SECURITON

Food Processing Facilities

SecuriHeat ADW, SecuriSmoke ASD

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1 Introduction

When food is produced for human consumption, the highest grade of hygiene is required. Many food processing plants are built with cleanroom-grade production environments that require constant air changes to keep filtered clean air circulating. Additionally, food handling areas are regularly washed using aggressive cleaning techniques. Steam, heat, pressurised water and/or chemicals are typically used on all surfaces and even walls, and there may be a requirement for any equipment in the room to be 'food grade' as well as being able to withstand such treatment. This severely impacts the options for fire detection as most conventional and even heavy-duty detection systems can neither withstand the conditions nor satisfy hygiene rules. The extremely robust SecuriHeat ADW line-type heat detector is an exception to this, as its stanless steel sensing tubes meets hygiene requirements and withstands almost any kind of cleaning process.

Like other industrial premises involving large scale, continued machine operations at high speed, food processing poses fire risks. Due to the unique characteristics of fire danger and risk profile, building occupancy is classified based on the presence and the level of hazard. For high hazard areas, significant emphasis is placed in preventing ignition sources and controlling ambient conditions to well below the explosive limits. For instance, a fire may be ignited from heating apparatus (include cookers, canning); hot surfaces (from space heating equipment, mechanical machinery, process or friction heating from conveyors); sparks (due to impact, from electrical equipment or electrostatic discharge); or by faulty electrical equipment, lighting or machines.

Equipment or heat source failure is a leading cause of structure fires in industrial and manufacturing properties. Electrical distribution, lighting, and power transfer equipment was identified as the leading equipment involved in ignition in industrial properties, while shop tools were the leading equipment category involved in manufacturing property fires. Other significant issues associated with food processing fire risks is the presence of flammable gasses, vapours and combustible dusts, which account for many fires and explosions from industrial or storage facilities with hazardous classifications. The OSHA NEP for example, found that food dust accounted for 23% of combustible dust incidents. This includes flour, proteins, spices and sugar.

Other unique characteristics of fire hazards associated with food processing are from hazards involving oil and fat processing and production. In these environments, hydrogen presents a high risk of explosion and fire in the hydrogenation process, for example when transforming vegetable oils (canola, corn, soybean) into margarine and cooking fats. Burning oils and fats may emit highly irritant fumes such as acrolein. Solvents such as hexane, used for the extraction of oils, are highly flammable and could also be toxic, although they are commonly used in closed systems. Oils are processed at high temperatures that result in radiant heat from the cooking vessels and steam pipes. Efficient mechanical ventilation should provide frequent changes of air around these processes.

Beyond building and asset safety, life safety in food industries is paramount due to the large number of factory workers in food processing facilities. Early alarm of a fire situation can be paramount to both life and building safety, as well as asset protection. Fire detection in food processing premises serves not only to provide a verifiable and reliable alarm for timely evacuation, but also other consequential events or actions such as power-down overhead equipment or conveyors, exhaust or extractor fan systems, the control of emergency lighting, smoke management system and fire shutters and fire doors. The fire detection system is also critical for the actuation of a suppression or sprinkler system in areas where these are installed.

With all the possible fire and explosion hazards present in food processing facilities, there is a wide range of fire preventive measures, including safety installations and best practices, that mitigate the delayed detection of a fire at its incipient stage and safeguard occupants from injury or death. The likelihood of interruption to business operation and losses of valuable manufacturing equipment reinforces the desire for facility owners to adopt rigid risk management regimes and for insurers to manage risks through the recommendation of best practices in fire safety and protection.

From life safety and business continuity perspectives, even false alarms, when not verified leading to the real conditions for true fire alarms, will not only interrupt business operation, inconvenience the workers and cause loss of productivity, they can also potentially lead to unwarranted emergency evacuation. This is particularly troublesome for food industries where a large quantity of food would potentially be wasted if this happens mid-process. In food manufacturing facilities, an elevated risk of false alarms makes it more important that the fire alarm system has robust measures to reduce their frequency. In areas where it is more likely that an alarm may be accidentally triggered – for example, where there are plumes of food dust in the air – additional measures should be taken to reduce the risk, such as dust filters with intelligent sensitivity settings. Using advanced detectors with multiple alerts and alarms for system integration, a suitable ventilation system may be actuated by a detection system to remove surplus airborne dust particles.

The use of reliable and Early Warning Fire Detection represents significant advantages over other conventional detection methods. Proper design of such a fire detection system for specific fire risk mitigation is of fundamental importance to protect food industries, as well as safeguard business continuity. While there are practical difficulties in choosing suitable detection products, a combination of SecuriHeat ADW LTHD and SecuriSmoke ASD and REK EWFD systems address all the key challenges and deliver early and reliable fire detection for a wide range of applications in the food processing sector.

