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Pocket guide to Flame Detection

FFE

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Contents

Foreword

The purpose of this guide is to provide information on the correct installation of Flame Detectors in life-safety and property protection applications. This guide briefly summarises the principles of operation of Flame Detectors, their design requirements and practical applications for their use as a component of a fire alarm system.

Flame Detectors can be important components of a well-designed fire alarm system. Their unique capabilities overcome many limitations of other detection types in open applications and harsh environments. This guide is designed to help you understand the Flame Detector's capabilities and its benefits compared to other detection methods.

Please note: This document is intended only as a general guide to the application of Flame Detectors. Reference should always be made to the Detector manufacturer's installation requirements and instructions, and local standards.

Glossary of terms

Flame Detectors
Flame detectors use optical sensors to identify the unique light wavelengths emitted by fire. They provide rapid flame detection, even in open or high-risk environments, by distinguishing flames from other light sources.

Aspirating Smoke Detectors
Air is drawn through a network of pipes to detect smoke. Smoke flows into the sampling chamber which detects the presence of smoke particles suspended in air by detecting the light scattered by them in the chamber.

Optical Beam Smoke Detector
A fire detector which uses a beam of light (usually infrared) projected across an open area to monitor for smoke emitted by an incipient fire. There are two types of Beam Detector:

- **End-to-End:** Transmitter and receiver are mounted at either end of the protected area.
- **Reflective:** Transmitter and receiver are mounted in the same housing and the beam is directed at a specially designed reflector, mounted at the opposite end of the protected area.

Point Detector
A device, which senses a fire at its early stage at a single location, most commonly using optical or ionisation smoke detection or heat detection. The area of coverage of a Point Detector is defined in local or national standards.

Linear Heat Detector
Uses a heat-sensitive cable to detect changes in temperature along its length. Linear Heat Detectors provide continuous coverage and are ideal for monitoring large or complex areas, such as warehouses, tunnels and industrial facilities.

Detector coverage
Detector coverage is the area wtihin which a detector is considered capable of detecting an emerging fire effectively. This area is defined by local and international standards.

Who should read this guide?

You should read this guide if:

- You specify or design fire detection systems
- You are responsible for your building's fire protection system
- You are the Fire Marshall for your workplace
- You are planning to install a Flame Detector or other flame detection system
- You are in a risk assessment role for fire protection
- Your role is to support or sell fire detection systems
- You work in the fire and rescue service

The guide offers general guidance; you should also consult local and national regulations and the manufacturer's technical specifications for particular Detectors.

Flame Detector applications: Shipping yards & docks

What is Flame Detection?

Flame Detection operates by continuously monitoring for the presence of flames using optical sensors that detect specific wavelengths of light emitted by fire. These sensors are designed to identify the unique spectral characteristics of flames, distinguishing them from other light sources. When a flame is detected, the system triggers an alarm to alert individuals to potential fire hazards.

How does Flame Detection work?

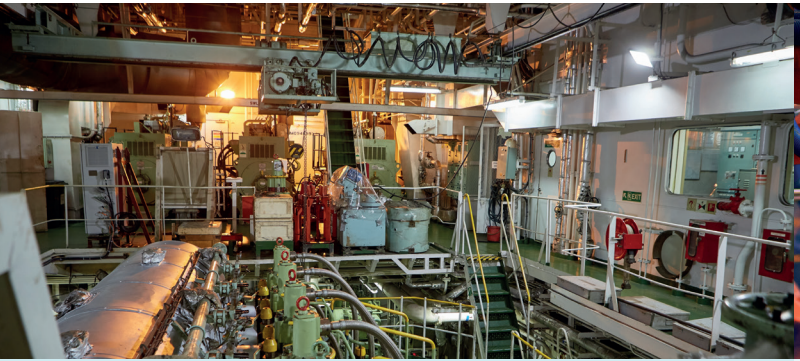
Flame Detection systems work by using optical sensors to identify the specific wavelengths of light emitted by flames. These sensors detect ultraviolet (UV), infrared (IR), or a combination of both to distinguish real flames from other light sources. When a flame is detected, the system triggers an alarm to signal a potential fire.

