

GENERAL SPECIFICATION

INSTRUMENTATION

GS EP INS 143

Fire and Gas Detectors and Associated Detection Systems
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Contents

1. Scope	4
2. Reference Documents	4
3. Terminology and Definitions	5
3.1 Abbreviations	6
4. General Principles	6
4.1 Hazardous Area Protection	6
4.2 Safety Integrity Level	7
4.3 Environmental Conditions	7
4.4 Ingress Protection	7
4.4 Detector Standardisation	8
4.5 Earthing	8
4.6 Electro Magnetic Interference Protection	8
4.7 Specific Requirements for Marine Classification	8
5. Conventional Fire and Gas Detectors Design	8
5.1 General Characteristics	8
5.2 Fire Detectors	8
5.3 Gas Detectors	12
6. Miscellaneous Detectors and Initiation Devices	17
6.1 Low Temperature Detection (Spill Detection)	17
6.2 Manual Alarm Call Points	17
6.3 ESD and Deluge Hand Switches	17
7. Specific Detection Systems	18
7.1 Image Based Flame Detectors (CCTV)	18
7.2 Early Warning Smoke Detection System	19
7.3 Addressable Fire and Gas Detection System	19
8. Identification, Tagging and Labelling	23
9. Inspection and Testing	23
9.1 Design Validation Tests	23

General Specification		GS EP INS 143
Fire and Gas Detectors and Associated Detection Systems		
Rev.: 00	Effective date: 09/2015	Page: 3 of 27

9.2	Factory Acceptance Tests.....	24
9.3	Test Report and Certificate	24
10.	Packing, Storage and Transportation.....	24
10.1	Instrument Preservation	25
11.	Documentation	25
	Bibliography.....	26

1. Scope

This specification defines the minimum requirements for the design, selection, engineering and installation of the Fire and Gas Detectors and associated detection systems for onshore and offshore oil and gas installations.

This specification shall be applied in conjunction with **GS EP SAF 312**, which defines the fire and gas detection philosophy including limit of application.

Fire and Gas System is defined within **GS EP INS 134**.

2. Reference Documents

The equipment shall satisfy the requirements and regulations of the country of installation and specific standards referred to in this specification.

Where national regulations exist, their provisions and those of the standards and codes to which they refer shall apply, supplementing or amending the provisions of this document.

The reference documents listed below form an integral part of this General Specification.

External Documents

Unless otherwise stipulated, the applicable version of these documents, including relevant appendices and supplements, is the latest revision published at the effective date of this document.

Reference	Title
Directive 94/9/EC	European Directive 94/9/EC (23/03/94) on the approximation of the laws of the Member State concerning equipment and protective systems intended for use in potentially explosive atmosphere
EN 54-10	Fire detection and fire alarm systems - Part 10: Flame detectors; Point detectors
IEC 60079 (Parts 14; 29-1)	Explosive atmospheres - Parts 14; 29-1
IEC 60529	Degrees of protection provided by enclosures (IP code).
IEC 61000-5	Electromagnetic compatibility (EMC) - Part 5: Installation and mitigation guidelines
IECEX	International electrotechnical commission system for certification to standards relating to equipment for use in explosive atmospheres (IECEX system)
NFPA 72	National Fire Alarm and Signalling Code

Total General Specifications

Unless otherwise stipulated, the applicable version of these documents, including relevant appendices and supplements, is the latest revision published in the applicable yearly collection.

Reference	Title
GS EP ELE 079	Electrical apparatus for potentially explosive gas atmospheres
GS EP INS 101	Instrumentation Design
GS EP INS 102	Instrumentation Identification
GS EP INS 106	Instrument Installation
GS EP INS 109	Instrument cabinets
GS EP INS 110	Instrumentation for package units
GS EP INS 115	Instrument Earthing
GS EP INS 116	Instrument Cables
GS EP INS 134	Design and supply of integrated control and safety system
GS EP SAF 050	Fire and Gas System and Fire Suppression System for Packaged Rotating Machinery Enclosures
GS EP SAF 222	Safety rules for turbines, Diesel engines, gas engines and process units in sheltered or enclosed areas
GS EP SAF 312	Fire and Gas detection systems

