ASPIRATING SMOKE DETECTION

Pinpoint Fire Risk, Earliest Possible

AVA PREVENT

Aspirating Cabinet Smoke Detection

Our Company and Products

Established in Taiwan for more than 15 years, AVA Prevent is a manufacturer of Aspirating Smoke Detectors with headquarters in New Taipei City, representation offices in Taichung, Kaohsiung, and a branch office in Shanghai, China. Our experienced team is not only responsible for the R&D and manufacture of our own products, but also provides technical support on the installation, commissioning and maintenance for our clients, in Taiwan.

In regard to the international market, not only we guarantee our services through our main distributors situated across the world, as we provide, additionally, OEM and ODM services.

The quality of our products are certified under the FM Approval in U.S., EN54-20 in Europe, CCCF in China, and KFI in Korea.

2024 QUARTAS-500s, QUARTAS-2000s obtained the EN54-20 certification — EN54-20

2022 Released a new generation of the CSD and ASD series

2020 QUARTAS-500s, QUARTAS-2000s approved by KFI Korea Fire Institute — KFI

2018 FM APPROVED — QUARTAS-500s, QUARTAS-2000s gained FM Approval

2017 First OEM and ODM project.

2014 QUARTAS-500, QUARTAS-2000, FANFARE-2000 gained China CCCF certification.

2013 New Model QUARTAS-2000 Four Pipes Scanning ASD were launched.

2012 FM APPROVED — QUARTAS-500 gained FM Approval. AVA Prevent (Shanghai) CO., Ltd. was founded in Shanghai.

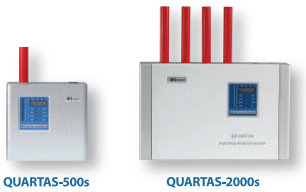
2011 QUARTAS-500 Single Pipe ASD and FANFARE-2000 Four Pipes/Four Detectors ASD were launched.

2010 QUARTAS-500 and FANFARE-2000 were certified by China National Centre of Quality Supervision and Testing. — CCCF

2009 AVA PREVENT was founded in Taiwan. Launched AVA's first model CSD-100, the world's first Cabinet Smoke Detector especially designed for Electrical Cabinet Fire Detection with Addressability to pinpoint the fire source

2008 R&D Started

QUARTAS series Aspirating Smoke Detector



QUARTAS-500s QUARTAS-2000s

FM APPROVED KFI EN54-20

QUARTAS Features	QUARTAS-500s	QUARTAS-2000s
Sensitivity	0.001~25%/m	
SSL Intelligent Algorithm	Yes	
3 in 1 Front Display	Yes	
RS 485 Network, Modbus RTU	Yes	
Relay Output (Configurable)	7	
Expansion Relays (Optional)	N	16
GPI (Configurable)	4	8
10-speed adjustable aspirator	1	4
Pipe Length (Linear/Branch)	100/240	400/960
No. of Sampling Holes (Class A/B/C)	30/60/60	40/60/100
Pipe Addressability	N	Yes (Pipe Scan)

FANFARE series Aspirating Smoke Detector

New Generation

VM1 VM2 VM4

Pipe Scan Adressability
Independent Aspirators

FANFARE Features	VM1	VM2	VM4
Sensitivity	0.001~25%/m		
SSL Intelligent Algorithm	Yes		
3 in 1 Front Display	Yes		
RS 485 Network, Modbus RTU	Yes		
Relay Output (Configurable)	3		
Expansion Relays (Optional)	3	8	8
GPI (Configurable)	1	1+2*	1+2*
10-speed adjustable aspirator	1	2	4
Pipe Length (Linear/Branch)	105/260m	210/520m	420/1040m
No. of Sampling Holes (Class A/B/C)	30/56/56	30/56/112	30/56/120
Pipe Addressability	N	Yes (Pipe Scan)	

Note*: Additional GPI is one the optional Expansion IO Board

HERCULES series Aspirating Smoke Detector

New Generation

VX1/2/4 VX2C/2H/2D
VX4C/4H/4D

Super High-Pressure Aspirator
Pipe Sensor Adressability
Duo HSSD coincidence & Redundancy Detection

HERCULES Features	VX1	VX2	VX4
Sensitivity	0.001~25%/m		
SSL Intelligent Algorithm	Yes		
3 in 1 Front Display	Yes		
RS 485 Network, Modbus RTU	Yes		
Relay Output (Configurable)	3		
Expansion Relays (Optional)	3	8	8
GPI (Configurable)	1	1+2*	1+2*
10-speed adjustable aspirator	1		
Pipe Length (Linear/Branch)	200/480m	400/960m	800/1280m
No. of Sampling Holes (Class A/B/C)	40/60/120	40/60/120	40/60/120**
Pipe Addressability	N	Yes (Pipe Sensors)	
High Sensitivity Smoke/CO Sensor	1 (VX1D)	2 (VX2D)	4 (VX4D)
High Sensitivity Smoke Sensor	1 (VX1H)	2 (VX2H)	4 (VX4H)
CO Sensor	1 (VX1C)	2 (VX2C)	4 (VX4C)

Note**: 60/80/120 for VX4D/VX4H

CUPID series Aspirating Smoke Detector

New Generation

HM1/HM1D
HM2/HM2D

Optimum for Total Cost of Ownership
Networking Capacity Ready

CUPID Features	HM1	HM2
Sensitivity	0.02~25%/m	
Fire Alarm Level	0.2~12.5%/m	
SSL Intelligent Algorithm	Yes	
3 in 1 Front Display	Yes (mini)	
RS 485 Network, Modbus RTU	Yes	
Relay Output (Configurable)	2	4
Expansion Relays (Optional)	4	8
GPI (Configurable)	1+1*	2+2*
10-speed adjustable aspirator	1	2
Pipe Length (Linear/Branch)	105/260m	210/520m
No. of Sampling Holes (Class A/B/C)	8/16/32	16/32/64
Pipe Addressability	N	Yes (Pipe Sensors)
High Sensitivity Smoke/CO Sensor	1 (HM1D)	2 (HM2D)