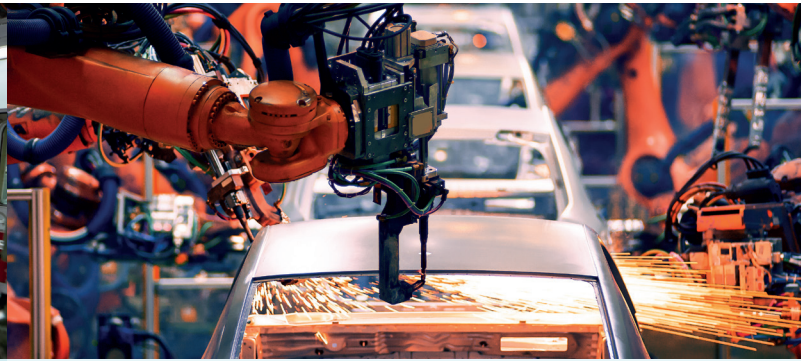
Unlike traditional Smoke or Heat Detectors, which require heat buildup or particle presence, Flame Detectors can identify fire at its source almost instantly. This makes them particularly effective in high-risk environments such as industrial plants, fuel storage areas and large open spaces where fast detection is critical.

Flame Detection systems can be designed for use in hazardous environments and may comply with ATEX and IECEx standards. Depending on the sensor technology and installation requirements, they can be deployed in explosion-proof housings or used with appropriate safety barriers to ensure reliable operation in classified areas.

Did you know?
Flame Detectors can differentiate between real flames and false sources like sunlight or hot surfaces by analysing the flickering pattern of fire. This advanced technology helps reduce false alarms, making them highly reliable for use in industrial facilities, chemical plants and hazardous environments.

Types of Flame Detection





Ultraviolet (UV) Flame Detectors

- Detect flames by sensing ultraviolet radiation emitted by fire.
- Provide fast response times, typically within milliseconds.
- Effective in environments with minimal UV interference, such as enclosed spaces.
- Can be susceptible to false alarms from sunlight or welding arcs without proper filtering.

Infrared (IR) Flame Detectors

- Identify flames by detecting infrared radiation patterns.
- Can distinguish between real flames and hot surfaces using flicker analysis.
- Suitable for high-risk industrial environments.
- Less affected by sunlight compared to UV detectors but may require filtering for other heat sources.

Types of Flame Detection

UV/IR Flame Detectors

- Combine ultraviolet and infrared detection to improve accuracy and reduce false alarms.
- Provide rapid flame detection while filtering out non-fire-related UV and IR sources.
- Ideal for applications requiring high reliability, such as fuel storage areas and chemical plants.
- Suitable for indoor or outdoor use

Multi-Spectrum Infrared (MSIR) Flame Detectors

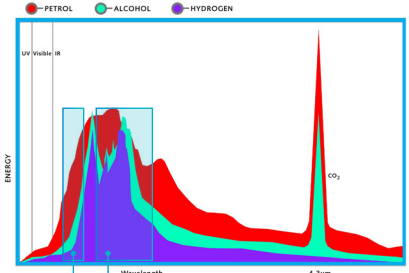
- Use multiple infrared wavelengths to detect flames while minimising false alarms.
- Highly effective in complex environments with hot machinery or fluctuating lighting conditions.
- Commonly used in oil and gas facilities, aircraft hangars, and power plants.

Types of Flame Detection

Feature	Ultraviolet (UV)	Infrared (IR)	UV/IR	Multi-Spectrum Infrared (MSIR)
Detection method	Senses UV radiation	Detects IR radiation	Combines UV and IR	Uses multiple IR wavelengths
Response time	Very fast (milliseconds)	Fast (milliseconds to seconds)	Very fast (milliseconds)	Fast (milliseconds to seconds)
Sensitivity	High to UV radiation	High to IR radiation	High to UV and IR	Very high, with advanced discrimination
False alarm susceptibility	High (sunlight, welding)	Moderate (hot surfaces)	Low (dual filtering)	Very low (multi-band filtering)
Sunlight immunity	Low	Moderate	High	Very high
Range	Short to medium	Medium to long	Medium	Long
Flicker analysis	No	Yes	Yes	Yes
Environmental suitability	Enclosed spaces with low UV noise	Industrial environments	Indoor/outdoor, hazardous areas	Harsh and complex environments
Typical applications	Indoor equipment rooms, cabinets	Warehouses, production lines	Fuel storage, chemical plants	Oil & gas, aircraft hangars, power plants
Cost	Low to moderate	Moderate	Moderate to high	High

IR2 Flame Detector

Two IR sensors



Two IR sensors

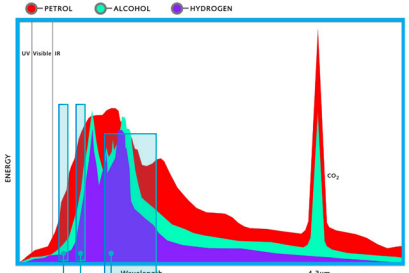
All sensors must be triggered in order to register a fire

Differences between Detectors can be most readily observed in the shape of the window in front of the 'black box' of the Detector.

