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Guidance on Industry Standard for Fire and Gas Detection

GIS 30-851

BP GROUP
ENGINEERING TECHNICAL PRACTICES

Foreword

This is the first issue of Engineering Technical Practice (ETP) BP GIS 30-851. This Guidance on Industry Standard (GIS) is based on parts of heritage documents from the merged BP companies as follows:

Amoco

A PS-F&GD-00-E	Process Safety—F&G Detection and Alarm Equipment—Engineering Specification, May 1997.
A PS-F&GD-00-G	Process Safety—F&G Detection and Alarm Equipment—Guide, May 1997.
A PS-F&GD-FDA-P	Process Safety—F&G Detection and Alarm Equipment—Fire Detection and Alarms—Supply Specification, May 1997.
A PS-F&GD-GD&A-P	Process Safety—F&G Detection and Alarm Equipment—Gas Detection and Alarms—Supply Specification, May 1997.

BP (pre-1999)

GS 130-10	Guidance for Specification 130-10, Specification for the Supply of Fire & Gas Systems, January 1994.
RP 30-7	Instrumentation and Control, Design Philosophy for Fire and Gas Detection and Control Systems, February 1994.
SPR/G/97/005	Guidance on F&G Detection, by SPR Operational Integrity Team, Part 1 General Requirements, Part 1, April 1997. (BP Exploration).
SPR/G/97/005	Guidance on F&G Detection, by SPR Operational Integrity Team, Part 2 Setting Performance Requirements, Part 2, April 1997. (BP Exploration).
SPR/G/97/005	Guidance on F&G Detection, by SPR Operational Integrity Team, Part 3 Detector Specification, Part 3, July 1997. (BP Exploration).
SPR/G/97/005	Guidance on F&G Detection, by SPR Operational Integrity Team, Part 6 Audit & Inspection, Part 6, April 1997. (BP Exploration).

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1. Scope

This GIS provides guidance on industry standard for the design, materials, fabrication, inspection, testing, documentation, and preparation for shipment of equipment for fire and gas detection.

2. Normative references

The following normative documents contain requirements that, through reference in this text, constitute requirements of this technical practice. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this technical practice are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies.

International Electrotechnical Commission (IEC)

IEC 61508-2	Functional safety of electrical/electronic/programmable electronic safety-related systems – Part 2: Requirements for electrical/electronic/programmable electronic safety-related systems.
IEC 61508-3	Functional safety of electrical/electronic/programmable electronic safety-related systems – Part 3: Software requirements.

3. Abbreviations

For the purpose of this GIS, the following abbreviations apply:

AWG	American wire gauge.
CCTV	Closed circuit television.
ESD	Emergency shutdown.
EMC	Electromagnetic compatibility.
F&G	Fire and gas.
FAT	Factory acceptance testing.
FSD	Full scale deflection.
HVAC	Heating, ventilation, and air conditioning.
IP	Ingress protection.
IR	Infrared.
I/O	Input and output.
LED	Light emitting diode.
LEL	Lower explosive limit.
LELm	Lower explosive limit metre.



LFL	Lower flammable limit.
mA	milliamps.
MAC	Manual alarm contact (US definition).
MAC	Manual alarm call point (UK definition).
MTBF	Mean time between failure.
RHO	Radiant heat output.
SAT	Site acceptance testing.
SIL	Safety integrity level.
T90	Time to reach 90% of scale.
TWA	Time weighted average.
UEL	Upper explosive limit.
UFL	Upper flammable limit.
UV	Ultraviolet.
Vdc	Voltage direct current.
VDU	Visual display unit.

The pair of terms LEL and LFL, and the pair of terms UEL and UFL are practically interchangeable. They are all units of measurement for gas flammability. The terms LFL and UFL are more common in the Americas, and LEL and UEL are more common in Europe.

The terms “fault” and “trouble” may be used interchangeably as they both describe improper conditions that could prevent detection, display functions, or control actions. “Trouble” is more common in the Americas, and “fault” is more common in Europe.

4. General

4.1. Local codes and standards

Fire and gas detection equipment shall comply with local codes and standards.