CSD series Aspirating Cabinet Smoke Detector

New Generation

CSD-V CSD-100

CSD-H RDU-PMC

Designed for Equipment Very Early Fire Detection
Pinpoint Fire Risk Each Mission Critical Equipment

CSD Features	CSD-H	CSD-V	CSD-100
Sensitivity	0.02~25%/m	0.001~25%/m	
Fire Alarm Level	0.2~12.5%/m	0.005~20%/m	
SSL Intelligent Algorithm	Yes		
Front Display	3 in 1 mini	LED	3 in 1
RS 485 Network w/o repeater, Modbus RTU	Yes		
Relay Output (Configurable)	2	3	
Expansion Relays (Optional)	4	4	NA
GPI (Configurable)	1	1	1
10-speed adjustable aspirator	1		
Capillary Tube/Pipe Length (Linear/Branch)	30/40m		
No. of Sampling Holes (Class A/B/C)	2/4/4	4/4/4	

AVA Technology

| Addressable

Since it's introduction, the very early warning Aspirating Smoke Detection system (ASD) has been widely used to solve fire detection problems due to its high sensitivity and flexible configuration of a sampling tube network to analise the smoke in the air. As an example, it can be used in telecom and computer rooms, data centers, clean rooms, electrical rooms, museums or art galleries, where an early fire detection is highly required. Also in large spaces such as warehouses (especially elevated warehouses), exhibition halls or air terminals where smoke sensitivity needs to be enhanced; or in harsh environments (high temperature, low temperature, humidity, dust) where traditional smoke detectors are not suitable for use, where constant maintenance is impossible or inconvenient, or where aesthetics are required...

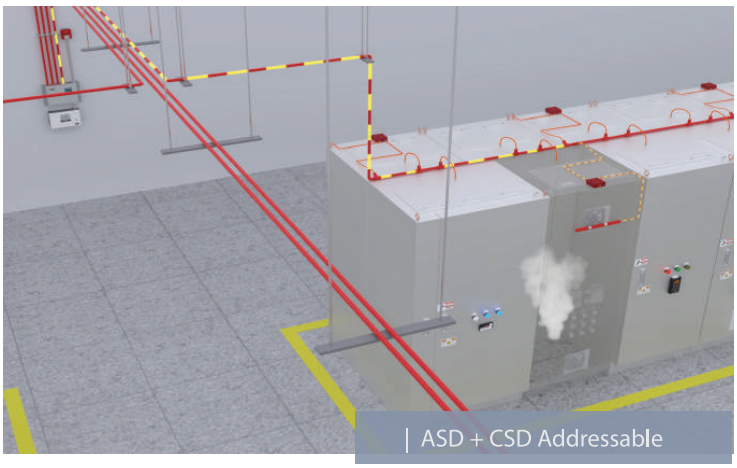
However, the ASD has one disadvantage: it can set the alarms for a large area, but it cannot pinpoint the exact location of the fire. This happens because the air that enters through the holes of the sampling tube network goes directly to the central of the High Sensitive Smoke Detector (HSSD) for smoke evaluation, and the HSSD is unable to distinguish which hole the smoke originates from or which sampling tube (in case of a multiple pipe inlet ASD). This inability to pinpoint the location of a fire may not be a problem for applications where the source of the fire is easily visible when an alarm occurs in a large space. However, it may be a problem for specific applications, such as when the fire originates in a power distribution panel in an electrical room, a server cabinet in a data room, or a space under a raised floor. For example, when the smoke detector detects abnormal signs and issues a fire alarm, the smoke is wrapped in the equipment cabinet and may not be recognized by the naked eye even if it spreads outside the switch-board, so finding the source of the fire will be a problem. To have a better idea, let's see this scenario when the alarm occurs, the staff rushes to the scene and needs to check dozens of cabinets in the electrical room one by one, the smoke of the fire is not visible, some cabinets cannot be opened, some cabinets have the risk of explosion, time passes, the pressure of the staff on the scene will be huge!

One of the features of AVA's technology is being ADDRESSABLE. AVA's products provide a variety of technologies to solve the problems of the fire localization in aspirating smoke detection systems.

CSD Independent Addressable Solution	AVA's Cabinet Smoke Detector (CSD) series, CSD not only has the aspirating smoke high sensitivity detection function, but also has a small, compact form, which makes it very suitable for protecting a single cabinet or equipment. Whether the CSD is fixed to the top of the cabinet and the sampling hose is connected to the sampling hole on top of the tray, or installed directly inside the cabinet, the CSD is the ideal solution. When each cabinet is protected by a separated CSD, the location of the fire will be naturally displayed.
CSD Multi-Channel Addressable Solution	The CSD cabinet smoke detector has also a multi-channel mode where multiple CSDs are installed. The sampling tube of each CSD extends to the respective protected cabinets and extracts air samples from the cabinets back to the CSDs for observation. When there is an abnormal smoke sign of fire in a cabinet, the corresponding CSD can issue an early warning alarm of fire.
ASD+CSD Addressable Solution	The CSD smoke detector is connected to the sampling hole and to the sampling tube of the ASD, at this time, though the ASD is used as a fire detector for all switchboards and enclosures, the CSD can also locate the hole of the smoke source. In this way, CSDs can be connected to all sampling holes or added only for important high fire risk switchboards and enclosures.
ASD Multi-Channel Multiple pipe inlet Addressable Solution	AVA's multi-tube and multi-detector ASD. Each sampling tube connected to an independent High-Sensitivity Smoke Detector (HSSD) so you can independently detect and locate the smoke source from an independent pipe inlet.
ASD Pipe Scanning and Addressable Solution	AVA's multi-tube scanning ASD shares a high sensitivity smoke detector. Since each sampling tube uses an independent pump, it is possible to control the opening and closing of the pipe inlet fan, so it can switch between the pipe inlet to perform the pipe scanning function when the high sensitivity smoke detector finds smoke abnormalities. The pipe scanning function will then be able to determine the smoke source and identify the smoke source from the pipe inlet.