- The two IR sensors operate on different spectral responses and signal characteristics. Both sensors must be activated to signal a fire.
- Detection in two seconds in optimum conditions.
- Flicker false alarm protection.
- Sees through glass.
- Universal flame detection.
- Most susceptible to false sources of alarm.

IR3 Flame Detector

Three IR sensors



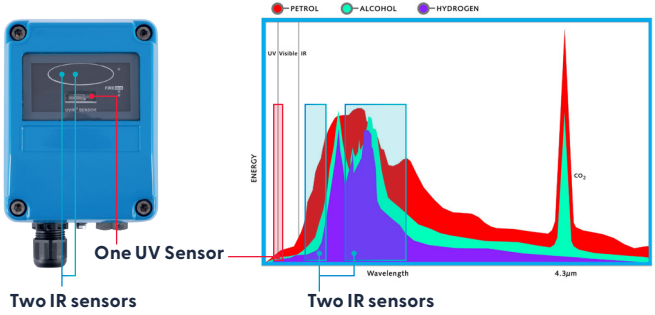
Three IR sensors

All sensors must be triggered in order to register a fire

Differences between Detectors can be most readily observed in the shape of the window in front of the 'black box' of the Detector.

- The three IR sensors are tuned to different IR wavelengths. All three sensors must be activated to signal a fire.
- Detection in five seconds in optimum conditions.
- Flicker false alarm protection.
- Sees through glass.
- Universal flame detection.
- Perfect for dirty environments – best choice for industrial applications.

UV/IR2 Flame Detector



All sensors must be triggered in order to register a fire

Differences between Detectors can be most readily observed in the shape of the window in front of the 'black box' of the detector.

- UV and IR sensors operate on different spectral responses and signal characteristics. All sensors must be activated to signal a fire.
- Detects in two seconds in optimum conditions.
- Flicker false alarm protection.
- Universal flame detection with one detector.
- Best rejection of false alarms.
- Reduction in performance in high smoke, dust and steam environments – these reduce the UV signal.

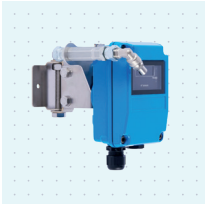
Accessories for Talentum Flame Detectors

Test Torch
Portable, wide spectral output: UV – visible – near IR, Flicker simulator, Designed for Talentum Detectors only, not Exd/IS.

Weather Shield [SS]
Sunlight, outside (weather – rain etc), some contaminated areas.

Weather Shield (Ex d) [SS]
Sunlight, outside (weather – rain etc), some contaminated areas.

Adjustable Mounting Bracket
Secures the Detector to prevent misalignment.



Air Purge Adapter
Keeps Detector clean in dirty environments.

Air Purge Adapter (Ex d)
Keeps Detector clean in dirty environments.

Flame applications:
Aircraft hangars

How do Flame Detectors differ from other detection methods?

Flame Detection systems differ from traditional Smoke and Heat detectors in how they identify fire. Smoke Detectors rely on airborne particles, while Heat Detectors activate when the temperature at a specific location exceeds a threshold. These methods can be slow in open or well-ventilated areas where smoke disperses, heat takes time to build up or the fire develops rapidly with little smouldering phase.

In contrast, Flame Detectors use optical sensors to detect the unique light wavelengths emitted by fire. This allows them to recognise flames almost instantly, even in large or outdoor environments where traditional Detectors may struggle. By analysing ultraviolet (UV), infrared (IR), or a combination of both, Flame Detectors can distinguish between actual fire and non-fire sources, reducing false alarms.

The key difference is detection speed and coverage. While Heat and Smoke Detectors rely on environmental changes, Flame Detectors provide direct, immediate fire identification, making them ideal for high-risk applications such as fuel storage, industrial plants and aircraft hangars.

How should Flame Detectors be installed?

Following the guidelines below will maximise the performance of Flame Detectors and minimise false alarms:

1 **Positioning for optimal coverage**
- Install Flame Detectors with a clear line of sight to the protected area.
- Avoid placing Detectors where obstructions like beams or machinery could block the field of view.
- Consider multiple Detectors for large or complex spaces to eliminate blind spots.