The purpose of this Design Guide is to provide fire safety and protection consultants, qualified fire system specifiers, design engineers or technicians, with recommendations for the application and use of SecuriSmoke ASD and REK Early Warning Fire Detection, as well as SecuriHeat ADW LTHD products to protect various operational and storage areas of typical large food processing facilities, with emphasis as follows:

- Risk-based detection within typical SecuriHeat ADW LTHT applications, include those in cleanroom grade areas that incur frequent and high pressure washdowns with detergent or chemicals.
- Large open spaces within food factories as well as risk-based return air grills & duct detection, using SecuriSmoke ASD for EWFD.

This Design Guide is also suitable for facility management and end-customers alike to gain a high-level insight to cost-effective, fit-for-purpose fire engineering solutions to meet prescriptive (DtS[1]) fire detection and protection compliance as well as enhanced fire detection methods to avoid business interruption, asset losses and mitigate risks through the best fire prevention practices.

The scope of this Design Guide covers detailed recommendations, design considerations and practices for SecuriHeat ADW LTHD and SecuriSmoke ASD and REK. To facilitate the best risk management practices and reliable emergency response procedures through early intervention and elimination of potential fire incidents, this Design Guide touches on:

- Securiton 360° Fire Protection Solution (FACP and ECP[2])
- Securiton software for designing, installing and maintaining fire detection systems, as well as local and remote monitoring

The Design Guide also provides key requirements on Inspection, Testing and Maintenance (ITM) of SecuriHeat ADW LTHD and SecuriSmoke ASD; and world-class technical and application support offered by Securiton through its headquarters teams in Europe and its vast global network of regional offices and distribution partners.

2 Aspects of Fire Safety and Prevention

The food sector is one of the largest industries in the world, responsible for providing sustenance to billions of people every day. The sector covers a series of industrial activities directed at the processing, conversion, preparation, preservation and packaging of foodstuffs for human and pets' consumption. The raw materials used are generally of vegetable or animal origin and produced by agriculture, farming and fishing. Food industries involve complex processes throughout the supply chain and come with particular hygiene standards as well as safety and fire hazards [1].

The food supply chain starts with the sourcing and transporting of raw materials for processing and manufacturing before final food products are produced, packaged for warehousing and distribution, then delivered to retailers. Food processing refers to the part of the industry involved with processing raw materials and intermediate products. Examples of these processes include meatpacking and processing, poultry processing, production of dairy products, grain milling, bakeries, the processing of sugar-beet oil and fat, and coffee bean and nut roasters.

Like other industrial premises involving large scale, continued machine operations at high speed, food processing poses fire risks. Building occupancy is classified based on the presence and the level of hazards. For high-hazard areas, significant emphasis is placed on preventing ignition sources and controlling ambient conditions to well below explosive limits. A fire may be ignited from heating apparatus (include cookers, canning); hot surfaces (from space heating equipment, mechanical machinery, process or friction heating from conveyors); sparks (due to impact, from electrical equipment or electrostatic discharge); or by faulty electrical equipment, lighting or material handling machines.

[1] DtS: Deem-to-Satisfy

[2] FACP: Fire Alarm Control Panel, also known as Fire Alarm Systems (FAS) or Fire Indication Panel; FACP is often categorised into Main and Sub panel; Related devices include Mimic Panel and Repeater Panel. ECP: Extinguish Control Panel

To enhance risk management, fire prevention and fire protection in these food industries, a central element of best fire safety practices is the use of reliable and Early Warning Fire Detection (EWFD). This chapter highlights the following key aspects of fire safety and fire prevention in these regards:

1 Food industries, with a focus in food processing plants and their key operational characteristics
2 Fire risk, consequence and safety
3 Challenges to reliable and Early Warning Fire Detection
4 Code compliance and Performance-based Design (PBD)

2.1 Food industries (Processing)

When food is produced for human consumption, the highest grade of hygiene requirements applies. Those high hygiene standards and the practices involved in maintaining them have a direct effect on fire detection and can severely limit the available choice detection system. Some processing plants are built with cleanroom grade production environments that require constant and high room air changes to keep filtered clean air circulating – with resulting smoke dilution making timely detection challenging. Many food processing areas have a requirement to be cleaned regularly to a very thorough standard, involving the use of steam, heat, pressurised water and/or chemicals. Any fire detection equipment installed in these areas will have to be able to withstand these cleaning processes. Indeed, there may be a further requirement for the devices themselves, or the parts that are within the relevant zone, to be of food grade materials such as stainless steel, for example.

For easy reference throughout this design guide, Table 1 lists part of ISO Classifications with the corresponding ISO 14644-1 Part 1 class of cleanrooms [2], of which ISO 6 or ISO 7 are most commonly used for food processing. It also shows typical ACR[3], room airflow velocity (in m/s or fpm (ft. per minute)) and typical FFU[4] coverage (% of ceiling area). The impact of the high airflow resulting from FFU speed and placement for designated cleanroom class must be taken into account when designing the fire detection system.