| CSD Independent Addressable

| CSD Multi-Channel

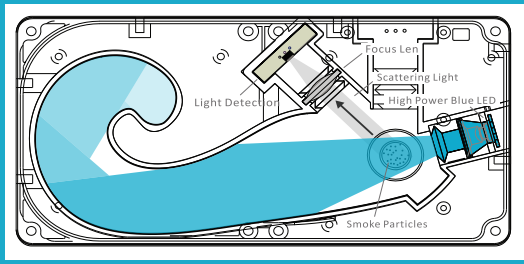


| ASD + CSD Addressable

| Very Early Warning

High Power Blue LED

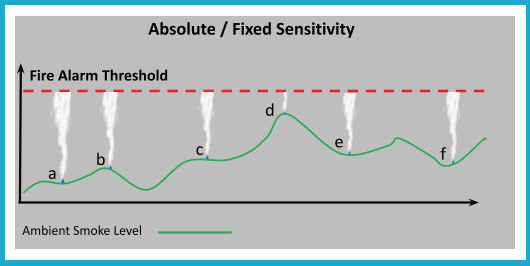
AVA's High-Sensitive Smoke Detector (HSSD) use a High Power Blue LED as the detection light source. The High Power Blue LED characteristics meet the basic requirement for the detection light source such as high brightness and long life span. The short wavelength of 470nm blue light is more responsive and sensitive to smaller size particles, thus Blue LED can provide effective detection from tiny particles to large particlest.

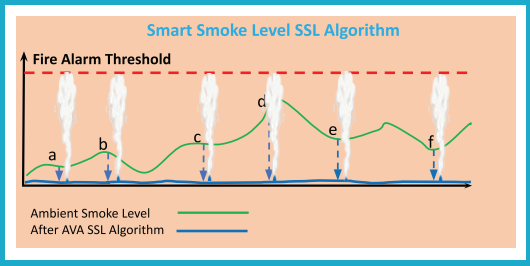


The High Power Blue LED can be said to combine both the advantage of first-generation ASD xenon light source with the second-generation infrared laser, however, it does not have the same problem of the short life span of the first-generation xenon light source, and the 2nd generation infrared laser light source with longer wavelength that is not sensitive to small particles of the shortcomings. We can say that the Blue LED is the ideal detection light source for high-sensitive smoke detectors.

Another feature of the AVA's blue LED detection light source is the "Three-Dimensional" evaluation of the air sample, rather than a "point" detection.
As shown in the picture above, the high brightness beam emitted by the AVA's blue LED can irradiate all air particles inside our three dimensional HSSD smoke chamber at the same time, so each air particle inside our HSSD chamber can contribute to the scattered light.
Although the brightness of the LED is not as high as the brightness of the Laser Beam focus and the scattered light from a single particle is not as high as that from the laser. However, the total scattered light signal is very big because the air sample contains large amounts of air particles. Moreover, the scattered light intensity is proportional to the total mass of all suspended particles, which is a more accurated representation of the actual smog concentration in the air.

| Artificial Intelligence





SSL (Smart Smoke Level)

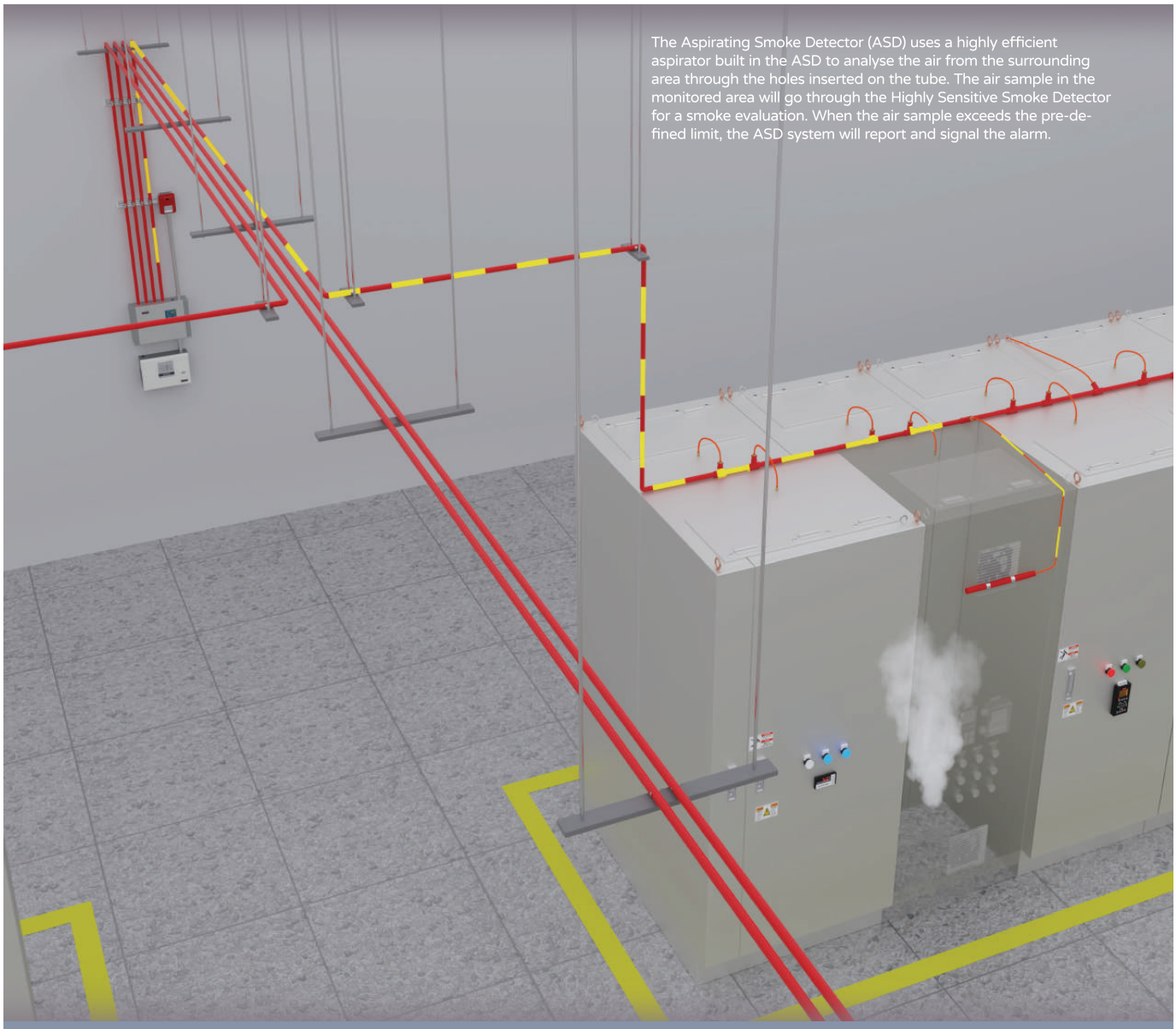
AVA's ASD System has a built-in SSL algorithm. The software will constantly collect the changes in the background smoke value, and calculate the average value of the background smoke concentration over a period of time, which is then used as the reference point for the smoke concentration and alarm threshold. When a fire occurs, the increase of smoke particles in the air, due to the material combustion, will cause the smoke concentration detected by the HSSD to increase from the background average (reference point), and when the increase of the smoke concentration exceeds the alarm threshold, AVA's ASD system will goes into the "Fire Alarm Stage".