2 **Mounting and stability**
- Secure the Detector using manufacturer-recommended brackets to prevent misalignment.
- Ensure the Detector remains stable, as vibrations can impact accuracy.

3 **Environmental considerations**
- Account for ambient light sources, reflections, and other potential false alarm triggers.
- Choose Detectors rated for the environmental conditions, including extreme temperatures, humidity, or outdoor exposure.
- Position Detectors to avoid direct exposure to sunlight or welding operations, which can interfere with detection.

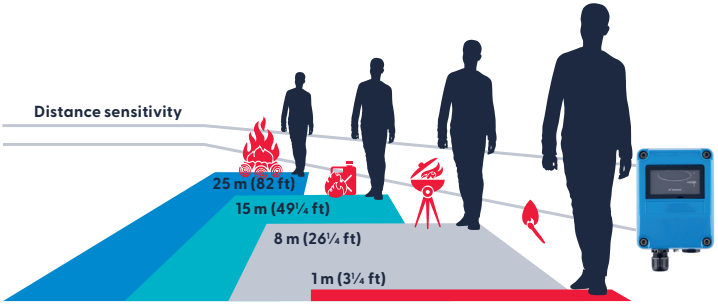
4 **Integration with fire systems**
- Verify compatibility with the fire alarm control panel and/or suppression system.
- Ensure proper wiring and power supply for reliable operation.

5 **Avoiding false alarms**
- Keep Detectors away from sources of infrared or ultraviolet radiation that could trigger false alarms.
- Regularly test and calibrate Detectors according to manufacturer guidelines to maintain accuracy.

6 **Maintenance and testing**
- Conduct periodic inspections to ensure lenses are clean and free from dust, dirt, or condensation.
- Perform functional testing to confirm proper response to simulated fire conditions.

By following these best practices, flame detectors can provide reliable, early fire detection in critical environments.

BS 5839 guidance

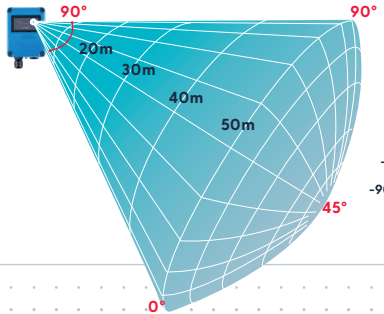


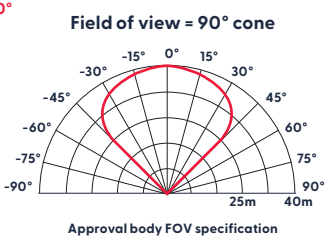
Sensitivity

The size of flame that can be detected is proportional to the distance from the Detector. If you double the distance, you need four times the size of fire. The pan fire at 25 m seems the same size flame as the lit match at 1 m from the Detector's perspective. A fire some kilometres away can be detected if it is big enough. This is important when planning your installation – if you need to detect a tiny flame then the Detector must be closer. It is also important when testing the Detector to ensure the same size flame is used at the same distance every time.

Field of view (FOV)

The maximum distance is dependent on the power of the fire (a raging inferno can be detected from many hundreds of metres away). The standard test fire for Flame Detectors is TF5 (n-heptane), but additionally TF6 (methanol with heptane accelerant) can also be used, although it is considered the 'harder' test due to a lower fire intensity. All Talentum Flame detectors have Class 1 performance as per the Flame Detector standard EN54-10. That is the ability to detect a 1 ft² (0.1 m²) pan fire at a distance of 25 m (82 ft) within 30 seconds. A reduction in the cone of vision for the Ex d flameproof casing is because the edge of the flameproof box clips the line of sight to the sensors in the Detector. This has a more pronounced effect on the Detector as it looks down – the combination of sensor window placement and protruding lip of the Detector severely constrains the lower area of the cone to 20°.



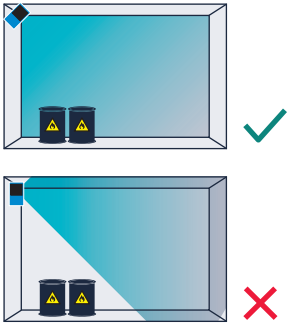


Approval body FOV specification

BS 5839 guidance

Line of sight
- Direct line of sight to hazard is required
- Point Detector at hazard or cover whole area
- Can detect flames anywhere within view
- The field of view originates at the window of the black box of the Detector – this is where the sensors are located.

