads shall be supplied with diode bases which enable connection to the Fire Alarm Control Panel. The mounting base of the detection device shall be equipped with a LED alarm indicator. The LED shall illuminate when the detector operates to the alarm



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condition and shall remain illuminated until the alarm condition has been reset at the Fire Alarm Control Panel.

Detectors should fulfil and be approved to EN54-5 and 17.

In addition, the detectors shall include communication of 3 different danger levels for differentiated alarm activation.

Electrical Termination shall be suitable for wire sizes up to 2.5 mm².

- Enclosure protection: IP 67 / Explosion proof (in Hazardous Areas).

IP 44 min (in Safe Areas).

- Protected area per detector: min 60 m².

- Alarm indicator in the base: LED.

- Colour: white.

- Applied Standard: DIN EN54.

7.4 Break-Glass Push Buttons and Sirens

7.4.1 Manual Fire Alarm Buttons

Manual alarm break-glass push buttons shall be provided in building and the metallic cabinet / skid along escape routes and mainly outside escape door.

Break-glass push buttons shall be connected to the corresponding detection zone and monitored by the main fire detection control panel. They shall consist of their base plates, inserts and covers. Replacement of glass must be easy.

Manual fire alarm buttons shall be two-wire type. Their nominal operating voltage shall be 24 V DC.

Minimum certification for Hazardous Areas shall be EEx IIB T3.

- Function type: break glass.
- Material of Enclosure: Cast-iron or die-cast-case.
- Enclosure Protection: IP 65 / Explosion proof (in Hazardous Areas).

IP 65 (in Safe Areas).

- Voltage rating: 24 V DC.

- Colour of fire alarm box : RED for Manual fire alarm buttons.

YELLOW for Manual Fire Fighting Actuating Buttons.



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BLUE for Manual Fire Fighting Deactivation Buttons.

- Installation: outdoor.
- Applied Standards: EN 54-11, DIN 14654.

In case of activation of a break-glass push button located in the vicinity of a room (fire compartment) a signal is transmitted so that ventilation (if any) of the room is shut-down and air intake and exhaust dampers are closed.

7.4.2 Fire Alarm Sirens

Fire Alarm Sirens with flash shall be provided and installed, for fire detection purposes and its sound shall be different of any other sirens installed in the area for other purposes.

Fire Alarm Sirens shall be suitable for external mounting. Sound level at a distance of 1m shall be 100dB.

Alarm sirens shall be two-wire, with red flash light. Their nominal operation shall be 24 VDC.

Minimum certification for Hazardous Areas shall be EEx IIB T3.

7.4.3 Lighting Flashing Labels (STOP)

Minimum certification shall be EEx IIB T3.

- Enclosure Protection: IP 65 / Explosion proof (in Hazardous Areas).
IP 65 (in Safe Areas).
- Operation voltage D.C.: 12-24V.
- Current Consumption (mA): 70.
- Installation: outdoor.
- Indication: 4 led.
- Stop Label: Included.

7.4.4 Fire Alarm Bells for Acoustic Pre-Alarm Indication

Minimum certification shall be EEx IIB T3.

- Enclosure Protection: IP 65 / Explosion proof (in Hazardous Areas).
IP 44 (in Safe Areas).

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- Operation voltage D.C.: 24V.
- Colour: Red.
- Installation: Indoor.
- Temperature Range: -12 to +50 °C.
- Mounting Base: available to mount both the Beacon and the Sounder provided.
- Sound Output 90-95 dB.

8. GAS DETECTION SYSTEM

Gas detectors are going to be installed in the Control building and in the shelter / skid. In principle, their function is to activate audible and visual alarms.

The final number and positioning of the detectors will be of Contractor's responsibility and will be decided during the detail-engineering phase and according to the building and cabinet and process layouts. Natural air ventilation currents inside the rooms must also be considered.

As a minimum the following rules will apply:

- One (1) gas detector per 25 m², plus one additional detector per room.
- No less than two (2) gas detectors to be installed in the same room.
- Detectors will be installed only in indoor areas.

Warning flashing lights and audible alarms will be installed in the Control building and in the metallic cabinet. External warning flashing lights will be installed at each external side of the Control building and Metering cabinet.

