

ACTIVE FIRE PROTECTION GUIDE

Detection Systems: Aspirating Smoke Detection

This document has been produced by the RISCAuthority Active Suppression & Detection working group to provide information and outline guidance on the application of Aspirating Smoke Detection (ASD) Systems.

Summary

Refer to AFIG-30 Detection Series Overview.

Aspirating smoke detection systems:

- comprise a very high sensitivity detector(s), extraction pump(s), and sampling pipe network. Its detection capabilities are not limited to just smoke. Unlike other smoke detectors, the sensing element is remote from the protected space.
- are dominant in property protection applications where very early detection might enable evasive measures to be taken before significant damage is caused to high value, critical, or strategically important systems (i.e. computer suites), and heritage buildings where good performance and low system visibility is required.
- are used in applications where the use of 'point detectors' would be too inefficient to cover the area and where smoke quantities may be reduced due to high air flow rates or high ceilings.
- are sometimes used as an alternative to 'Optical Beam Detectors' (see AFIG-36) where access, clutter, building deflection, and smoke dilution may impact performance.
- benefit from having good resilience against harsh environments (high temperatures, humidity, and contaminants), and where mechanical damage might be a problem.
- may require application to be extended to include real-time sampling of many other gases to control other risks or systems specific to the protected space(s).

Aspirating smoke detection systems

Aspirating detectors comprise a suction pump, detection chamber, and extensive perforated pipe network distributed. The detector may operate on ionisation or optical principles. The fan or pump is used to extract sample air from the protected space(s) which is delivered to the detection chamber via the pipe network. To allow for the impact of dilution of smoke, the detector employed is 100 times more sensitive of those used in conventional point detectors. They have found particular application in:

- computer suites and data centres where they are used to detect very small quantities of smoke in the air management systems
- manufacturing and laboratory clean rooms
- historical buildings where the visibility of installed fire detection systems needs to be low
- hospital operating theatres
- high ceiling and ventilated buildings such as warehouses
- locations with a high risk of vandalism
- harsh and dirty manufacturing environments.

Systems may also be augmented with additional gas detectors making them suitable for many industrial applications including UPS and battery charging rooms (where hydrogen build up is possible), cable tunnels and vaults, service tunnels, and underground car parks. They may also provide input to



environmental control systems such as hypoxic air/oxygen reduction systems (see AFIG-10).

All ASD systems are capable of being connected to common fire protection electrical infrastructure that interprets signals, communicates alarms, and controls other fire systems (see AFIG-30).

ASD system installation must conform to the requirements of BS 5839-1.

ASD Classes

BS EN 54-20 defines 3 sensitivity classes as follows:

Class C: Normal sensitivity systems, where each individual sampling orifice is capable of detecting the test fires used to test point-type smoke detectors (BS EN 54-7), and as such may be used as an alternative to point-type smoke detectors.

Class B: Enhanced sensitivity systems, where increased sensitivity is needed to overcome some dilution effects such as high ceilings or moving air flows.

Class A: High sensitivity systems, where areas with high smoke dilution or where the earliest warning is required for the protection of business-critical or high-value processes or objects.

It is important to note that the Class of an ASD relates to the sensitivity of the sampling holes, not to the sensitivity of the sampling unit.

Electrical Equipment Protection (BS 6266):

BS 6266 *Fire Protection for electronic installation* seeks to control the extensive damage that fire can cause to electronic equipment, and the ability to continue with the provision of operations and services that the equipment supports. It makes extensive reference to ASD systems.

Class selection is made in respect of the challenge presented by the situation which, for a typical electronic control room, in order of descending difficulty, might be detecting smoke in:

- the return airflow from the room's aircon system (high airflow, high dilution)
- within a cabinet or enclosure (high airflow)
- at the room's ceiling or within a floor or ceiling void (a normal detection scenario).

ASD would be applied as follows:

- Class A aspirating smoke detection should be used for High and Critical Risk Category areas to monitor air flows returning from the air-conditioning. The system must be capable of passing test fires TF2A, TF3A and TF5A as defined in BS EN 54-20.
- High sensitivity systems at risk from pollen being introduced via the fresh air (air-con) system should mitigate the potential for false alarms by using a reference detector in the fresh air system.
- When used to detect smoke within a cabinet or enclosure, a Class A or B system should be used to provide early warning.
- When used to detect smoke at the ceiling of the room or within a floor or ceiling void, a Class A or B system should be used when the air-conditioning is to remain operational.
- A Class C system may be used when the air-conditioning can be switched off or is not present.
- ASD may be used to trigger fire protection systems.

Careful consideration must be given to the location of the ASD sampling points to ensure the fire is detected in its early stages. In the air-conditioned situation smoke will be drawn into the return vent and this is the best location for early detection. When the room is not conditioned, the air-con is switched off, or the fire is sizeable, smoke will rise meaning detection is best made from devices located at the ceiling. The best location may be confirmed by conducting 'smoke tests' or with CFD modelling. For specific details on the protection of electronic installations refer to BS 6266.

General protection (BS 5839-1):

Where the ASD system is intended to provide general area protection, each sampling point should be regarded as a point detector, providing the sensitivities are equivalent.

Where installed for property protection (early warning) and supplementary to other fire detection that meets compliance, the system should be installed with reference to the manufacturer's guidance and BS 6266.

Where used to protect spaces with high ceilings (>25m) and there is a risk of smoke stratification before reaching the ceiling, sampling should be provided at multiple levels via drop pipes.

Challenges and considerations

Dirt and contamination: ASD systems can tolerate a certain amount of dirt within the detector but like any system will require (possibly in law) regular maintenance. Extreme contamination can result in obstruction of the sampling system.

Detection sensor(s) lifespan: Many of the sensors used within the system may have a defined operating life (i.e. gas species) and these will require replacement when exhausted.

Management of false and unwanted alarms: By their very nature, ASD systems are relatively tolerant of false and unwanted alarms. Additional guidance is given in RISCAuthority document RC47: *Recommendations for the management of fire detection and alarm systems in the workplace*.

Applicable standards

BS 5839-1 *Fire detection and fire alarm systems for buildings Part 1: Code of practice for design, installation, commissioning and maintenance of fire detection and fire alarm systems in non-domestic premises*.

BS 5839-6 *Fire detection and fire alarm systems for buildings Part 6: Code of practice for design, installation, commissioning and maintenance of fire detection and fire alarm systems in domestic premises*.

BS EN 54-1 *Fire detection and alarm systems Part 1: Introduction*.

EN54 Part 20: *Fire detection and fire alarm systems: Aspirating smoke detectors*.

BS 6266: *Fire protection for electronic equipment installations – Code of practice*.

FIA Code of Practice: *Design, Installation, Commissioning and Maintenance of Aspirating Smoke Detector(ASD) Systems*.

Schemes

BAFE SP203-1 *Design, Installation, Commissioning and Maintenance of Fire Detection and Fire Alarm Systems Scheme*.

LPCB LPS 1014 *Scheme requirements for certificated fire detection and alarm system firms*.

Best practice

All providers of systems should be third party certificated to approved schemes.

Fire Services should be consulted on their requirements and necessary provisions for supporting the fire safety of the property.

The provision of Regulation 38 information is essential so that the role the detection and alarm system plays in the overall fire safety management plan of the building remains front and centre.