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Pocket guide to Aspirating Smoke Detection



Protecting lives. Protecting assets. Protecting property.
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Foreword

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

Aspirating Smoke Detectors can be an important component of a well-designed fire alarm system. Their unique capabilities enable Aspirating Smoke Detectors to overcome many limitations of other detection types in business critical, large open areas, aesthetically sensitive and in harsher environments. This guide has been developed to help give you an understanding of the Aspirating Smoke 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 Aspirating Smoke Detectors. Reference should always be made to the detector manufacturer’s installation requirements and instructions and local standards.

Glossary of terms

Aspirating Smoke Detector

A detector that continuously draws air through a network of sampling pipes to detect smoke particles. Aspirating Smoke Detectors provide continuous coverage and are ideal for monitoring large or complex areas, such as warehouses, data centres and industrial facilities.

FIA CoP for ASD systems

The Fire Industry Association Code of Practice for ASD systems provides recommendations for the planning, design, installation, commissioning and maintenance of aspirating smoke detection systems. It identifies categories of ASD systems and typical applications

where such systems are used. It also provides specific design rules on common applications and guidance on good practice.

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.

Integrating or cumulative effect

When combustion aerosols are drawn into multiple sampling points, their cumulative effect increases the sensitivity of the ASD compared to aerosols entering a single sampling point.

Glossary of terms

Maximum transport time

The maximum time taken for combustion aerosols to travel through the ASD pipework from the most remote sampling point to the smoke sensing element.

Point or Spot 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.

Sampling pipe network

A core component of an Aspirating Smoke Detection system, installed into the protected area and designed to transport air samples to the ASD.

Response time

The elapsed time from the point at which combustion aerosols are generated at the source to the point at which their presence is indicated by the ASD.

Note: This includes the time for aerosols to reach the sampling points, the transport time through the pipe network and the analysis time within the ASD and is typically determined during performance testing.

Detector coverage

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

Performance test

A practical verification that confirms the system detects combustion aerosols within the required response time and sensitivity by conducting smoke tests at defined locations and measuring the system’s response against the intended detection objective.

Detection class

EN54-20, the European standard to which ASD systems are approved, classifies three classes of ASD: Class A (Very High Sensitivity), B (Enhanced Sensitivity) and C (Normal Sensitivity). These classes are explicitly referenced in BS 5839-1, BS 6266 and the FIA Code of Practice to support the appropriate

selection and application of ASD systems.

NFPA takes a comparable approach by describing detection objectives as Very Early Warning (VEWFD), Early Warning (EWFD) and Standard Detection (SFD). However, NFPA does not reference a single core product classification standard equivalent to EN54-20.

Glossary of terms

Sampling point

A defined opening in the ASD sampling pipework through which air from the protected area is drawn and transported to the detector for analysis.

Primary detection

An arrangement of sampling pipework and sampling holes positioned where smoke is most likely to travel or accumulate. Typical locations include the air-intake grilles of air-handling units (AHUs) and pressure-relief vents (PRVs).

Secondary detection

An arrangement of sampling pipework in which the sampling points are positioned as an alternative to Point-type Smoke Detectors. Sampling holes are therefore located in accordance with the relevant national or international standards. These are maximum spacing requirements and may be improved through performance-based design.

Who should read this guide?

You should read this guide if:

- You specify or design fire detection systems.
- Your role is to support or sell fire detection systems.
- You are responsible for your building's fire protection system.
- You work in the fire and rescue service.
- You are the Fire Marshall for your workplace.
- The guide offers general guidance; you should also consult local and national regulations and the manufacturer's technical specifications for particular detectors.**
- You are planning to install an Aspirating Smoke Detector or other smoke detection system.
- You are in a risk assessment role for fire protection.

ASD applications:
Warehouses



What is Aspirating Smoke Detection (ASD)?

Aspirating Smoke Detection (ASD) continuously draws a small amount of air from the protected area through a network of sampling pipes. Air enters the system via calibrated sampling holes, typically positioned in locations comparable to traditional Point or Spot Detectors.

Unlike Point Smoke Detectors, which monitor smoke density at a single fixed location, ASD provides continuous monitoring across a defined area or along a specific path. This makes ASD particularly effective in environments where smoke dilution or stratification is common and where earlier warning is required because Point Detectors may not perform reliably.

ASD applications:
Storage facilities

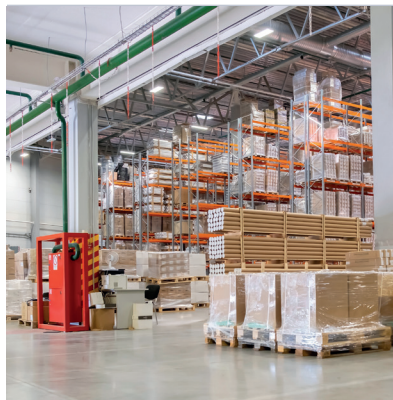


How does ASD work?

Aspirating Smoke Detection (ASD) systems continuously monitor air drawn from the protected area for smoke, from the earliest incipient stage through smouldering, flaming and fully developed fire conditions. Multiple alarm thresholds can be configured to provide warning at each stage of fire development.