In fact, the smoke concentration and alarm threshold displayed by AVA's ASD system is a relative value, "relative" to the background average smoke over a period of time, so we also call SSL a "Relative Scale" system.

Advantages of SSL

- **Maintains Consistent Performance:** As can be seen from the figure above, the scale system alarm value is related to the smoke background value, that way the fire detection capability is fixed.
- **Greatly Reduce False alarm :** Since the ASD system continuously studies the environment in the background, it will NOT create any false alarm due to a normal Non-Fire condition change on the background value.
- **Extremely Simple Testing and Commissioning :** The SSL relative scale will be working continuously during 24 hours and 365 days after the ASD is switched-on, and will automatically adjust the limit level, making the commissioning of AVA's ASD extremely simple.
- **Easy to spot any anomalies:** Since the SSL algorithm continuously learns the environmental background as a reference point (zeroing), any change above the background average is easily noticed and thus it could provide a Very Early Warning signal.

What is Aspirating Smoke Detection (ASD)



The Aspirating Smoke Detector (ASD) uses a highly efficient aspirator built in the ASD to analyse the air from the surrounding area through the holes inserted on the tube. The air sample in the monitored area will go through the Highly Sensitive Smoke Detector for a smoke evaluation. When the air sample exceeds the pre-defined limit, the ASD system will report and signal the alarm.

The use of ASDs has significantly increased since their introduction, their incorporation into BS 5839 Part 1; BS 6266; NFPA 72; NFPA 76; and the publication of the 1996 BFPSA Code of Practice for Category 1 Aspirating Systems. ASDs now provide the solution to a wide range of fire detection problems.

The ASD system is often an integral part of the overall fire detection and alarm system particularly when used as an alternative to point or beam type smoke detectors. When this is the case, the ASD system designer must still maintain compliance to National Standards, especially for fault monitoring, zoning, battery standby etc.

There are many reasons and motivators for using ASDs, as summarized in 4.2. This Code of Practice is intended to describe most of the challenges of specific applications and to provide practical guidance on how to engineer reliable smoke detection solutions using ASD systems.

Reasons for using ASD

1. Very Early Warning	For the earliest indication of smoke, so that evasive measures can be initiated before any significant damage is incurred in areas containing high value, critical or strategically important artefacts or operations.
2. Enhanced Smoke Sensitivity	For reliable smoke detection in applications where smoke is difficult to detect (e.g. to combat smoke dilution where there is high air flow or where the ceiling is higher than normal).
3. An alternative to point or beam type smoke detectors	As an alternative to point or beam type smoke detectors for a variety of physical reasons, e.g. maintenance access, building deflection, dilution of smoke, and obstructions to line of sight.

Common Motivators

*There are many motivations for deploying an ASD system. The following list is intended to assist in the classification and therefore specification of ASD systems.

1. Extreme environments	Harsh environments (e.g. extreme temperature, humidity, contamination etc.).
2. Restricted/difficult access	Future access for maintenance will be difficult or even impossible after installation.
3. Exceptional ceiling heights and heat barriers	Stratification, dispersion and dilution issues are present as well as access restrictions.
4. Aesthetics	Architectural or aesthetic requirements preclude mounting services on the ceiling.
5. Risk of mechanical damage	Operational damage is anticipated (e.g. in racking and storage systems).
6. Anti-vandal systems	Vandalism may be an issue so therefore discreet detection is required.
7. Hazardous environments	The risk is hazardous, e.g. explosive, chemical, radioactive environments etc.

Sensitivity Classes

EN54-20 Class	TF2 x End-of-test condition	Description
Class A - Very High Sensitivity	0.05dB/m	Smoke is not visible due to low quantity of smoke and/or high dilution caused by air movement.
Class B - Enhanced Sensitivity	0.15dB/m	Smoke is visible but insufficient to be detected by point or beam technologies according to EN-54 Part 7 or 12.
Class C - Normal Sensitivity	2dB/m	Smoke visible and sufficient to be detected by point or beam technologies according to EN-54 Part 7 or 12.

NFPA76 Class	Sampling Hole Sensitivity	Sampling Hole Coverage	Maximum Transport Time
VEWFD (Very Early Warning Fire Detection)	Alarm: 3.2%/m Alert: 0.65%/m	18.6m^2	60s
EWFD (Early Warning Fire Detection)	Alarm: 5%/m	38.2m^2	90s
SFD (Standard Fire Detection)	NFPA 72	NFPA 72	120s

Note: VEWFD: Where stand-alone packaged HVAC units are used, sensors or ports should be installed where return air is brought back to the unit. Spacing of sensors should be installed such that each covers no greater than 0.4 m^2 (4 ft^2) of the return air opening.

Warehouse

ASD Applications

Issues to have in consideration when designing an ASD system in a warehouse

- High Ceilings
- Stratification
- Compartimentalisation caused by racking/shelving
- High fire load
- Maintenance acess
- External/Internal pollutants

Considerations for additional protective areas

- Forklift truck re-charging areas
- Control systems
- Loading/docking areas
- Electrical distribution equipment

Code Recommendation for the Smoke detectors installation

BS5839-1/FIA ASD Limits of ceiling height	
General limit	10.5m
Class C with at least 5 holes	15m
Class C with at least 15 holes	25m
Class B with at least 15 holes	40m

FIA ASD Code of Practice

10.3.1 Ceiling detection

A 'code compliant' design may be achieved using a Class C ASD system mounted on the ceiling as an alternative to point detectors, thereby providing advantages both in terms of installation and maintenance, and in improved performance on account of the cumulative effect.