Talentum Flame Detectors are known as 'Optical' Detectors because they detect the light emitted from the flame. In the case of the Talentum products, they usually detect wavelengths of light that are invisible to the human eye, in the infra-red (IR) region. The UV/IR2 also detects in the ultraviolet (UV) region).

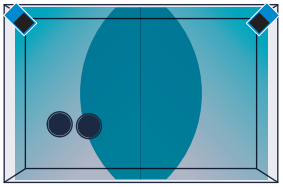


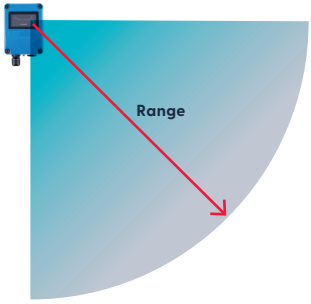
Position
- Corners
- 90° cone of vision
- Provides full coverage of a room

Height
- UV/IR2 Ex d must be 2.2 m (7¼ ft) above ground

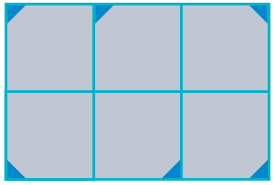
Ex d approval requirements
- All other models can be at any height

Range
- Calculated along direct line of sight

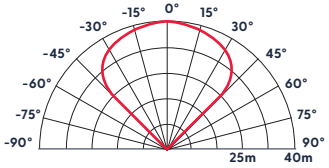




Coverage



30 x 45 m (98½ x 147¾ ft) room



At 3 m (9¾ ft) height:
15 x 15 m (49¼ x 49¼ ft) box

NFPA 72 guidance (2022 edition)

General rules
(NFPA 72 Section 17.8.3.1)
Radiant energy-sensing fire detectors shall be employed consistent with the listing or approval and the inverse square law, which defines the fire size versus distance curve for the detector.

Field of view and positioning
(NFPA 72 Section 17.8.3.2)
The location and spacing of detectors shall be the result of an engineering evaluation that includes:

- Size of fire to be detected
- Fuel type
- Detector sensitivity
- Detector's field of view
- Distance from fire to detector
- Atmospheric absorption of radiant energy
- Presence of extraneous radiant energy sources
- Purpose of detection system
- Required response time

Because flame detectors are line-of-sight devices, their ability to respond to the required area of fire in the zone that is to be protected shall not be compromised by the presence of intervening structural members or other opaque objects or materials.

Other conditions
(NFPA 72 Section 17.8.4)
Radiant energy-sensing detectors shall be shielded or otherwise arranged in a fashion to prevent action from unwanted radiant energy.

Where used in outdoor applications, radiant energy-sensing detectors shall be shielded from conditions such as rain or snow and yet allow a clear field of view of the hazard area.

FM3260 guidance

Detector type and use
(Section 2.1.1–2.1.2)
Detectors require line-of-sight between the hazard and the sensor.

Each fuel emits unique spectral radiation; not all detectors are suitable for all fuels.

Use detector types appropriate to the flame source (e.g. UV/IR for hydrocarbons, IR3 for alcohols, etc.).

Placement & field of view
(Sections 3.7.1, 3.7.4, 4.4)
Install according to the manufacturer's specified sensitivity and field of view.

Place detectors so they have unobstructed views of the protected hazard area.

Mounting & environment
(Section 3.2.1)
Detector must be securely mounted independent of wiring.

Power & wiring
(Sections 3.2.6–3.2.10, 3.3.3, 3.4.4, 4.11)
Wiring must comply with NFPA 72 and manufacturer guidance.

Commissioning & maintenance
(Sections 3.6, 3.7.3, 3.7.4)
Clean lens regularly; accumulation of dust can reduce sensitivity.

Perform regular response tests using:
- Approved test sources or
- Manufacturer-defined reproducible test technique
- The response test must represent the energy from certified flame types.

What tools do you need for installation?

The specific instructions for installing, aligning, and testing Flame Detectors vary by model and manufacturer, so always follow the guidance provided with your system. Having the right tools ensures a smooth installation process and helps maintain the reliability of the Flame Detection system. Typical equipment for installation include the following:

Mounting tools
Drill, cross-head and flat-head screwdrivers, and other basic tools for securing detectors to walls, ceilings, or mounting brackets.

Multimeter and test leads
Essential for checking power supply, continuity, and troubleshooting wiring issues.

Laser alignment tool
Useful for precisely aiming optical flame detectors to ensure optimal coverage and reduce false alarms.