No national or international standards that could cover the requirement for fire and gas detection on BP sites are available at the time of creating this ETP. Particular standards may be mandatory in some countries or states and these must be followed.

4.2. Power supply

Detection equipment should operate on a nominal 24 Vdc power supply within a range of 18 Vdc to 32 Vdc.



4.3. Safety integrity level

Detectors used to ensure safety or protect the environment with a specified integrity level shall comply with IEC 61508-2 and IEC 61508-3, and the assigned safety integrity level (SIL).

Normal practice should be to avoid the need for significant reliance on F&G systems by incorporating inherently safe design where possible. In this case the F&G system need not be SIL rated. Otherwise a maximum of SIL 1 should be assigned unless special measures are taken to achieve a higher integrity specification. This recognises the practical difficulty in achieving higher than SIL 1 with the conventional F&G function for detection, logic and final element action.

4.4. Electrical connections

- a. Detection equipment shall have sufficient connection terminals for all electrical conductors, with one conductor per terminal.
- b. Conductor sizes may be up to 2.5 mm² (AWG 10).

4.5. Vibration

Detection equipment shall be designed to ensure correct operation during vibration up to 1 mm (0.04 in) from 2 Hz to 60 Hz.

This is a vibration level for typical BP sites.

The foundation may be expected to vibrate at the site power generation frequency and its harmonics.

4.6. Ingress protection

Detection equipment installed outdoors shall have an ingress protection rating of at least IP66 (NEMA 4).

4.7. Switch and relay contact rating

Relay contacts or switch contacts used for input circuits to the F&G panel shall have a minimum rating of 1A at 24 Vdc.

4.8. Environmental protection

- a. Detection equipment shall be suitable for the environment in which they are installed, and shall be protected from the effects of corrosion, dust, vibration, and hosing-down operations.
- b. Detection equipment may be fitted with protection from the environment (for example, sun visors or water splash guards). Such protection should not impair detection capability.

4.9. Communications protocol

At this time, no common protocol exists for fire and gas detectors. In some applications, preference should be given to suppliers of complete F&G detection systems because there are fewer different protocols. Preference should also be given to widely recognised (but not proprietary) protocols.

5. Flame detection

5.1. Type

Flame detectors should be closed circuit television (CCTV), infrared (IR), or ultraviolet (UV).



5.2. Sensitivity

For general use, equipment should detect a fire of 10 kW radiant heat output (RHO) at 10 m (33 ft).

Detector sensitivity may be reduced from this value depending on where it is installed and the expected fire types. Consideration should be given to the desensitising effects of airborne obscurants and contaminants on the window.

5.3. Response time

Response time shall be less than 10 seconds.

5.4.

Alignment

- a. Detectors shall allow easy horizontal and vertical adjustment of $\pm\pi/4$ radians (45 degrees).
- b. Detectors shall lock in the desired position.

5.5. Diagnostics

System shall contain diagnostics for checking that the detector is online.

5.6. Output

- a. Detectors or interface units shall have volt-free relay contacts for:
 1. Alarm.
 2. Fault.

Current output (4-20 mA) should not be used, because this prevents multidropping several devices on a single loop. Placing multiple devices on a single loop is common practice for fire detectors but not gas detectors.

- b. Detectors should have serial communication capability (or equivalent) for use with interrogation tools or connection to smart control equipment.

5.7. Testing

A fire alarm simulation test source that can be used a minimum of 5 m (16 ft) from the detector should be provided.

5.8. Field of view

Detectors shall have at least a $\pi/2$ radian (90 degree) field of view in the horizontal axis.

5.9. False alarm immunity

Solar interference (sunlight), artificial lighting, or regularly modulated black body radiation shall not cause false alarms.

5.10. CCTV flame detectors

Closed circuit television (CCTV) flame detectors that analyse object motion and behaviour should be used for detecting hydrocarbon fires.

CCTV flame detectors can be used as simple fire detectors. This technology is used to full advantage when the video image is displayed at the control point.

5.11. Infrared flame detectors

- a. Single frequency detectors that respond to infrared radiation equivalent to the CO₂ band should be used to detect hydrocarbon fires.