Detection is achieved using a highly sensitive optical sensing chamber. A small sample of the air drawn through the pipe by an onboard fan or aspirator is analysed using advanced blue / ultraviolet sensing technology, providing both high sensitivity and a wide detection range, typically from 0.05% to 25% obs/m.

ASD is particularly effective in large or complex environments, including data centres, warehouses, atria and aesthetically sensitive buildings, as well as areas where conventional detection may operate unreliably or provide insufficient warning to prevent loss or damage.



Did you know?

Aspirating Smoke Detection is ideal for protecting large open spaces such as logistics warehouses.

Unlike traditional Point Detectors, ASD continuously and actively senses smoke levels across the entire area, providing early warning without the need for multiple sensors.

A single ASD can protect an entire fire zone, significantly reducing the number of individual devices that need to be installed and maintained.

Types of ASD

All ASD systems operate on the same basic principle, however different ASD classes are available to meet specific application and performance requirements.

- **Class A** ASD systems provide Very Early Warning at the very first stage of a fire, the incipient stage. They are capable of detecting highly diluted, cold smoke that is often invisible to the naked eye. These systems are typically installed in business-critical environments such as data centres, telecommunications facilities and industrial processing equipment rooms.
- **Class B** ASD systems provide Early Warning at the smouldering stage of a fire. They are well suited to large open spaces such as warehouses, shopping centres and atria, where smoke dilution is common. In these environments, Class B systems can be supplemented with low cost vertical sampling runs, overcoming smoke stratification by penetrating through thermal layers.
- **Class C** ASD systems provide detection performance comparable to Point Smoke Detectors, while retaining the inherent advantages of aspirating systems. These include improved accessibility for maintenance, fewer installed devices and a lower overall cost of ownership.



- **Class A+B+C** ASD systems provide all three classes of detection within a single device. This simplifies product selection where multiple levels of detection performance are required within the same application. For example, in a data centre, Class A detection can be used to alert staff to abnormal background smoke levels at the incipient stage. Later alarm thresholds, such as Class C, can then be used to initiate fire response actions, including firefighting intervention or automatic fire suppression.

Sensis ASD systems provide all classes of detection from a single platform, supporting staged warning and response without the need for multiple detector types.

Sensis ASD models

Feature	Programmable
Smoke detection range	
Sensis Azure	0.001-25% obs/m
Sensis Cobalt	0.02-25% obs/m
Sensis Indigo CSD	0.02-25% obs/m
Alarm sensitivity range	
Sensis Azure	0.005-20% obs/m
Sensis Cobalt	0.01-20% obs/m
Sensis Indigo CSD	0.1-12.5% obs/m
Maximum sample pipe length	
Sensis Azure 2000s – Branched	4 x 240 m/787½ ft
– Linear	4 x 100 m/328 ft
Sensis Azure 500s – Branched	1 x 240 m/787½ ft
– Linear	1 x 100 m/328 ft
Sensis Cobalt HM2 – Branched	2 x 260 m/853 ft
– dual pipe unit – Linear	2 x 105 m/344½ ft
Sensis Cobalt HM1 – Branched	1 x 260 m/853 ft
– single pipe unit – Linear	1 x 105 m/344½ ft
Sensis Indigo CSD	1 x 30 m/98½ ft
Number of sample holes (Class A, B, C)	
Sensis Azure 2000s	40/60/100
Sensis Azure 500s	30/60/60
Sensis Cobalt HM2 – dual pipe unit	12/32/64
Sensis Cobalt HM1 – single pipe unit	6/16/30
Sensis Indigo CSD	2/4/4

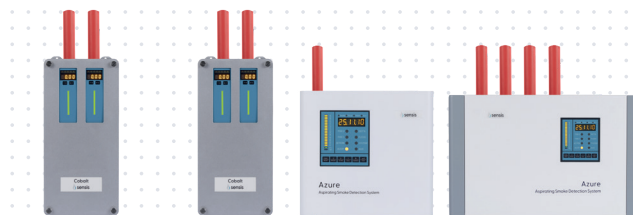
Feature	Programmable
Number of alarms	
Sensis Azure 2000s 4A16 (addressable)	4 alarms per pipe
Sensis Azure 2000s	4 alarms
Sensis Azure 500s	4 alarms
Sensis Cobalt HM2 – dual pipe unit	2 alarms*
Sensis Cobalt HM1 – single pipe unit	1 alarm*
Sensis Indigo CSD	1 alarm*
Number of relays	
Sensis Azure 2000s 4A16 (addressable)	7 + 16 (4 per pipe) (configurable)
Sensis Azure 2000s	7 (configurable)
Sensis Azure 500s	7 (configurable)
Sensis Cobalt HM2 – dual pipe unit	4 (configurable)
Sensis Cobalt HM1 – single pipe unit	2 (configurable)
Sensis Indigo CSD	2 (configurable)
Area coverage	
Sensis Azure 2000s Class C	2,000 m²/21,528 ft
Class A	1,000 m²/3,281 ft
Sensis Azure 500s Class C	1,860 m²/20,021 ft
Class A	750 m²/2,461 ft
Sensis Cobalt HM2 – dual pipe unit Class C	2,000 m²/6,562 ft
Class A	300 m² (12 holes x 25 m²)
Sensis Cobalt HM1 – single pipe unit Class C	1,600 m²/5,249 ft
Class A	150 m² (6 holes x 25 m²)
Sensis Indigo CSD Class C	100 m²
Class A	50 m² (2 holes x 25 m²)

*1 alarm outputs plus 1 fault or 2 for the HM2, these alarm outputs are configurable as, Alert, Action, Fire 1 or Fire 2 thresholds. Please refer to relay table above for the number of physical alarms that can be interfaced.