3. Terminology and Definitions

There are five types of statements in this specification, the “shall”, “should”, “may”, “can” and “must” statements. They are to be understood as follows:

Shall	Is to be understood as mandatory. Deviating from a “shall” statement requires derogation approved by Company.
Should	Is to be understood as strongly recommended to comply with the requirements of the specification. Alternatives shall provide a similar level of protection and this shall be documented.
May	Is to be understood as permission.
Can	Is to be understood as a physical possibility.
Must	Expresses a regulatory obligation.
Company	TOTAL E&P or any TOTAL E&P subsidiary.
Contractor	Any Company TOTAL E&P has signed a Contract with for the Engineering, Procurement, Construction, and Installation of a part of a project.
Vendor	The Package Vendor sub-contracted by the Contractor or by Company.

Fire and Gas Detectors and Associated Detection Systems

Rev.: 00

Effective date: 09/2015

Page: 6 of 27

Supplier The Party that manufactures or supplies equipment, either individually or as a Packaged unit for the project.

Package Prefabricated process or utility self-contained unit, generally able to operate on its own, supplied fully tested and ready for immediate installation.

3.1 Abbreviations

CCR	Central Control Room
ESD	Emergency Shut Down system
EPC	Engineering Procurement Construction
FAT	Factory Acceptance Test
FGS	Fire and Gas System
ICSS	Integrated Control and Safety System
MAC	Manual Alarm Call Point
MIR	Multi-frequency Infrared Flame Detector
RTD	Resistance Temperature Detector
SPL	Sound Pressure Level
UCP	Unit Control Panel

4. General Principles

Fire and Gas Detectors shall comply with the requirements defined in **GS EP INS 101** and shall be installed as defined in **GS EP INS 106**.

The vendor shall provide all the necessary accessories for proper mounting, protection, alignment and calibration of the detectors.

Physical or chemical filters before the sensors shall only be accepted if the sensors' sensitivity and detection speed are not altered.

4.1 Hazardous Area Protection

All equipment must comply with the requirements of the specific hazardous area where they are installed. Refer to **GS EP ELE 079** for detailed requirements about hazardous area definitions and protection methods.

Detectors and associated detection systems shall comply with the requirements of **GS EP INS 101**.

ATEX European **Directive 94/9/EC** shall strictly apply in European Countries and associated countries (e.g. Norway, Iceland).

ATEX European **Directive 94/9/EC** or **IECEx** standards shall apply in other countries.

All detectors located indoors or outdoors shall be certified for installation in Zone 1. However, detectors (MAC, Heat and smoke) located fully within accommodation spaces need not be certified zone 1 and shall follow project requirements.

General Specification		GS EP INS 143
Fire and Gas Detectors and Associated Detection Systems		
Rev.: 00	Effective date: 09/2015	Page: 7 of 27

Detectors in battery room, or otherwise subject to risk of hydrogen gas, shall be certified for Zone 1, Gas Group IIC, Temperature Class T3.

Detectors shall follow the selected project protection method.

All detectors shall be installed in accordance with [IEC 60079-14](#) regulations. An IS loop calculation sheet shall be submitted for each installed IS detector.

Certified equipment shall be stamped on a permanent plate with its ATEX/[IECEX](#) marking according to the protection and the relating code and shall be delivered with a conformity certificate issued by a Notified Body. It shall not be assumed that the packaging of individually certified components makes a certified unit. A third party certification must be provided by a Notified Body.

All work associated with hazardous area equipment shall be carried out by a competent person as per [IEC 60079-14](#).

Any modification to hazardous area equipment shall be fully in compliance with the IEC requirements and the equipment certification

4.2 Safety Integrity Level

Fire and gas detectors, as they are part of a Safety Instrumented Function, shall be certified suitable for SIL 2 applications.

Detection systems will also require to be certified suitable for SIL 2 applications. Specific requirements defined in the certification and Safety manual shall be followed.

It is noted that certain detectors e.g. conventional smoke and heat, are not individually product SIL certified. Project shall therefore ensure suitability of such equipment to meet their required function.