Cleanroom grade production areas are used in food and beverage manufacturing to conform with relevant government regulations or industry code of practices, such as FDA CGMP[5] or EU Commission Regulation [3] on good manufacturing practice for materials and articles intended to come into contact with food. These regulations aim to ensure the safety of food by addressing issues such as appropriate personal hygienic practices, design and construction of a food plant and maintenance of plant grounds, plant equipment, sanitary operations, facility sanitation, and production and process controls during the production of food.

ISO 14644-1 ISO CLASS: Air Change Rate, Airflow and FFU Ceiling Coverage

Class	ACR (ACH)	Average Airflow Velocity m/s (fpm)	FFU Ceiling Coverage %
ISO 4	300-540; Unidirectional	0.25-0.46 (50-90)	50-90%
ISO 5	240-480; Non-unidirectional	0.20-0.41 (40-80)	35-70%
ISO 6	150-240; Non-unidirectional	0.13-0.20 (25-40)	25-40%
ISO 7	60-90; Non-unidirectional	0.05-0.08 (10 -15)	15-20%
ISO 8	5-48; Non-unidirectional	0.01-0.04 (1-8)	5-15%
ISO 9	Up to 48; Non-unidirectional	Up to 0.04 (up to 8)	Up to 15%

Table 1 Typical Air Change Rate, airflow and FFU ceiling coverage [4], [5]

On the other hand, volatile organic compounds (VOCs), hazardous air pollutants (HAPs), and odorous emissions can be generated during various stages of food processing, including cooking, baking, frying, and various other processing methods. VOCs combine in the atmosphere to form smog and are regulated as ozone precursors under EPA's criteria pollutant program.

High quality of food products also reflect on rigid environmental control throughout the food transformation process, packaging, storage and transportation. Goods sensitive to ambient conditions need to be stored and handled in an ambient-controlled environment. For example, food processing related refrigerated storage facilities usually consist of deep freezers with operating temperature typically in the range of -30 to -15°C (-22 to 5°F), chillers from -9 to 2°C (16 to 36°F) and coolers and loading bays at 0 to 18°C (32 to 65°F). Special design considerations must be given to these areas, which lie beyond the scope of this document and are covered in detail in Securiton's Design Guide to Refrigerated Storages [6].

[3] ACR: Air Change Rate (in Air-Change per Hour (ACH)); ACR range depends on the activities and equipment within the room (e.g. less obstructions, lower airflow)
[4] FFU: Fan Filter Unit
[5] CGMPs: Current Good Manufacturing Practices

Food processing is an industry that involves various techniques and methods to transform raw ingredients into edible products for consumption. While the main food manufacturing facility structure may be classified as industrial and storage occupancy, the nature of the fire hazards and life safety concerns is evolving. Despite many variations in the structural shape and types of food processing involved, the design of a reliable Early Warning Fire Detection system can follow a certain set of rules. Figure 1 illustrates typical production environments in the food processing sector such as

(a) Large open spaces: Food processing areas are often large open space structure. The cleanroom grade processing rooms use FRP[6] or stainless steel cleanroom walls to allow regular chemical cleaning. Stainless steel is generally preferred for wall surfaces due to its durability, ease of cleaning, and resistance to corrosion, suitable for the high-traffic and high-heat environment. HVAC is designed to control temperature and humidity in food cleanrooms with recessed HEPA filtration to prevent moisture from reaching HEPA filters. There may be conveyor openings for production movement and roll up doors for material transfer.

(b) Food production machinery and equipment: Large machinery and equipment is intensively used in food processing that requires 24/7 continuous operation with complex mechanical and electrical systems, fast-moving/rotating and substantial long conveyor network to move production between different processes. There is also large equipment, such as fryers, oil cookers, nut roasting systems throughout food processing, packaging and canning/bottling.

(a) Large open space (food processing and cleanroom grade production facilities)

(b) Large machinery and equipment (24/7 continuous operation; complex mechanical and electrical systems; fast-moving/rotating)

Figure 1 Food industries (manufacturing plants, processing machinery and equipment)

2.2 Fire risk, consequence and safety

There are no national level public statistics available to specifically track fires at food processing facilities. They are included in broader categories like manufacturing and processing, refrigerated storage, and agricultural facilities that are more aligned with building occupancy as defined in national fire data collection systems, such as NFIRS[7] in the USA. For example, NFIRS recorded the number of fires at all manufacturing or processing plants in 2019 at over 5,300 (almost 15 a day). Additionally, more than 2,000 fires occurred in agricultural, grain and livestock, and refrigerated storage facilities, which could all include food processing operations. According to a comprehensive NFPA report [7], from 2017 to 2021, structure fires in manufacturing or processing properties were responsible for associated annual losses totalling 22 civilian deaths, 211 civilian injuries, and $1.5 billion in direct property damage.

US fire departments responded to an average of 36,784 fires annually (2017-2021) at industrial and manufacturing sites. Large fires involving food industries in the USA include [8]

- Moses Lake, Washington (2023): A fire heavily damaged the Basic American Foods plant, causing significant disruptions.