Sensis ASD models



Model	Sensis Indigo CSD-H10 (smoke only)	Sensis Indigo CSD-H11 (smoke + CO)
Conventional	✓	✓
Addressable	✓	✓
Optional Auxillary Sensors	✓	✓
Sensitivity	0.02-25%/m	0.02-25%/m
Pipe length (linear/branch)	30/40 m (solid or capillary)	30/40 m (solid or capillary)
No. sampling holes (Class A/B/C)	2/4/4	2/4/4
Pipe addressability	✗	✗
SSL Algorithm	✓	✓
Relay output	2	2
Expansion relays (optional)	4	4
3-in-1 display	✓	✓
No. of aspirators	1	1
Internal filter	✗	✗
EN approval	✓	✓
FM approval	Imminent	Imminent



Sensis Cobalt HM1	Sensis Cobalt HM2	Sensis Azure 500s	Sensis Azure 2000s
✓	✓	✓	✓
✓	✓	✓	✓
✓	✓	✓	✓
0.02-25%/m	0.02-25%/m	0.001-25%/m	0.001-25%/m
105/260 m	210/520 m	100/240 m	400/960 m
6/16/30	12/32/64	30/60/60	40/60/100
✗	✓	✗	✓
✓	✓	✓	✓
2	4	7	7
4	8	N/A	16
✓	✓	✓	✓
1	2	1	4
✗	✗	✓	✓
✓	✓	✓	✓
Imminent	Imminent	✓	✓

How do ASD systems differ from other technologies?

Aspirating Smoke Detection (ASD) systems are a specialised form of Optical Smoke Detector. Unlike traditional detectors, ASD systems monitor smoke levels at several sampling points throughout the protected area, rather than focusing on a single location. These systems operate actively, drawing air from the environment using a network of sampling pipes and directing it to a detection chamber for analysis.

Point or Spot type Optical Detectors function as passive devices. They depend on smoke naturally drifting into a fixed sensing chamber to detect the presence of fire. These detectors require a relatively high concentration of smoke in their immediate vicinity to trigger an alarm. Consequently, their effectiveness can be compromised in situations where smoke is diluted or unevenly distributed across the area.

Both ASD systems and Optical Beam Detectors are categorised as integrating detectors. Optical Beam Detectors measure smoke obscuration along the entire path of the beam, whilst ASD systems integrate the smoke sampled from multiple holes distributed throughout the protected environment. This approach ensures comprehensive coverage and detection sensitivity.



Beam Detectors perform more reliably in conditions where smoke is diluted compared to Point Detectors. However, the installation of Beam Detectors requires a clear line of sight and precise alignment. Although fewer Beam Detectors may be needed for coverage compared to Point Detectors, ASD systems deliver superior detection performance. Furthermore, ASD systems offer a lower cost of ownership, as a single ASD device can protect an entire fire zone.

How should ASD systems be designed and installed?

Following the guidelines below will maximise the performance of Aspiring Smoke Detectors and minimise the occurrence of faults and false alarms:

- 1** Establish performance criteria and validation or testing methods at the outset. This will guide your design strategy and determine important factors such as sample pipe separation, hole spacing, installation and commissioning efforts and specific details like alarm thresholds.
- 2** When used to protect business critical areas requiring Class A (Very Early Warning), adopt an engineered approach to design and application. Consider smoke dilution and effects of HVAC systems on smoke behaviour. Always achieve design compliance in accordance with local codes and standards by applying Secondary Detection but enhance the design to include sample pipe in locations where you know the smoke will travel to, such as Primary Detection across return or exhaust air vents. This enhanced approach is covered comprehensively in guidance documents such as the FIA Code of Practice for ASD systems, BS 6266 and NFPA 76.



- 3** For Class C, normal sensitivity applications where deemed to comply is the main goal, position sample holes where you would normally place Spot or Point type Smoke Detectors. However, always consider environmental factors that may affect detection performance, for example thermal layering in high ceiling areas such as warehouses. You may want to elevate the design to an engineered approach; for instance, installing vertical sample pipes inside racking to counteract smoke stratification. Implementing a Class B Early Warning protocol can also help make fuller use of ASD's broad sensitivity range and multiple alarm thresholds. The FIA Code of Practice for ASD systems offers excellent advice on applying these strategies across a wide range of applications.

How should ASD systems be designed and installed?