However, in recognition of the large fire loads and high values associated with storage, it is often advantageous to provide enhanced protection at the ceiling, particularly in areas where items are stored above head height. Hence, it is recommended that in any area with storage above head height, a ceiling mounted Class B ASD system should be installed, with sampling holes spaced according to national guidelines (eg max 7.5m from any location on the ceiling according to BS 5839-1).

Ceiling mounted sampling points should be positioned above the aisles wherever possible, particularly where the rack height is >90% of the ceiling height.

10.3.2 In-rack detection

For many warehouses, additional detection within the rack is often desirable. The following points provide recommendations which are applicable in whole or part to the majority of warehouses – subject to the particular risks and characteristics of any individual project.

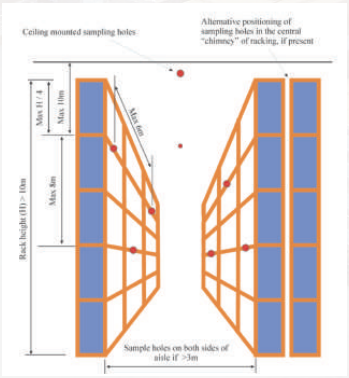
1. When protecting warehouses with high racking/shelving, sampling points should be provided within the rack, commensurate with the fire load created by the stored items and the height of the rack. A higher density of sampling holes in the horizontal plane is recommended to reduce the possibility of smoke passing between sampling holes. A maximum horizontal spacing of 6m is recommended.
2. Where rack heights extend above 8m, in-rack sampling should be provided. The top level of in-rack sampling should be within the top 25% of the rack height and no less than 10m from the ceiling. Additional levels of in-rack sampling should be provided, to ensure a maximum vertical spacing of 8m. Thus racks where rack heights exceed ~10.5m are likely to require two levels of detection and racks over ~21m are likely to have three or more levels of sampling.
3. Where multiple levels of sampling are provided, each level should be offset to the one below to minimize the possibility of smoke rising vertically and passing between multiple layers of sampling points.

NFPA 72

A.17.7.6.2 For the most effective detection of fire in high-rack storage areas, detectors should be located on the ceiling above each aisle and at intermediate levels in the racks. This is necessary to detect smoke that is trapped in the racks at an early stage of fire development when insufficient thermal energy is released to carry the smoke to the ceiling. Earliest detection of smoke is achieved by locating the intermediate level detectors adjacent to alternate pallet sections as shown in Figure A.17.7.6.2(a) and Figure A.17.7.6.2(b). The detector manufacturer's published instructions and engineering judgment should be followed for specific installations.

A projected beam–type detector can be permitted to be used in lieu of a single row of individual spot-type smoke detectors.

Sampling ports of an air sampling–type detector can be permitted to be located above each aisle to provide coverage that is equivalent to the location of spot-type detectors. The manufacturer's published instructions and engineering judgment should be followed for the specific installation.



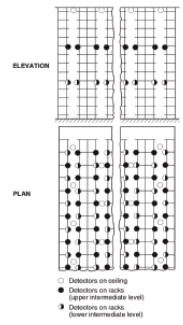


FIGURE A.17.7.6.2(a) Detector Location for Solid Storage (Closed Rack) in Which Transverse and Longitudinal Flue Spaces Are Irregular or Nonexistent, as for Slatted or Solid Shelved Storage.

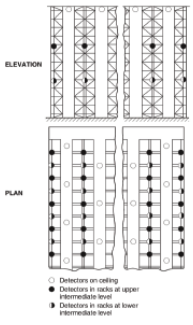


FIGURE A.17.7.6.2(b) Detector Location for Palletized Storage (Open Rack) or No Shelved Storage in Which Regular Transverse and Longitudinal Flue Spaces Are Maintained.