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6 FRP: Fiber Reinforced Plastic

7 NFIRS: National Fire Incident Reporting System

- Hermiston, Oregon (2022): An explosion and fire ripped through Shearer's Foods, raising concerns about safety protocols.
- Chicago, Illinois (2023): Firefighters battled a blaze at an Evans Food Group processing plant.
- Los Angeles (2022): The large QC Poultry processing plant in Montebello, just east of East Los Angeles, caught fire.

Equipment or heat source failure was a leading cause of structure fires in industrial and manufacturing properties [7]. Electrical distribution, lighting, and power transfer equipment was identified as the leading equipment involved in ignition in industrial properties, while shop tools were the leading equipment category involved in manufacturing property fires. Other significant fire risks associated with food processing are flammable gasses and vapours, and combustible dusts, which account for a fair share of overall flammable vapour or dust fires and explosions from industrial or storage facilities with hazardous classifications. There is extensive literature and database at both local and national level tracking these incidents [9] [10]. The OSHA NEP[8] [11] for example, includes organic dust from flour, grains, spices etc., which accounted for 23% of combustible dust incidents, one percentage point behind wood dust.

Other unique characteristics of fire hazards associated with food processing are from hazards involving oil and fat processing and production. In these environments, hydrogen presents a high risk of explosion and fire in the hydrogenation process, for example transform vegetable oils (canola, corn, soybean) into margarine and cooking fats. Burning oils and fats may emit highly irritant fumes such as acrolein. The solvents, such as hexane, used for the extraction of oils are highly flammable and could also be toxic, although they are commonly used in closed systems. Oils are processed at high temperatures that result radiant heat from the cooking vessels and steam pipes. Efficient mechanical ventilation should provide frequent changes of air. In many situations, LEV[9] is required to remove solvent vapours at the point of origin, or closed systems should be used.

Electrical installations present a risk of electrical shock in damp and steamy conditions. All equipment, conductors as well as portable equipment or lights should be suitably protected such as the installation of ground fault circuit interrupters in these challenging food processing areas.

To counteract the above-mentioned risks and hazards, there is a wide ranges of fire preventive measures that the food processing industry can adopt. These include safety installations and best practices that mitigate the delayed detection of a fire at its incipient stage, hinder the spread of fire, and ensure occupant life safety. The risk of fire and significant consequences from damages to complex food processing facilities with high fuel loads harden the desire for facility owners to adopt rigid risk management regimes. These can go beyond adhering to government regulations and include working with insurers to manage risks through the recommendation of best practices in fire safety and protection. Early and reliable detection is key to ensuring fire incidents can be avoided or minimised. Even as the fire situation progresses, fire services can be notified automatically and arrive at the scene much earlier before the fire spreads.

Figure 2 illustrates key aspects and advantages of using a reliable Early Warning Fire Detection system:
- How the intensity and destructive power of a blaze grows exponentially, from an incipient stage, through a growth period and into a fully-fledged fire which will rapidly cause a total loss as well as being extremely dangerous.
- How business operation interruptions and potential losses due to fire damage may be minimised by EWFD, compared to standard detection and the even greater damages when only sprinklers are used, with no prior detection.
- Suitable points for a staged response where EWFD is coupled with multiple stages of alert and alarm.
- Increase of available safe egress times thanks to EWFD.

In the case of food processing plants, early detection can mean the difference between an orderly and early evacuation and a dangerous rush amid smoke and flames. Additionally, detecting late in an environment where detection is challenging, such as very large open spaces, will leave very little time to intervene at a stage prior to that where massive destruction of the building and contents are likely.