- 4 ASD provides flexibility, allowing detector placement almost anywhere, but consider power supply and integration with your host system for cost effective alarm and fault reporting. Be mindful of the maximum length of sample piping allowed, as extended runs can reduce detector efficiency and increase response time. Assess whether access for maintenance personnel is limited or if conditions lie outside the detector's humidity and temperature range. In these cases, install the detector outside the protected area, ensuring you vent the detector exhaust back into the protected space if there are differences in air pressure.
- 5 Object detection with ASD is straightforward, though designing these systems may require specialised knowledge or test simulations to set the right sensitivity class (A, B, or C). Typically, the level of risk supports the use of enhanced Class B or very high sensitivity Class A systems.
- 6 Insist on SensisFlow performance modelling for all designs to validate that they are within the product specifications and that they achieve the intended detection class or classes.



- 7 Use manufacturer-approved pipe and fittings where possible. For specialised environments like food processing or clean rooms, metal pipes such as copper or stainless steel may be necessary.
- 8 Consider ambient conditions (temperature, humidity, dust) and ensure detectors are rated for these conditions. Use air conditioning measures – filters, water traps, heaters or coolers – to maintain sample air within ASD specifications.

Guidance – The FIA Code of Practice and British Standards

Route to compliance

The Fire Industry Association Code of Practice for ASD systems (FIA CoP) provides guidance on the route to compliance (Prescriptive or Performance based). It refers to British Standards (BS) for prescriptive compliance and additionally, provides guidance on performance tests in Appendix A to validate both prescriptive and performance-based compliance.

Detection classes

ASDs are designed and installed as class A, B or C systems or a combination of classes. Examples:

- **Class A** Secondary detection at ceiling level conforming to BS6266 sample hole spacing.
- **Class B or C** Secondary detection at ceiling level conforming to BS5839 sample hole spacing.

Note that the highest class must be achieved if more than one class is the goal.

Area coverage and hole spacing:

An ASD may cover up to one BS fire zone on the basis that failure of a single device or component may not affect more than 2,000 m² (21,528 ft²).

Secondary hole spacing is arranged such that the air sampling points are sited and spaced as an alternative to Point type Smoke Detectors. Sampling holes are therefore positioned in accordance with the relevant standard BS6266 or BS5839.

For ease of design, a typical coverage guideline is 100 m² (1,076 ft²) per sampling hole for Class B and C systems under BS5839 and 25 m² (269 ft²) per sampling hole for Class A systems under BS6266.

Guidance – The FIA Code of Practice and British Standards

Ceiling height limits

The FIA CoP recognises that historically the stated Point Detector limits in British Standards are conservative for ASD systems. Independent testing has confirmed that a Class C ASD system with 20 sampling holes at a height of 43 m (141 ft) can detect small fires relative to the space (<500 kW). Updated recommendations are therefore given below. These have been adopted by some national codes and may be used to justify a departure from more conservative requirements.

Detector type	Generally applicable max. ceiling height	10 % of ceiling height no greater than
Any ASD system approved to Class A, B or C (at least 2 holes – see 10.1.1)	10.5 m (34½ ft)	12.5 m (41 ft)
ASD system with: at least 5 Class C holes or at least 2 Class B holes	15 m (49¼ ft)	18 m (59 ft)
ASD system with: at least 15 Class C holes or at least 5 Class B holes	25 m (82 ft)	28 m (91¾ ft)
ASD system with: at least 15 Class B holes	40 m (131¼ ft)	43 m (141 ft)

Where any such variation is proposed, the associated risk should be assessed and performance testing considered to confirm acceptable system response.

Power supplies

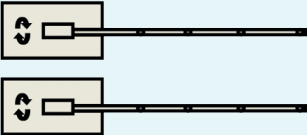
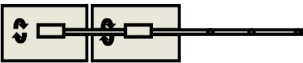
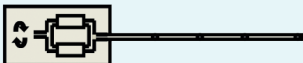
The power to an ASD should be supplied by a power supply unit (PSU) complying with EN 54-4. The PSU should be installed in accordance with local wiring regulations. In the UK, it should be installed to meet the requirements BS 5839-1 and BS 7671.

Fire suppression

It is common practice to use ASD to provide part or all of the smoke detection in areas where automatic extinguishing may be released to suppress or extinguish fires.

These are typically Class A+C systems providing both Very Early Warning and Standard Warning for suppression activation. This often requires coincidence detection to avoid false operation and unnecessary extinguishant release. A variety of coincidence arrangements is possible using ASD systems.

Guidance – The FIA Code of Practice and British Standards

Description	Figure	Comments	Consideration	Disadvantages	Example
Scheme A Two ASD systems protect the same area with independent aspirator, detector and pipe networks.		All system components are duplicated with independent detector, fan and sampling pipe systems. Coincidence or redundancy (not both).	Coincidence achieved from at least two sampling locations.	More equipment required: expensive.	Critical category risks such as Internet Hosting Centres or Nuclear/ Biological Control Rooms.
Scheme B Two ASDs protect the same area with independent aspirator, detectors and a shared pipe network.		ASDs are duplicated: redundancy (excluding shared pipe work). Coincidence from independent detectors.	Smoke at a single location could trigger suppression.	Shared sampling pipe network.	High category risks such as Main IT Facilities or Telecomms Areas.
Scheme C A single ASD with two detectors protects the risk with a shared pipe network and shared aspirator.		Detector modules are duplicated; redundancy is achieved.	Smoke at a single location could trigger suppression.	Shared pipe work and aspirator fan.	Medium category risks such as Call Centres.
Scheme D A single ASD with two detectors protects the risk with separate pipe networks.		Coincidence from independent sampling pipe networks and detector modules.	Fan is not redundant.	Shared aspirator fan.	Medium category risks such as Call Centres.