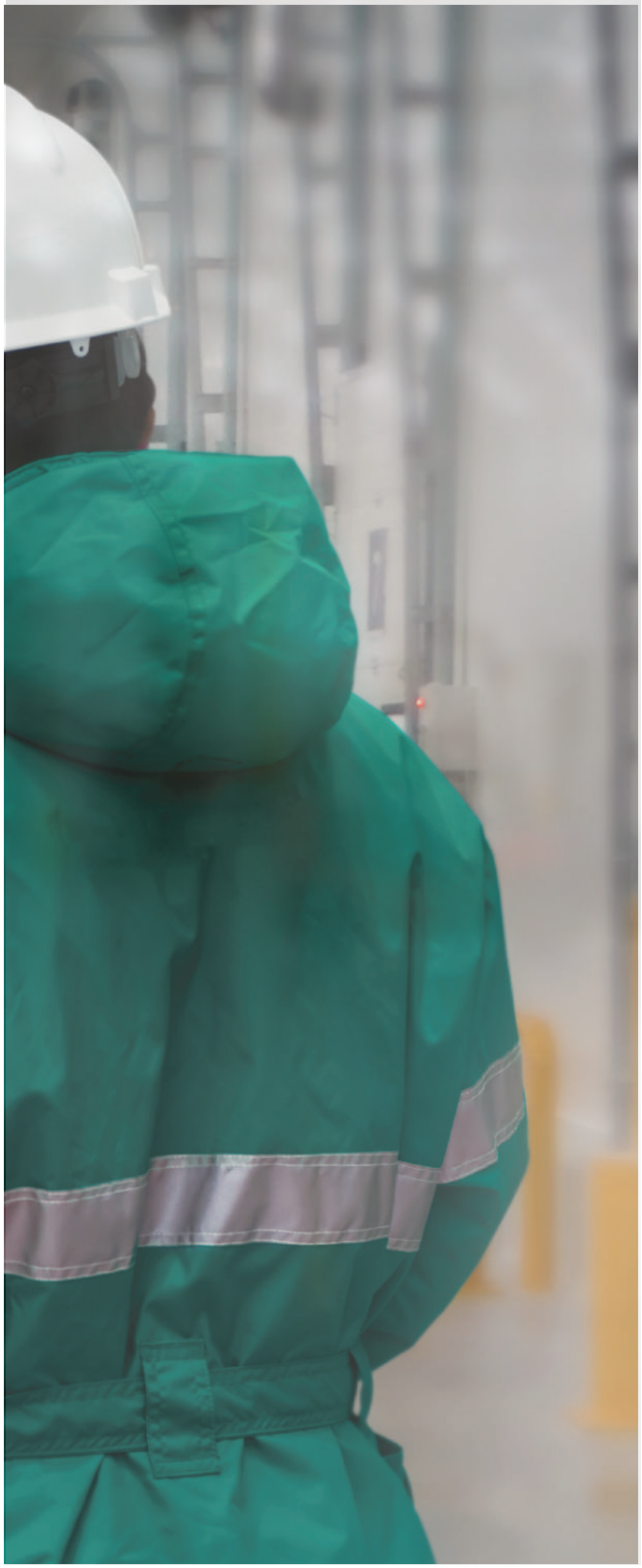
Cold Storage

ASD Applications

Factors to have in consideration on a Cold Storage

The traditional detection cannot be applied	The temperature inside the storage is too low, it may cause the traditional detector to freeze or fail.
Many Fire Hazards	Air-Conditioning refrigeration equipment, cargo transfer equipment, lighting equipment and other electrical or mechanical failure, polystyrene foam thermal insulation materials, plastic packing materials, wooden pallet filled inside the cold storage. Long term low temperature caused the cable jacket materials to become brittle and easy to break, which further causes the short circuit and combustion. Furthermore the dry air inside cold storage is abnormally dry, the fire will burns at faster rate helping the fire to grow faster rate.
Difficulties to extinguish a Fire	The smoke will be trapped inside a confined space, it spreads and burns along the thermal insulation materials. The situation will become worst if interior space has a large internal compartment and many storage shelves. The water extinguisher might not be effective to suppress the fire.

Code Recommendation for the Smoke detectors installation



FIA ASD Code of Practice

10.6.1 Cold areas
Cold storage and process areas fall into three categories; blast freezers that have high air movement and very low temperatures that are often as low as -30oC; freezer stores that have less air movement; and chill storage and process areas normally at 3-5oC. All of these environments require an assessment of the following considerations.

10.6.1.1 Temperature of the air sample
If the sampled air temperature is below the manufacturer's specification, the air sample may require warming before it enters the ASD. There are three techniques generally employed. Firstly, to have sufficient pipe outside the cold area, whereby the normal ambient temperature will raise the temperature of the air sample within the pipe to an acceptable level. Secondly, to pass the air sample through an enclosure that contains a heater or thirdly, to heat a section of the pipe with trace heating tape.
Note: Even if the temperature of the sample entering the detector is within the manufacturer's specification, consideration should be given to external condensation forming on the cold equipment during periods of high humidity.

10.6.1.2 Moisture
The risk of moisture entering the ASD in a cold store is low, because condensation normally forms on the outside of the cold pipes as they exit the cold store and not inside. However, where there is any risk of condensation forming inside the pipes, the recommendations of clause 10.6.2 should be followed.

10.6.1.3 Freezing of the sample points
In general, freezers are dry by the very nature that all moisture is frozen but the following should be considered:
• Sample points should not be positioned near to doors or directly in front of the freezer units.
• When doors are opened, humidity in the warm air entering the freezer freezes.
• Another source of moisture is from the freezer units, when in a defrost cycle.
• Where there are particular problems with the icing up of individual sampling points, local heating can be employed to prevent it or other techniques, such as regular back-flushing of the pipe with dry air may be appropriate.

10.6.1.4 Installation
The pipes can be installed in, or above the area to be monitored. In either case, it is imperative that whilst pipe is being installed into an existing cold area, that all open ends of the pipes penetrating through the ceiling/insulation are temporarily sealed until the final connections are made. This is to stop moisture in the air condensing inside a pipe and running down to the sample point and freezing.
Where there is a requirement for the ASD exhaust to be returned to the cold store, then consideration should be given to the possibility of icing at the re-entry point.
Consideration should be given to the type, layout and fixing of the sampling pipe used, as pipe will expand and contract when subjected to changes in temperature. Also, the pipe material must be suitable for use at low temperatures.

Clean Room

ASD Applications

Clean Room challenges on fire detection

The high air flow will cause serious smoke dilution situations;
A big area will cause serious smoke dilution situations;
Smoke and Fire will contaminate the environment and need to be avoided;
The dificulty to extinguish a fire in a big environment.

Code Recommendation for the Smoke detectors installation

NFPA 318 Standard for the Protection of Semiconductor Fabrication Facilities

11.1.3 Detection Systems.

Δ 11.1.3.1* Smoke Detection System. A listed or approved smoke detection system shall be provided in the cleanroom return airstream.

N 11.1.3.1.1 Detection shall be permitted to be accomplished using aspirating smoke detection (air sampling–type smoke detection) or spot-type detection systems.

11.1.3.5 Where smoke detection is installed below a waffle floor to detect smoke in the airstream passing from the clean- room to the sub-fab, area of coverage of spot-type detector or sampling port shall be limited to 18.6 m^2 (200 ft^2).

N 11.1.3.5.1 The minimum alert sensitivity for a single sampling port or spot-type detector shall be a maximum value of 0.65 percent/meter (0.2 percent/foot).

N 11.1.3.5.2 The minimum alarm sensitivity for a single sampling port or spot-type detector shall be a maximum value of 3.2 percent/meter (1.0 percent/foot).

N 11.1.3.6* In the absence of performance-based design criteria, where smoke detection is installed at the entry to the return air path, area coverage of spot-type detector or sampling port spacing shall be limited to 0.4 m^2 (4.3 ft^2).

N 11.1.3.6.1 The minimum alert sensitivity for a single sampling port or spot-type detector shall be a maximum value of 0.65 percent/meter (0.2 percent/foot).