[8] NEP: National Emphasis Program
[9] LEV: Local Exhaust Ventilation

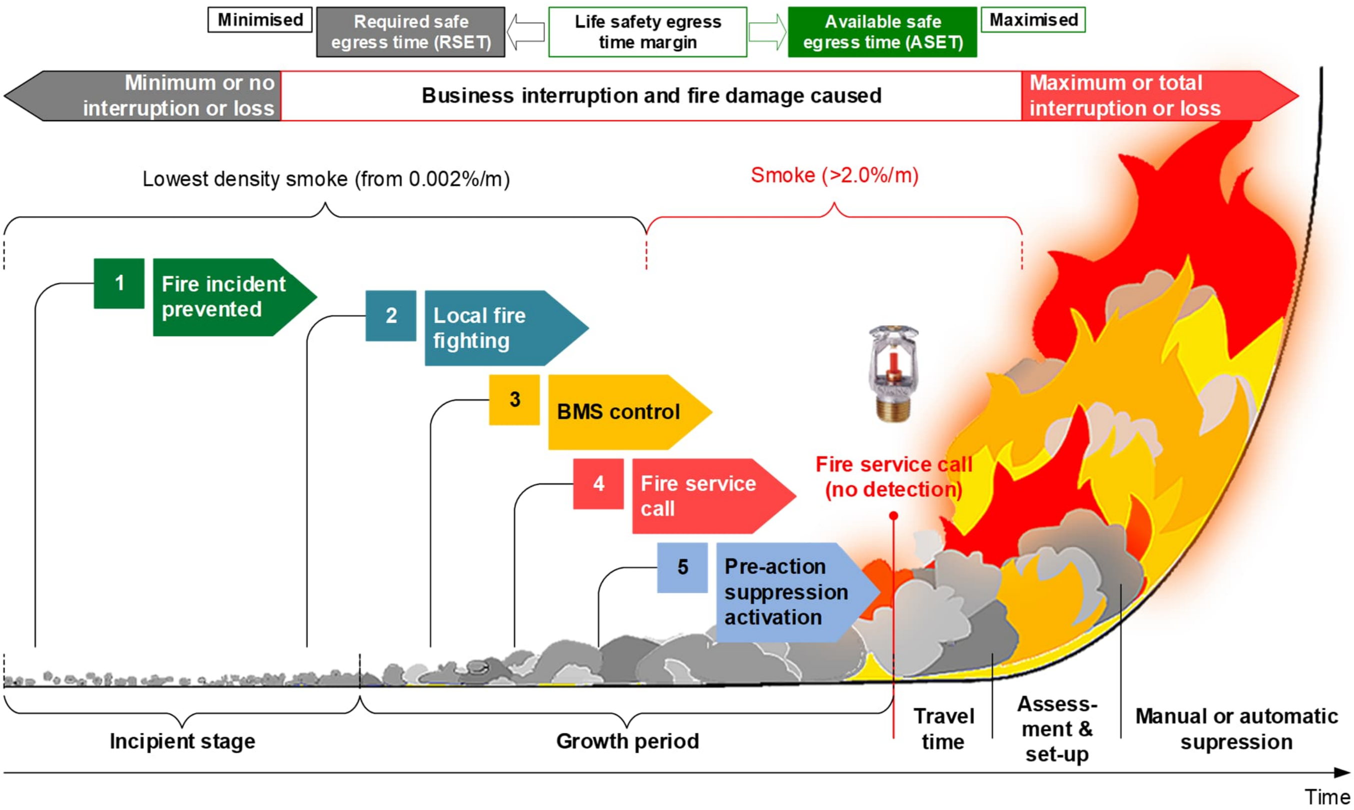


Figure 2 Impact of a detection system on life safety and loss due to fire damages

2.3 Challenges to reliable and Early Warning Fire Detection

Food processing industries have unique operational characteristics (see Chapter 2.1). Many aspects of food processing require sound fire safety measures, facilitated with a suitable fire prevention and protection solution to address issues including smoke and fire dispersion within large open areas, restricted access to cleanroom grade production areas, and the desire to avoid operational disruption and maintain business continuity. Due to the complex processes in such a manufacturing environment, the fire safety measures must also allow for a suitable degree of flexibility for localised detection, integration with established operational and process protocols, and meet insurer requirements.

Early alarm of a fire situation can be paramount to both life and building safety, as well as asset protection. Fire detection in food processing premises serves not only to provide a verifiable and reliable alarm for timely evacuation, but also other consequential events or actions ranging from power-down of overhead equipment or conveyors, exhaust or extraction fan systems, to the control of emergency lighting, smoke management system and fire shutters and fire doors. The fire detection system is also critical for the actuation of a suppression or sprinkler system in areas where these are installed.

The large amounts of electrical and mechanical equipment, cooking and food production apparatus and cabling installed throughout the inside and around food processing premises present significant risks of fire. Other fire incidents from transport conveyor network where lint, dust and oil build-up, or friction fires caused by mechanical equipment failure may originate in less visible areas such as underneath the conveyor platform in large open spaces or inside these cleanroom grade food production rooms. Early detection of such fire incidents require detection to be close to where the fire hazards are.

These fire incidents can start in either isolated areas, inside large industrial equipment, ceiling voids or raised floor areas; or in large open spaces where any smoke or heat can be diluted and moved quickly. Risk of unnoticed incipient fire, smouldering due to overheating, in enclosed, concealed and voided spaces, unsupervised areas and fully automated operation spaces, increase the likelihood of a much-delayed fire detection and emergency evacuation. There will be significant interruption to operation and higher property damage if such fire incidents are not detected and managed early.

From life safety and business continuity perspectives, even false alarms, when not verified leading to the real conditions for true fire alarms, will not only interrupt business operation, inconvenience the workers and cause loss of productivity, they can also potentially lead to unwarranted emergency evacuation. This is particularly troublesome for food processing plants where there is potential for a large quantity of food be wasted and a costly time-consuming operation restart processes. In food manufacturing facilities, an elevated risk of false alarms makes it more important that the fire alarm system has robust measures to reduce their frequency. In areas where it is more likely that an alarm may be accidentally triggered – for example, where there are plumes of food dust in the air – additional measures should be taken to reduce the risk, such as dust filters with intelligent sensitivity settings. These advanced detectors with multiple alerts and alarms for system integration, a suitable ventilation system may be actuated by a detection system to remove surplus airborne dust particles.