The functionality of the gas detection system, which also includes the operation of the warning lights, audible alarms, will be managed by a suitable control unit that it is going to be installed in the stations control room. This control unit will be interfaced to PLC system, to facilitate the transfer of the associated alarm & malfunction signals to a remote main control centre of the Natural Gas Transmission System (NGTS), via an existing SCADA system.

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8.1 Gas Detection Control Panel

The Gas Detection System shall be complete including, but not limited to, the Central Gas Control Panel, installed in the Control building, automatic intelligent addressable and analogue gas detectors with indication lamp and individual identification.

When a gas alarm condition is detected and reported by one of the systems initiating devices or appliances, the following functions shall immediately indicate alarm by light and sound signals and indicate the location of the gas leakage at the main panel at the Control building. Control Panel shall have 230V, 50Hz power supply from UPS distribution panel and shall have rechargeable Ni-Cd or sealed lead acid battery (installed inside the relevant panel), 24VDC backup for 12-hour autonomy (in quiescence) plus 30 minutes' autonomy (in alarm status), in case of main power loss. Any malfunction of the battery pack or the charger will be displayed at the control panel. Panel shall be microprocessor based and addressable.

The central unit shall be provided with potential free contact to convey Gas alarm information to the Station redundant RTU/SCADA, connected to a station redundant PLC system, via an Ethernet link (Modbus TCP), to facilitate the transfer of data.

Additional alarm relays with potential-free SPDT contacts and necessary terminals are required.

The Gas Control Panel shall be divided into zones for gas detectors, for sirens and for yellow warning flashing lights. The panel shall include lamps for fault, high alarm and high-high alarm, set-point controls for high alarm and high-high alarm, calibration facilities, test alarm and reset facilities.

All gas detection devices shall be of conventional type and shall be connected to the PLC Cabinet. In particular, the following devices shall be used:

- Natural gas detectors inside Control building and metallic cabinet / skid (if EExi, then via dedicated intrinsically safe line barriers).
- Hydrogen detectors inside Control building (if EExi, then via dedicated intrinsically safe line barriers).
- THT detectors inside the odorized room (EExi, then via dedicated intrinsically safe line barriers).

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- Visual and sound alarm devices (yellow color for visual alarm devices) outside and inside the Control building and the metallic cabinet (If EExi, then via dedicated intrinsically safe line barriers).
- Yellow flash lights at all the external walls of Control building and metallic cabinet / skid.

Not less than two (2) gas detectors shall be installed in the same room.

8.2 Gas Detectors

The Gas Detectors shall be of “Catalytic combustion principle” type, with two elements (one sensing and one as reference) suitable for detecting Natural Gas below Lower Explosive Level (LEL).

Detectors shall be fitted with a collection cone to allow sensing at very low % LEL.

Detectors shall be 2-wire (4-20 mA loop powered) and shall be certified by a recognized authority (e.g. BASEEFA or CENELEC) as a minimum to EEX IIB T3.

Detectors shall be design to minimize errors due to the presence of traces of other gases as H₂O or SO₂.

Detectors input shall be 24V DC and output signal shall be 4-20mA.

The detector alarm setting for the LEL shall be:

- 10-25% LEL for Low Level Alarm
- Above 25% LEL for High Level Alarm

The technical characteristics of the Gas Detectors are presented below:

- Sensor Type: Catalytic Combustible.
- Response time <10s @50% LEL.
- Zero Drift <5% span/year.
- Repeatability +/- 5% full scale.
- Life Span >3 years.
- Transmitter Type: Microproc.
- Power Supply: 24 VDC.
- Shall be providing with free alarm contact.



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- Housing Type: Intrinsically safe or EEx"d" or EEx"e".
- For Area Classification Cl. 1, Div. 2
- Measurement Range: 0-100% LEL.
- Gas Components: Natural Gas, THT and Hydrogen
- Shall be provided with calibration kit

Hydrogen sensor shall include a catalyst whose conductivity changes in the presence of low levels of hydrogen. H2 Detectors shall be provided within the control building (H2 Detection shall activate ventilation).

8.2.1 Gas Alarm Sirens

Gas Alarm Sirens shall be suitable for external mounting. Sound level at a distance of 1m shall be 100dB.

Alarm sirens shall be two-wire. Their nominal operation shall be 24 VDC.

Minimum certification shall be EEx IIB T3.

- Enclosure protection: IP 67 / Explosion proof (in Hazardous Areas).
IP 44 min (in Safe Areas).
- Installation: Outdoor and indoor.