N 11.1.3.6.2 The minimum alarm sensitivity for a single sampling port or spot-type detector shall be a maximum value of 3.2 percent/meter (1.0 percent/foot).

N 11.1.3.7 For an air sampling–type system, the maximum transport time from the most remote sampling port to the detection unit shall not exceed 60 seconds.

N 11.1.3.8 Smoke detection systems shall be maintained in accordance with NFPA 72.

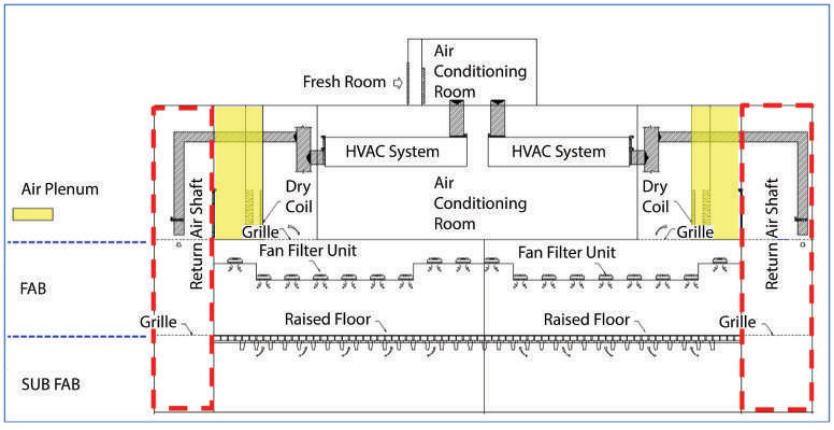


Illustration of a Fab Cleanroom

Clean area fire safety equipment installation points

The clean room, upper return air layer, lower return air layer and pipe bridge should be monitor by automatic fire alarm equipment or Aspirating Type smoke detection system according to the characteristics of circulating air flow and space, and its signal should be transferred and integrated with the fire alarm system or other control equipment or facilities (station). Additional air return shaft should be monitor with aspirating type smoke detection system.

Data Center

ASD Applications

Data Center challenges on fire detection

- High air flow environment;
- The smoke energy is not sufficient;
- The smoke temperature is low;
- The high air flow will cause a serious smoke dilution situation;
- Periodic supply of fresh air.

Therefore, the smoke detection is required in the ceiling, underneath the raised floor and in the return air vents of the AHU, taking into account the space above the ceiling if necessary. Depending on the area, it may be necessary to use a separate ASD system to monitor the specific areas mentioned earlier (separate zones). However, in applications smaller than 150m^2 an ASD system with a Class A detector can be used to cover all of those areas.

Code Recommendation for the Smoke detectors installation

NFPA 76 Recommended Practice for the Fire Protection of Telecommunications Facilities		
Protection Area	Large Telcommunications Facilities	Small Telcommunications Facilities
Telecommunication Equipment	VEWFD	EWFD
Power Area	EWFD	EWFD
Main Distribution Frame	VEWFD	EWFD
Cable Entrance Facility	VEWFD	EWFD
Standby Engine Area	STD	STD

BS6266 Fire protection for electronic equipment installations – Code of practice

8.4.2
When a facility is manned continuously, there can be value in installing a higher sensitivity detection system, as this can give an early indication of a potential fire and thus lead to early manual intervention.

NOTE 1 The overriding factor affecting the overall sensitivity of a fire detection system within an electronic equipment area is that of high airflows necessary as part of the air-conditioning used to cool equipment. Such airflows might be in the region of 10 to 100 air changes per hour at velocities greater than 1 m/s, and sometimes run counter-directionally to airflows produced by natural buoyancy (e.g. where air is extracted at low level with inlets at high level). These airflows are also complicated by localized high heat output from equipment which generates convection currents. These factors can result in a reduction in the speed of response of fire detectors, because the smoke might be diluted or fail to reach ceiling-mounted detectors.

NOTE 2 The sensitivity of fire detection systems covers a wide range. A highly sensitive system can detect an incipient fire condition when, for example, PVC cable has just begun to overheat. If action is taken at this stage, to extinguish the fire or to prevent further overheating (e.g. by powering down), damage to the electronic equipment is minimal. Normal sensitivity systems are likely only to detect a fire when it has reached a sustained smouldering or flaming stage producing appreciable products of combustion, when fire and smoke might already have caused some damage to sensitive equipment. At this stage, if the fire is not extinguished in a relatively short time, it can grow rapidly to spread to the whole room or area.

Sensitivity of aspirating smoke detectors
The intended sensitivity of an aspirating smoke detector should be specified by clearly stating the class required (see 8.3.1.5 and BS EN 54-20:2006), taking into account the following points.
• The class of an ASD relates to the sensitivity of the sampling holes, not to the sensitivity of the detection unit.
• It is important to check that the capability of the particular type or model of ASD is suitable for the application and can provide the number of sampling holes required.

NOTE 1 Some ASD systems are capable of providing a few sampling holes (e.g. <5) while others are capable of providing many sampling holes (e.g. >30) of a particular class.
• ASD systems are able to detect low density smoke dispersed by the airflows within an electronic equipment area because of the cumulative effect whereby smoke of a lower concentration will generate an alarm if it enters more sampling holes.

More specifically:
• when used to detect smoke in the return airflow from the room, a Class A system should be used to provide early warning;
• 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.
NOTE 2 A Class C system may be used when the air-conditioning can be switched off.

Electrical Cabinets

ASD Applications

Reasons for a fire occurrence on an electrical equipment

Short circuit;
Aging insulation;
Bad wire connections;
The temperature exceeds the component specifications;
Electric overload;
Equipment failure.

*The downtime loss is usually greatly lager than the direct fire loss in an industrial structure fire, caused by the electrial distribution and equipment.