Fire and life safety in food industries require both passive and active fire prevention and protection measures. However, compare with these built environments classified as assembly or multi occupancy with high occupant load, such as shopping malls or transport hubs, it may not be possible to implement fire compartments to be structurally integrated to prevent the spread of fire except these concealed spaces where large quantity of electrical cablings are. Fire resistant shutters may be installed only at the perimeter of a food processing areas with large open spaces to prevent fire spread to the adjacent buildings. These just highlight the importance of appropriate fire detection and prevention systems inside the food processing areas to protect business assets and operation continuity. Other high priority areas of fire engineering design are ventilation and smoke extraction systems that work with compartmentation mechanism, in particular along the dedicated emergency egress routes. Many of these fire safety measures rely on a timely fire detection to be effective.

Reliable and Early Warning Fire Detection can play a crucial role in fire prevention measures for safeguarding food processing facilities. However, the design must take into account what type of detection technology is chosen, level of detection performance and reliability, and how the systems are installed and maintained. The primary challenges of fire safety and use of suitable reliable and Early Warning Fire Detection system are:

- Many food production areas require ISO grade cleanrooms in order to meet strict hygiene standards and minimise contamination risks. In these environments, fire detection and protection system engineering must take into account the consequential operational issues such as frequent washdowns with detergents or chemicals, stainless steel fix outs and pressurised atmosphere.
- The potential rapid spread of fire and smoke from the time of ignition because fires can be particularly threatening at food processing facilities due to the presence of highly flammable elements such as ammonia. A catastrophic explosion is likely to occur if fire reaches such systems.
- The need for early detection of a fire in its incipient stage in order to eliminate it before it causes damage. Even a power failure from a small fire in electrical or plant room could cause large volume of spoiled inventory because a food plant requires refrigerated storage, food dust control or cleanroom grade environments to produce food products.
- In large open spaces, usually high ceiling with overhead equipment or high air changes in cleanroom grade environments, smoke can be diluted quickly or be invisible to occupants until it is too late.
- Early detection of a fire depends on flexible detection methods such as the combination of ceiling level and vertical locations of detection, and use of suitable materials such as stainless steel components and accessories inside the protected zones whether they are hazard-classified or with have challenging environmental conditions.
- Danger of undetected overheating of any sources can lead to smouldering or combustible conditions, whether from a moving conveyor system, cooking equipment or surfaces, or damaged steampipe insulation. A fire can grow and spread rapidly at the presence of large fuel load (food products) in food processing and storage areas.
- Due to the flammability of food particles or regulated ambient air treatment, whether in the form of flammable vapours, combustible food dusts or odour emission, high-powered ventilation systems are always installed. Despite the requirement of regular cleaning to prevent dust buildup, design of fire detection systems need to take into account potentially even explosion-proof equipment in high-risk areas.
- Unique critical plant infrastructure, such as control rooms, require high level of protection from fire due to the significant consequential losses of property and unacceptable interruption to operations.
- Fire Detection systems must be flexible to adapt to general code compliance requirements, as well as offering localised detection to address specific fire hazard and detection needs. Reliable fire detection must provide complete false alarm immunity whilst ensuring rapid reaction and warning of a fire.
- Fire detection systems should operate reliably through the full product life cycle with a nominal product life of 10 years or more. Easy and non-intrusive access for routine or urgent services and maintenance.

Challenge	Securiton advantages
Challenging operational environment with frequent aggressive cleaning	▪ ADW sensing tube available in food grade stainless steel can resist pressure washing and chemicals.
Risk-based detection	▪ Placement for ADW sensing tube with optional detection coils at targeted locations of hazards, compartments, or localised detection along production processing equipment and conveyors. ▪ Flexible ASD sampling pipe and sampling hole placement for detection at multilevel, compartments, vertical riser type, or enclosures and vaults alike concealed spaces.
Obstructed or restricted access	▪ ADW and ASD both allow control units and testing points to be located in areas easy to access or outside the protected areas or positioned at locations away from operational areas.
Large Open Space (normal or clean-room grade food processing)	▪ Dual channel, long sensing tube length per ADW main control unit, certified for ceiling level installation with various response classes. ▪ ASD active aspirating sampling with powerful fans and approval listings.
Forced, changing or natural ventilation	▪ ADW sensing tube spacing, suitable for buildings with natural ventilation ▪ Flexible placement of ASD sampling points and spacing between them
Rapidly diluted smoke	▪ Very high, consistent ASD EWFD detection sensitivity for incipient fires; position of sampling holes at a lower level
Wide ambient temperature range	▪ ADW Main Control Unit: -30 to +70°C (-22 to +158°F) Stainless steel sensing tube: -40 to +300°C (-40 to +572°F) ▪ ASD operating temperature range is -30 to +60°C (22 to 140°F)
False alarms	▪ ADW offers optimal protection from false alarms with in-built intelligent DHW algorithm (Dynamic Heat Watch) and self-checks via an integrated pressure generator. ▪ Built-in features for false alarm rejection, redundancy design options (e.g., SecuriSmoke ASD 535 with two detectors, designed to cover one single protected zone).
System integration in difficult ambient conditions	▪ Integrated with fire protection systems. ▪ Integrated smoke control and management for the purpose of safe egress. ▪ Suitable ADW accessories for system expansion, testing devices, tools and fittings for fast and high-quality installation (see Appendix A:), ASD accessories used to address installation with ambient conditions such as dust, high humidity, corrosive and ventilated environment (see Appendix B:).