Scissor lift or access equipment
Required for safely installing and adjusting detectors at height. Regular maintenance and testing are typically performed from the ground when possible.

Protective gear
Gloves, safety goggles, and other personal protective equipment (PPE) for working in hazardous environments.

How should Flame Detectors be maintained

To ensure reliable performance, Flame Detectors should be maintained regularly. The frequency of maintenance depends on environmental conditions, but the following steps should be performed periodically:

1. **Inspect the Detector and housing:** Check for physical damage, dirt accumulation, or obstructions that could affect performance. Ensure the Detector's field of view remains clear.

2. **Perform functional tests:** Follow the manufacturer's guidelines to test the Detector using a flame simulator or approved test method. Avoid using open flames, as this may trigger suppression systems.

3. **Clean the optical sensors:** Wipe the Detector lens with a soft, lint-free cloth to remove dust, grease, or condensation that could reduce sensitivity.

4. **Check electrical connections:** Ensure wiring at junctions, terminals and power sources is secure and corrosion-free. Loose connections can lead to malfunctions.

5. **Verify system integration:** Test communication with the fire alarm control panel and connected suppression systems to confirm proper operation.

6. **Reassess installation:** If environmental conditions change (e.g., new equipment, airflow alterations, or increased background radiation) adjust the detector's placement or settings accordingly.

7. **Keep maintenance records:** Document all inspections, tests, repairs and recalibrations to track system performance over time.

Where can you install them?

Did you know?
Choosing the wrong type of Flame Detector for your application can lead to costly false alarms or, worse, missed fire events. For example, installing a UV Detector near welding activity can trigger nuisance alarms – while a Multi-Spectrum IR Detector in the same location would only react to a real fire. Matching the Detector type to the environment is critical for both safety and system reliability.

Ultraviolet (UV) Flame Detectors – best for clean, controlled indoor spaces

- Electrical cabinets and control rooms
- Engine test cells
- Laboratories
- Paint spray booths
- Pharmaceutical manufacturing areas
- Small enclosures with minimal UV interference

Infrared (IR) Flame Detectors – good for industrial environments with radiant heat

- Industrial ovens and furnaces
- Power generation facilities
- Printing facilities
- Pulp and paper plants
- Storage warehouses with flammable materials
- Wood processing and sawmills

UV/IR Flame Detectors – great for general purpose indoor/outdoor use

- Aircraft hangars
- Chemical processing plants
- Fuel storage depots and tank farms
- Loading bays and gas turbine enclosures
- Marine engine rooms
- Refineries
- Waste treatment facilities

Multi-Spectrum Infrared (MSIR) Flame Detectors – ideal for complex, harsh or hazardous locations

- Aircraft maintenance hangars
- Large open spaces with machinery (e.g. steel mills, heavy manufacturing)
- LNG terminals
- Mining sites and tunnels
- Offshore oil and gas platforms
- Onshore oil refineries
- Petrochemical processing plants
- Power stations and transformer rooms

Which Detector works best?

Application	Fire characteristics	Typical preferred detection approach
Data centres / server rooms	Smoke is usually the earliest fire signature. Flame detection is generally supplementary only.	**Primary:** ASD **Supplementary:** Flame, where justified
Electrical cabinets / switchgear	Arcing and overheating often begin inside enclosures, limiting line of sight.	**Primary:** ASD or Point Smoke
Control rooms / technical offices	Low fire load and high availability favour early smoke detection.	**Primary:** Point Smoke or ASD
Cable trays, risers and voids	Fires are often concealed and smoke-led in the early stages.	**Primary:** Linear Heat or ASD/Smoke
Battery rooms (UPS)	Overheating, off-gassing and smoke often occur before visible flame.	**Primary:** Smoke or Heat **Supplementary:** Flame, where justified
Energy storage systems (ESS/BESS)	Fire development can include off-gassing, smoke and later flame.	**Typical approach:** Multi-technology, application-specific
Conveyors, bearings, rotating equipment	Temperature rise is often the earliest indicator of failure.	**Primary:** Linear Heat or Heat Detection
Ceiling and underfloor voids	Concealed spaces have limited visibility; smoke is often first detectable.	**Primary:** ASD
Mixed-risk industrial buildings	Detection should match the fire risk in each zone.	**Typical approach:** Zonal, multi-technology design

Notes

Further information

FFE provides training to support development for those interested in Flame Detection network design, configuration and maintenance to ensure peak sensitivity and accurate fire detection.

For details contact **marketing@ffeuk.com**