Guidance – The FIA Code of Practice and British Standards

Commissioning

The installation must be inspected to ensure that it meets original design criteria and is installed according to SensiFlow modelling calculations. Compliance to the relevant BS should also be ensured and deviations noted. Smoke transport time should be validated against performance calculations by introducing a small amount of smoke into the last sample hole. Performance testing should be conducted wherever possible to ensure that smoke will reach sample hole locations and performance should be recorded. The FIA CoP provides excellent guidance on suitable smoke tests covering a wide array of scenarios.

Type	Application	Response Class A	Response Class B	Response Class C
Primary	Clean room, Telco or computer facility (ceiling <3 m/10 ft)	2 m/6½ ft PVC wire (E.2)	1 m/3¼ ft PVC wire (E.1)	7-9 g/l½ oz pellet (B.1)
	Other (inc. open areas and high ceilings)	1 m/3¼ ft PVC wire (E.1)	7-9 g/l½ oz pellet (B.1)	13-18 g/l½ oz pellet (B.2)
Secondary	Low ceilings (<3 m/10 ft)	2 m/6½ ft PVC wire (E.2)	1 m/3¼ ft PVC wire (E.1) Paper Chimney (C.1)	7-9 g/l½ oz pellet (B.1) Paper Chimney (C.1) Poly'mat (G) Pot' Lactose (H)
	Normal ceilings (up to 20 m/65½ ft unless otherwise stated)	7-9 g pellet (B.1) Paper Bin (C.2 @ 30%)	13-18 g/l½ oz pellets (B.2) Paper Bin (C.2 @ 50%)	2 x 13-18 g/l½ oz pellets (B.3) Paper Bin (C.2) Poly' mat (G) Pot' Lactose (H)
	High ceilings (>20 m/65½ ft)	N/A	2 x 13-18 g/l½ oz pellets (B.3) Paper Bin (C.2 @ 50%)	Paper Bin (C.2) Pot' Lactose (H)
Localised	Custom test to reflect risk - otherwise use...	2 m/6½ ft PVC wire (E.2)	1 m PVC wire (E.1)	7-9 g/l½ oz pellet (B.1) Poly'mat (G) Pot' Lactose (H)
In-cabinet	Vented/cooled	2x12 ohm for 80 sec (F.3)	2 m/6½ ft PVC wire (E.2)	1 m/3¼ ft PVC wire (E.1)
	Unvented >3 m³/10 ft³	12 ohm for 70 sec (F.2)	2x12 ohm for 80 sec (F.3)	2 m 2 m/6½ ft PVC wire (E.2)
	Unvented <3 m³/10 ft³	12 ohm for 8 sec (F.1)	12 ohm for 70 sec (F.2)	2x12 ohm for 80 sec (F.3)
Duct	For smoke generated in Duct	2 m/6½ ft PVC wire (E.2)	1 m/3¼ ft PVC wire (E.1)	7-9 g/l½ oz pellet (B.1)
	For smoke generated in the room*	1 m/3¼ ft PVC wire (E.1)	7-9 g/l½ oz pellet (B.1)	13-18 g/l½ oz pellets (B.2)

NFPA 72, 75 and 76 guidance

NFPA 72

Section 3 explicitly recognises Aspirating Smoke Detection by defining ASD as a system that draws air through a piping network to a sensing chamber. It is described as an Air-Sampling-Type Smoke Detector in the standard.

Section 17 covers aspects such as design, installation and application of ASD systems and notes that each sampling port must be treated as a Spot-type Smoke Detector for spacing and location, unless a performance-based design is used. The standard highlights that Performance-Based design is commonly used with high-sensitivity ASD systems.

NFPA 72 also references NFPA 75 and 76 which specifically address Early Warning in Data processing and Telco by using ASD.

NFPA 75

The standard doesn't explicitly mention ASD but it permits and strongly aligns with Early Warning Fire Detection as a requirement for IT equipment areas which in practice is commonly implemented using aspirating smoke detection systems installed to NFPA standards.

Furthermore, Section 8 states that:

- Detection equipment shall be a listed smoke detection-type system and shall be installed and maintained in accordance with NFPA 72. This explicitly allows ASD, as they are listed smoke detection systems under NFPA 72.
- Fire detection in IT equipment rooms is intended to provide early warning rather than life safety coverage alone. This objective closely aligns with very early warning ASD systems.

NFPA 75 does not mandate a detector technology, only the performance outcome of early detection.

Aspirating Smoke Detectors are commonly used because they:

- Detect incipient and pre combustion smoke.
- Perform well in high airflow environments such as data halls and under floor plenums.
- Support staged alarms before suppression release.

NFPA 72, 75 and 76 guidance

NFPA 76

Unlike NFPA 75, NFPA 76 explicitly defines Very Early Warning Fire Detection and Early Warning Fire Detection, which are typically implemented using aspirating (air sampling) smoke detection systems.