Table 2 Challenges to and solutions for food processing industries protection with Reliable and Early Warning Fire Detection

The use of reliable and Early Warning Fire Detection represents significant advantages over other conventional detection methods. Proper design of such a system for specific fire risk mitigation is of fundamental importance to protect factories, people, and safeguard business continuity. While there are practical difficulties in choosing suitable detection products, combination of SecuriHeat ADW LTHD and SecuriSmoke ASD and REK EWFD systems address all the key challenges in order to deliver early and reliable fire detection for wide range of applications in food industries (see Table 2 above).

2.4 Code compliance and Performance-based Design

The most critical fire protection design aspects for food processing facilities are to meet the industry-specific regulatory compliance framework, building, fire and life safety codes and standards, and facility operators' fire safety objectives. Food industries have a greater than average chance of fire due to processes from raw materials to finished products, transient storage needs, combustible food dusts and unsafe storage of combustible and flammable materials. Other fire hazards are electrical malfunctions and open flames, sparks, conveyors and hot surfaces, found in most food processing lines. Despite some unique operational characteristics, food factories are generally constructed under building codes (e.g., IBC [12]), and applicable design standards such as NFPA 5000 [13] and WBDG[10] Design Recommendations [14], with regards to areas like Architecture and Fire Protection Engineering.

Like other industrial manufacturing sites, fire hazards are generally assessed in line with the classification of occupancy as well as commodities (for example NFPA 1 [15] and FM Global DS 8-1 [16]) as well as building and Life Safety Codes such as NFPA 101 [17]. Food processing facilities can be both an industrial premise and storage warehouses, and can involve chemicals, hazardous materials and combustible and potentially toxic gas leaks or explosive ambient environments. Standard/normal industrial building occupancy with low hazard level may have less concern for hazardous materials, but dust or temperature variations can have a great impact on the type of fire detection system installed. Beyond the building and life safety codes that focus predominantly on life safety when fire detection/alarm system and fire protection requirements are prescribed, fire safety considerations must be taken into account to address specific fire hazards and to mitigate associated risks uniquely to food processing facilities. Industry codes of practice and best risk management practices shall be conformed with.

Examples of design codes and standards related to the food processing industry are:

- NFPA 61 [18] standard for the Prevention of Fires and Dust Explosions in Agricultural and Food Processing Facilities. The standard "*protects lives and property from fires and dust explosions in facilities handling, processing, or storing bulk agricultural materials, their by-products, or other agricultural related dusts and materials.*". From the latest revision of 2020, this standard had been combined into a new consolidated NFPA 660 Standard for Combustible Dusts, due first edition release in 2024.
- NFPA 96 [19] standard for Ventilation Control and Fire Protection of Commercial Cooking Operations. The standard "*provides preventive and operative fire safety requirements intended to reduce the potential fire hazard of both public and private commercial cooking operations.*".
- NFPA 497 [20] Recommended Practice for the Classification of Flammable Liquids, Gases, or Vapors and of Hazardous (Classified) Locations for Electrical Installations in Chemical Process Areas
- NFPA 70 [21] National Electrical Code is the benchmark for safe electrical design, installation, and inspection to protect people and property from electrical hazards. The definition of hazardous locations with classes that are associated with risky of combustible gases and vapours, dangerous due to combustible dust or ignitable fibres.

Combustible dust is a significant risk in the food processing industry. In accordance with relevant codes such as NFPA 61 or NFPA 652 of Standard on the Basics of Combustible Dust, a dust hazard analysis (DHA) is mandatory for a proper review of the hazards by identifying the potential danger and the dust involved. Such requirement places the owners of food processing facility as the responsible party with a plan to mitigate the hazards, develop and implement facility's emergency action plan (EAP).

A similar regulatory regime in managing risk of combustible dusts exist in other countries. For example, in the UK HSE enforces the Dangerous Substances and Explosive Atmospheres Regulations (DSEAR) [22] to eliminate or control risks from explosive atmospheres. The regulations are supported with relevant industry codes and standards, such as BS/EN 14491 Dust explosion prevention systems, BS/EN 61241 Part 10: Electrical equipment for use in combustible dust atmospheres and BS/EN 14797 Explosion venting devices.