Code Recommendation for the Smoke detectors installation

BS6266 8.2.5 Positioning of detectors

Fires can originate in the electronic equipment, in associated equipment such as the air-handling plant, within the room or voids, or in another part of the building. Detectors should be positioned to take into account all these possibilities.
Early warning of a fire condition is most often achieved by positioning high sensitivity (Class A) detection at the air return vents to the air-conditioning system and using normal sensitivity point-type or ASD sampling holes at the ceiling. The ceiling-mounted system provides detection when the air-conditioning is off and, where appropriate, provides confirmation that significant smoke concentrations are present in such quantities that automatic extinguishing systems should be activated. The ceiling-mounted system can also provide an early warning signal in addition to a normal sensitivity alarm signal.
Positioning of detectors and/or sampling points should be undertaken only with full knowledge of the air flows in the protected area.
Where fixed fire suppression is provided for the protection of individual cabinets (see 9.1.1), cabinet detection should be provided.
See Annex A for further advice on the positioning of detectors.
Early warning can be achieved by siting detectors or sampling points to protect individual equipment cabinets in addition to the general room area. Cabinet detection is essential if automatic cabinet fire suppression (see 9.1.1) is to be used.

BS6266 A.3

Position of detectors for cabinet protection
Where detection is required for the detection of fire in individual cabinets, the following recommendations should be met.

a) Detectors or sampling holes should be located where smoke is more likely to migrate. For example, in an unventilated (i.e. sealed) cabinet, detection should be within the top 10%, whereas in a ventilated cabinet, detection should provided where the ventilation exits the cabinet. In a naturally vented cabinet, this will be the upper ventilation vent.
b) Multiple detectors or sample points should be provided where the cabinet has multiple or very large outlet vents.
c) Detectors with enhanced sensitivity should be used when the ventilation rates are such that dilution of the smoke is likely to render normal sensitivity detectors ineffective.
d) Where cabinets are fitted with in-cabinet suppression systems, the detection system should provide an alarm signal for each cabinet (or group of cabinets if the suppression system is to be released into several cabinets simultaneously).

NOTE: Where in-cabinet suppression is not fitted, a single detection zone may cover several cabinets.

Recommendations are given in 14.3.1 for the performance tests that should be used to confirm the operation of detectors intended to protect cabinets.

FIA ASD Code of Practice

10.4 In-cabinet detection
Cabinets generally fall into three types, which additionally may or may not be compartmentalized:

- Sealed
- Naturally ventilated
- Forced ventilated

A portable sampling detector may be useful when searching and identifying the cabinet that is the source of an alarm – particularly where the ASD system is Class A.
Recommendations are given in Appendix A for the performance tests that should be used to confirm the operation of detectors intended to protect cabinets.

10.4.1 Sealed cabinets

Where cabinets are sealed, internal sampling is required. Dependent upon the sealing integrity, it may be necessary to provide a breather air inlet to ensure circulation of air. If the cabinet is compartmentalized, it is recommended that a sample point for each compartment be installed.

10.4.2 Sample hole location and recommendations

Where detection is required for the monitoring for fire in individual cabinets, the following recommendations should be met.

a. Sampling holes should be located where smoke is more likely to migrate. For example, in an unventilated (i.e. sealed) cabinet, detection should be within the top 10%, whereas in a ventilated cabinet, detection should be provided where the ventilation exits the cabinet. In a naturally vented cabinet, this will be the upper ventilation vent.
b. Multiple sample points should be provided where the cabinet has multiple or very large outlet vents.
c. Multiple sampling points should be provided where the cabinet is large (e.g. greater than 1200x600mm footprint).
d. Class A or Class B systems should be used when the ventilation rates are such that dilution of the smoke is likely to render normal sensitivity detectors ineffective.
e. Where cabinets are fitted with in-cabinet suppression systems, the detection system should provide an alarm signal for each cabinet (or group of cabinets if the suppression system is to be released into several cabinets simultaneously).

These recommendations are very general and where the cabinets are particularly critical or where there are high air flows, then the number of sampling holes in each cabinet should be increased.

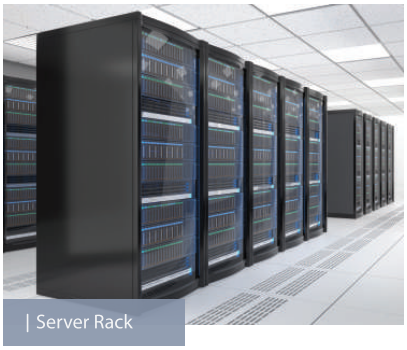
High Risk Equipment

ASD Applications

Fire Risk = Fire Probability x Fire Damage Loss

The Fire Risk is determined by two main factors: The Fire Probability and the Fire Damage Loss caused by a burning occurrence. On the field, not all equipment is prone to a fire occurrence, but from past experience, we know that some equipment have a higher possibility to generate fire, this may be due to the internal equipment having high current, high voltage, high temperature, mechanical friction or even containing flammable and explosive components inside. On the other hand, IF FIRE occurs, it will caused huge losses. In additional to the high value equipment costs, some equipment are essential, having a critical task or functionality. When

| Energy Storage System



| Server Rack

| Constant Temperature Test Machine

| Wind Turbine

these equipments stop working due to a fire, it may cause the whole plant to stop working or business interruption, and the loss at this time will be far greater than the value of the equipment itself.

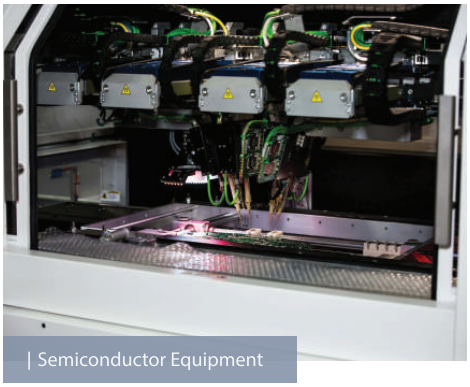
AVA CSD Cabinet Smoke Detector is specially designed and provides a Very Early Warning Aspirating Smoke Detector for such a high risk equipment. This will avoid and reduce the production loss by reducing the fire risk on key equipment on site and the reliability of the overall process can be greatly improved.

| MRI/CT Machine

| High Voltage Switchgear/Capacitor/MCC Cabinet Machine

| Elevator Shaft

| Process Oven



| Semiconductor Equipment

Pinpoint Fire Risk, Earliest Possible

Addressable

Very Early Warning

Aspirating Smoke Detection

AVA PREVENT

Aspirating Cabinet Smoke Detection

2024/12