8.2.2 Flash for Gas Alarm Sirens

Minimum certification shall be EEx IIB T3.

- Type: (Xenon).
- Enclosure Protection: IP 65 / Explosion proof (in Hazardous Areas).
IP 65 (in Outdoor / indoor Safe Areas).
- Operation voltage D.C.: 24V.
- Installation: Outdoor and indoor.
- Flash Rate: 60/min.
- Temperature Range: -30 to +70 °C.
- Mounting Base available to mount both the Flash and the Sounder provided.

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8.2.3 Yellow Gas Warning Flashing Light

Minimum certification shall be EEx IIB T3.

- Enclosure Protection: IP 65 / Explosion proof (in Hazardous Areas).

IP 65 (in Outdoor Safe Areas).

- Operation voltage D.C.: 24V.
- Installation: Outdoor.
- Flash Rate: 60/min.
- Temperature Range: -30 to +70 °C.
- Colour: Yellow.

9. CABLES FOR FIRE & GAS DETECTION AND FIRE FIGHTING SYSTEMS

All power cables and all control & communication signal cables used for Fire Detection, Fire Fighting and Gas Detection Systems (including those, which supply all the relevant control panels from UPS) shall be in accordance with the following requirements:

- EN 54-14 specifies the minimum requirements for these cables, as follows: “cables which may need to function for more than 1 minute after detection of a fire should either be able to withstand the effects of fire and firefighting for at least 30 min or be given suitable protection able to withstand the effects for that period.”
- For this project, all aforementioned power & control cables shall be fire resistant for at least 30 min, according to EN 50200 or IEC 60331.
- The fire behaviour of all aforementioned power & control cables shall comply with standard EN 13501-6 concerning the flame propagation & calorific value, smoke production, flame droplets & debris, acidity & conductivity. The new Greek “Fire Protection Regulation for Buildings” shall also be taken into consideration. All cables shall have the required Declaration of Performance (DoP) by the Manufacturer.
- All cables shall carry the required labelling (including CE marking and the CPR Classification), according to EN 50575.

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10. INSPECTION AND TESTING

10.1 General Requirements

All equipment shall be subject to inspection at the Supplier's works by the Client.

The Supplier is to confirm in their quotation that their workshops contain all facilities required to perform all necessary factory tests. The cost of rectification and repair of defects discovered during inspection shall be at the Supplier's expense.

10.2 Test & Certificates

The Supplier shall submit to the Client a system performance testing procedure, to be approved by the Client, which shall include requirements specified by the Client, in addition to the Supplier's requirements.

Inspection and Test performed by Supplier's at works shall be in accordance with Inspection / Test plan approved by the Client.

However, the responsibility for inspection testing rests with the Supplier; the Client reserves the right for stage inspection of material, manufacturing process, testing etc. Such inspection does not relieve the Contractor / Supplier of the responsibility of suitable design and workmanship.

Test data shall be provided to the Client. Certification of tests must be submitted to the Client prior to shipment of the equipment.

11. DOCUMENTATION

11.1 Extent of Documentation

The system design and implementation shall be documented to cover all detailed engineering, procurement, supply, installation and testing of all Metering components referred to in this specification.

All correspondence, drawings, instructions, data sheets, design calculations or any other written information shall be in the English language. In case of dual language, English shall be one of the languages.

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11.2 Acceptance Test Procedures

The Acceptance Test Procedures shall be developed by the Supplier to enable the demonstration and validation of all elements of the supply.

Following installation and commissioning of the delivered system, a Site Acceptance Test (SAT) shall take place. The emphasis of the SAT shall be to validate the performance of the system in an operating environment, including Station Control System based operations.

11.3 User Documentation

The following User documentation shall be produced by the Supplier during the course of this contract. User documentation is to be supplied in electronic and hard copy form.

- Systems Manual. This manual provides information on all elements of the system and details procedures for operations such as system back-up.
- User Manual. This manual provides detailed instructions on the operation of the system.
- Configuration Manual. This manual contains comprehensive details on the configuration of the system.
- Maintenance Manual. This manual provides details of any maintenance that can be undertaken by Client personnel.
- As built Drawings and Documentation including Functional Design Specification, System Block Diagram, P&IDs, Installation and Commissioning Procedures, Bill of Materials.