NFPA 76 establishes three levels of fire detection:

- Very Early Warning Fire Detection (VEWFD).
- Early Warning Fire Detection (EWFD).
- Standard Fire Detection.

VEWFD systems are intended to detect low energy, incipient fire before they threaten services. EWFD systems provide earlier notification than standard smoke detection and are suitable where service continuity is critical.

NFPA 76 places explicit limits on sensor and sampling point coverage, which directly maps to aspirating systems:

- Maximum 200 ft² per sensor or sampling port.
- If two levels of detection are provided (high and low), coverage may increase to 400 ft² per level.

NFPA 76 directly refers to ASD systems via VEWFD and EWFD definitions and performance criteria.

NFPA 76 is performance based and explicitly written around the capabilities of aspirating smoke detection. Among NFPA standards, NFPA 76 is the clearest and strongest endorsement of aspirating smoke detection for mission critical environments.

FM guidance

FM Global Data Sheet 5-48 (Automatic Fire Detection) references Aspirating Smoke detection:

Within Data Sheet 5-48, Aspirating Smoke detection is addressed under section 2.2.3 – Smoke Detectors.

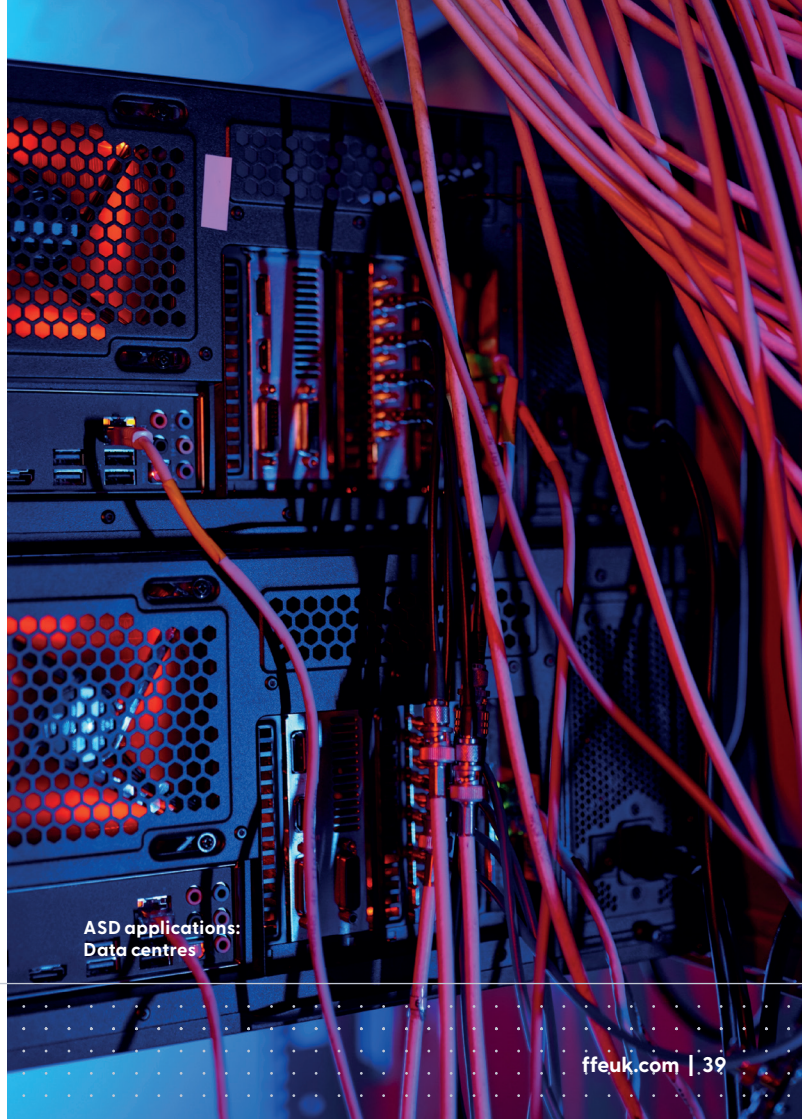
The document addresses smoke actuated detection technologies, including:

- Spot type Smoke Detectors.
- Beam Detectors.
- Air Sampling (Aspirating) Smoke Detectors.

The data sheet acknowledges air sampling systems as a form of smoke actuated fire detection, particularly suitable for:

- High airflow areas.
- Large or tall spaces.
- Mission critical facilities where early or very early warning is required.

Aspirating Smoke Detection systems are recognised by FM Global as smoke-actuated fire detection systems under Data Sheet 5-48 and may be applied where early detection is required in high-airflow or large-volume spaces, provided systems are FM Approved and installed in accordance with NFPA rules.



ASD applications:
Data centres

What process do you follow for design and installation?

1

Define the detection objectives

Identify the underlying driver for selecting ASD:

- When operational uptime and service availability are critical: Typical EN 54-20: Class A / VEWFD. Often includes Class C / Standard detection for confirmed fire condition.
- When smoke behaviour or building dynamics make conventional detection ineffective: Typical EN 54-20: Class A or B / VEWFD or EWFD.
- When the protected space is difficult or disruptive to access for ongoing maintenance: Typical EN 54-20: Class C or B / EWFD or Standard smoke detection.
- When detection must be visually discreet or resistant to interference: Typical EN 54-20: Class B or C / EWFD or Standard smoke detection.
- When occupant movement or evacuation is complex, slow, or high impact: Typical EN 54-20: Class B or A / EWFD or VEWFD.