4.3 Environmental Conditions

The equipment shall be suitably designed for permanent indoor and outdoor operation under the prevailing environmental conditions of the installation location or as specified by project particular design conditions.

It should be noted that the environmental conditions at the fabrication yard may be different to those of the final site location. Therefore, the fabrication yard storage and installation conditions shall also be taken into account.

4.4 Ingress Protection

"Degree of protection" of detectors shall be in accordance with ([IEC 60529](#)).

The minimum degree of protection for detectors or associated equipment:

- Indoors within technical buildings (excluding analyser shelters and battery rooms): IP 21
- Indoors with water mist: IP 54
- Outdoors including analyser shelters or battery rooms: IP 65 or IP 66 if subject to marine classification.

4.4 Detector Standardisation

Detector standardisation requirements shall be addressed during Basic Engineering and shall take into consideration the project contractual strategy (i.e. different EPC Contractors).

Detector standardisation will be considered for the whole plant, including packaged units, i.e. same technology, supplier and model for the same use.

Detectors and associated systems shall only be from approved vendors.

4.5 Earthing

Instrument earthing shall comply with [GS EP INS 115](#).

4.6 Electro Magnetic Interference Protection

All detectors and associated system shall meet emission and Radio Frequency Immunity (RFI) requirements as per [IEC 61000-5](#). As a minimum type-test certificates shall be provided.

4.7 Specific Requirements for Marine Classification

For floaters (FSO, FPSO, FPU, Buoy and other upgraded floaters) used for the production of oil and gas offshore, detectors and associated detection systems which are subject to marine classification - typically within the hull and living quarters - shall be type approved by the project selected Classification Society.

Factory Acceptance Test of the detector and associated systems shall be witnessed by the project selected Classification Society.

5. Conventional Fire and Gas Detectors Design

5.1 General Characteristics

- Analogue signal shall be 0-22 mA covering normal operation (4-20 mA), fault and alarms. If HART is provided then it shall be fixed at factory. Therefore, at site it will only be possible to read the measurement, configuration parameters and diagnostic information. Access to configuration for modifications shall be forbidden.
- Operating voltage shall be 24 VDC.
- Detectors shall be powered by the FGS, package FGS or Addressable FGS as appropriate via the signal cable.
- Detectors shall be immune to solar interference (direct or reflected sunlight), heavy rain, fog, mist and steam.

5.2 Fire Detectors

The following types of fire detectors may be utilised in accordance with [GS EP SAF 312](#):

- UV/IR Flame Detectors
- Multi-frequency IR Flame Detectors
- Optical Smoke Detectors

- Oil Mist Detector
- Rate of Rise Heat Detectors
- Fixed Temperature Heat Detectors
- Heat Sensitive Cables
- Fusible Plugs
- Image Based Flame Detectors (CCTV) (refer to § 7)
- Early Warning Smoke Detection System (refer to § 7).

5.2.1 UV/IR Flame Detectors

Hydrocarbon fire generates both UV and IR radiation. Fire is detected when both UV and IR emissions are detected.

Only UV detection (coming from arc-welding, sun reflection ...) or only IR detection on its own is not considered as confirmed fire detection.

The main characteristics of this equipment are:

- Detection principle: ultraviolet and infrared emission detection
- Sensitivity: as per [EN 54-10](#) requirements, Class 1-3
- Response time: less than 10 sec at 15 metres of gas-oil fire (surface 0.1 sq.m)
- Enclosure material: SS 316L
- Automatic self-resetting type
- Equipped with automatic self-testing features including testing of electronics and optical integrity
- Equipped with normal, fault and alarm indication.

The vendor shall confirm the following information:

- UV and IR detection wavelengths or band.

5.2.2 Multi-frequency Infrared Flame Detector (MIR)

Flame is an important source of IR radiation. Fire will be detected by a minimum of three IR wavelengths with overlapping frequency bands to ensure false alarm immunity.

The main characteristics of this equipment are:

- Detection principle: multiple wavelength infrared emission detection
- Sensitivity: as per [EN 54-10](#) requirements, Class 1-3
- Response time: less than 10 seconds at 15 m of gas-oil fire (surface 0.1 sq.m)
- Enclosure material: SS 316L