- When fire suppression systems are installed and an unintended or unnecessary discharge would be costly, disruptive, or damaging: Typical EN 54-20: Class A and C / VEWFD and Standard smoke detection.
- When environmental conditions challenge conventional detectors, such as dust, humidity, temperature extremes: Typical EN 54-20: Class C or B / Standard detection or EWFD.

Several of the above drivers may apply.

Establish what the system must achieve

- Class A (Very early warning), Class B (Early warning), Class C (standard sensitivity) detection or a combination of detection classes.
- Protection of people, assets, processes, or service continuity.

This drives sensitivity, sampling density and alarm strategy.

What process do you follow for design and installation?

2 Understand the protected environment

Collect environmental and operational data:

- Space size, height and geometry.
- Airflow direction, velocity and air change rate.
- Obstructions, equipment layout and cable routing.
- Contaminants such as dust, humidity, fumes or cold air.

Identify where smoke is most likely to appear and where it will travel.

3 Select the ASD system type

Choose a system appropriate to the objective and environment:

- Single pipe or multi pipe.
- Zonal or pipe addressable.
- Sensitivity range and alarm staging capability.

4 Design and model the sampling pipe network

Key design elements:

- Sampling hole and pipe locations based on standards guidance and smoke movement.
- Number of holes per pipe.
- Hole diameter sizing to balance airflow.
- Maximum pipe length and branch lengths.
- Transport time from furthest sampling point to detector.
- Balanced airflow across all branches.

Design outcome:

- Smoke at any sampling point reaches the detector reliably and quickly.
- All sampling points operate within the detector's sensitivity range.

Model the design:

- Transport time meets system capability.
- Required sensitivity is achieved at the sampling points.
- Alarm thresholds align with the fire response strategy.

This is proven using SensisFlow calculation software.

What process do you follow for design and installation?

5 Produce design documentation

Prepare a complete design package:

- Pipe routing drawings.
- Sampling point locations and hole sizes.
- Detector selection and settings.
- Cause and effect or alarm logic.
- Performance calculations.

This documentation supports approvals, installation and future maintenance.

6 Install pipework

- Use approved pipe material and fittings.
- Follow the design exactly, especially hole sizes and locations.
- Maintain correct support and spacing.
- Clearly label pipework as smoke detection sampling pipe.

Accuracy at this stage is critical. Small deviations change performance.

7 Install the detector and interfaces

- Mount detectors in accessible locations.
- Connect power, communications and outputs.
- Install filters and airflow monitoring components
- Ensure exhaust air is correctly routed.

8 Configure and commission

- Configure airflow setpoints.
- Configure alarm thresholds and delays.
- Verify pipe integrity and airflow balance.
- Test smoke response at representative sampling points.
- Confirm fault conditions report correctly.

No commissioning should be accepted without functional smoke testing.

9 Handover and lifecycle planning

Provide:

- As built drawings.
- Configuration and sensitivity settings.
- Commissioning records.
- Inspection and maintenance requirements.
- Operator training if required.

What process do you follow for design and installation?

10 Tools required

Design tools:

- SensisFlow ASD pipe network modelling software.
- CAD software or pen and paper for simple layouts.
- Airflow drawings or building services information where available.

Installation tools:

- Pipe cutters and deburring tools.
- Calibrated drill bits for sampling holes.
- Measuring tools and alignment tools.
- Approved pipe solvent cement or connectors.
- Identification labels for pipework.

Commissioning tools:

- SensisTool ASD configuration and diagnostic software (not essential).
- Portable computer or service terminal (not essential).
- Smoke test equipment suitable for ASD systems. Refer to the FIA CoP Appendix A for guidance.

Typically, but not limited to:

- Hot wire tester for Class A / VEWFD data centres, IT, clean rooms or Telecoms.
- Smoke pellets and hot plate for Class B and C / EWFD and standard sensitivity applications.
- Multimeter and signalling test equipment.

11 Key principles

- ASD design is often performance based, not merely prescriptive.
- Pipe network design is as important as detector selection.
- SensisFlow modelling software is essential for correct design.
- Installation accuracy directly affects detection reliability.

Commissioning must verify airflow, sensitivity and detection response.

How should ASD systems be maintained?

Like all fire detection systems ASDs must undergo routine maintenance to maintain optimal performance and minimise the risk of false alarms. In numerous jurisdictions, such maintenance may be mandated by law; although ASDs are often regarded as low-maintenance devices, they still require consistent upkeep and should not be considered maintenance-free.

The frequency and method of maintenance should be clearly documented for each installation and determined by a risk assessment that should include consideration of at least the following:

- Equipment installed in dirty conditions will need to be checked more thoroughly and at more frequent intervals than that in clean and dry situations.
- The class of the system.
- Value or extent of the risk.
- Detector technology employed.
- Manufacturer's recommendations.
- Practicalities of performing safe and compliant maintenance/testing of sampling points removing the need to work at height or in confined spaces to reduce risk.



Maintenance

The FIA CoP and manufacturers documents provide detailed maintenance recommendations. The guidance provided here focuses on testing, that is significant to the ongoing performance of ASD systems.

Maintenance should be undertaken at least annually. More frequent maintenance may be required where the ASD system operates in dirty or dusty environments, or where this is indicated by the risk assessment. The maintenance regime adopted for a specific premises should be appropriate to its use and operating conditions.

Routine testing

Maintenance and functional testing should be carried out in accordance with the ASD manufacturer's instructions and performed by a suitably trained and competent person.

How should ASD systems be maintained?

Functional testing

The objective of the functional test of a system is to ensure that the ASD and its associated pipework are still operational.

- Verify transport time from the furthest hole or a maintenance test point by introducing a small smoke sample and time how long it takes to reach the detector. Note that the detector merely needs to see a background change in smoke value, you are not measuring the time to alarm, only how long it takes to travel down the entire length of each pipe run. Compare the transport time to that recorded during commissioning and investigate major changes.
- Confirm that flow monitoring can detect the loss of sampling points that are deemed to be acceptable for the risks involved.

Performance testing

While it is noted that repeating the commissioning smoke test is not always practical, it is nevertheless a very effective way of validating the ongoing performance of ASD systems and should be performed wherever possible, particularly where the ASD was installed to provide very early or early warning.

The objective of performance testing is to validate the detection performance of the system, not just the Detector, considering factors that affect how smoke behaves in the environment. Maintenance performance testing highlights deviation from the original commissioning tests brought about by changes in the protected area, such as:

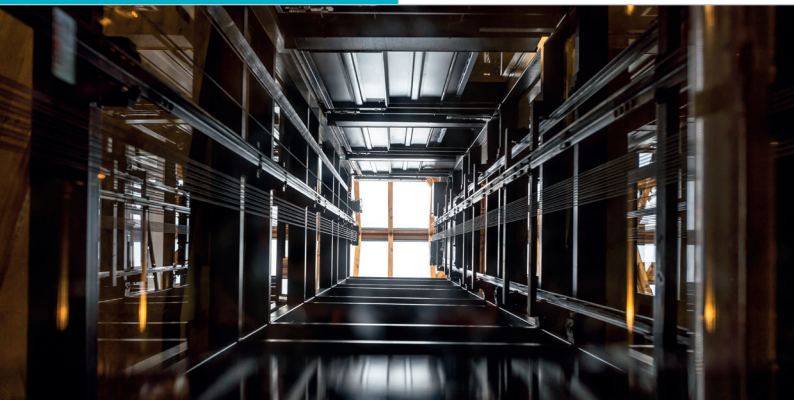
- Changes to the use of the premises.
- Changes to the layout of the premises.
- Introduction of new processes or changes to existing processes.
- Changes to the internal environment, such as installation of new air-conditioning.
- Changes to the external environment, such as an increased level of background diesel fumes or increased levels of exhaust from another building in close proximity.

The performance smoke test and its results should be found in the commissioning documents. If not, guidance on suitable tests can be found in Appendix A of the FIA CoP.

Where can you install them?

Did you know?

Aspirating Smoke Detector sampling pipe is not only able to protect spaces horizontally. They are often installed to protect vertical installations such as lift shafts and racking in high bay warehouses, instead of a more complex installation of Point Detectors.



Applications

Large spaces

- Warehouses and logistics facilities
- Aircraft hangers
- Lift shafts
- Sports halls
- Theatres

Heritage, cultural and prestigious buildings

- Museums
- Galleries
- Archives
- Modern buildings

Industrial buildings

- Manufacturing facilities
- Mining operations
- Electrical rooms

Restricted access

- Mass transit terminals
- Manufacturing sites
- Inaccessible voids

Critical process areas

- Data centres
- Telecommunications
- Clean rooms
- Semiconductor manufacturing
- Pharmaceutical production

Transport infrastructure

- Stations
- Control rooms
- Airport terminals and baggage handling

Which Detector works best?

Application	Fire characteristics	Typical preferred detection approach
Small, straightforward rooms with easy access	ASD may add unnecessary pipework and design complexity where very early warning or remote maintenance is not required.	Point Smoke Detectors
Very dusty or heavily contaminated environments	High contamination may increase filtration and maintenance requirements. The environment should be assessed before selecting smoke detection.	Heat, Flame or Linear Heat detection
Outdoor or open-sided areas with unpredictable airflow	Smoke may disperse before it reaches the sampling points, making reliable smoke detection difficult.	Flame or Heat detection
Risks involving rapidly developing flames	Where flame is expected to be the first reliable fire signature, direct flame detection may provide a faster response.	Flame Detectors
Localised overheating along cables, conveyors or machinery	The primary fire signature may be heat developing along a defined route rather than airborne smoke.	Linear Heat detection
Large, clear open spaces requiring standard smoke detection	Where very early warning, discreet sampling or remote maintenance is not required, another technology may provide a simpler solution.	Optical Beam Smoke detection



Notes

Further information

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

For details contact
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