Cleanroom grade production areas used in food and beverage manufacturing conform with relevant government regulations or EU Commission Regulation [3] on good manufacturing practice for materials and articles intended to come into contact with food. These regulations aim to ensure the safety of food through addressing matters such as appropriate personal hygienic practices, design and construction of a food plant and maintenance of plant grounds, plant equipment, sanitary operations, facility sanitation, and production and process controls during the production of food. Other industry related codes include FM Global DS 8-29 for Refrigerated Storage [23] and ISO 22000 Food safety management standard for dry and refrigerated food-grade storage warehouses.

Life safety is another important aspect of fire safety in food processing facilities. Life Safety codes (e.g., NFPA 101 [17]) stipulate detailed requirements on fire prevention and protection system design principles based on designated building occupancy and fire risk and hazard assessment with prescribed system placement, actuation (e.g., NFPA 13 [24]) and safe egress in various fire scenarios.

Risk assessment is a very important process to devise a fit-for-purpose fire detection and protection solution for food processing industries. Examples include the use of AS/NZS ISO 31000 Risk Management [25] and NFPA 551 [26], government regulators' guidelines for factories and warehouses [27]), as well as insurers requirements (e.g., FM Global and AXA XL Risk Consulting [28] [29]).

Although there might be marginal differences from one country to another in prescriptive (DtS[11]) building, fire and life safety code requirements on fire detection, a combination of DtS prescriptive and risk-based design approach is the best engineering practice to meet prescriptive requirements as well as to satisfy facility operators' need for business continuity and property protection.

[10] WBDG: Whole Building Design Guide
[11] DtS: Deem-to-Satisfy

Modern food processing plants often incorporate automation and complex production flow design to incorporate large open plan spaces and smooth connectivity between open sections of production floors and storage holding areas. The structure of these spaces could directly contravene building or life safety regulations, whether is due to an extreme high ceiling, alternatives to meet extended egress distance requirements, potentially increased fuel loads in certain areas. It is important to consider the applicable guidance and legislation as well as how a Performance-based Design (PBD) approach, together with the use of a suitable Early Warning Fire Detection system, can overcome these issues.

Performance-based Design (PBD) is typically implemented when elements of fire safety and protection system design are not covered in the prescriptive codes among others due to unique building structure, environmental conditions, added detection for early warning or extended egress considerations [30]. A PBD approach is commonly adopted for either of the following:

1 As means to determine equivalency to a prescriptive code or standard
2 As an approach to achieve broadly defined fire safety goals and objectives

Relevant design and alarm codes must be applied when selecting a suitable fire detection system, for example NFPA 72 [31], BS 5839-1 [32], VdS 2095 [33], and others like AS 1670.1 in Australia [34], NEN 2535 in Netherland [35], R7 in France [36] or DBI 232 in Denmark [37]. Taking into account requirements from all relevant codes and standards, industry codes of practice and government regulations, combining risk analysis and PBD is a fitting fire engineering methodology to devise a suitable fire detection solution to safeguard food processing facilities.

Design Parameters	BS/EN 54-22 [38] [12]		NFPA 72 [31]	
Detection Class vs. Detection Range	**Response Class**	**Detection Range °C (°F)**	**Temperature Class**	**Response Temperature °C (°F)**
	A1	54-65 (129-149)	Ordinary	58-79 (136-174)
	A2	54-70 (147-158)	Intermediate	80-121 (176-250)
	B	69-85 (156-185)	High	122-162 (252-324)
	C	84-100 (183-212)		
	D	99-115 (210-239)		
	E	114-130 (237-266)		
	F	129-145 (264-293)		
	G	144-160 (291-320)		

Table 3 Design performance response classes for LTHD per codes and standards

A reliable fire detection system that automatically alarms local fire services can make a huge difference in minimising the damage that a fire can cause. The ability to detect and alert early also allows local facility operators to control the initial outbreak or to remove potential hazards that would help the fire grow. Early detection of an incipient fire can prevent avoidable business interruption and facilitate orderly and safe evacuation as the fire situation evolves. With the right tools a suitable fire detection system can be designed and installed at a low TCO[13] that can achieve building and life safety objectives as well as protection of business assets, regardless of the size, fuel and occupant loads, layout and operational uses across the food industry.

Table 3 above illustrates how SecuriHeat ADW LTHD system detection performance is defined in terms of Response Class. Note that design of SecuriHeat ADW in this Design Guide is in the context of PBD: response classes and environment groups per BS/EN 54-22 [38]; and temperature classes and range of spacing options per NFPA 72 [31], are referenced as design standards.

Table 4 below illustrates how Early Warning Fire Detection system performance (for smoke detection), as well as the fire safety goals and objectives, are defined.

[12] ISO 7240-20 [12] and AS 7240-20 [12] are derived from BS/EN 54-20.
[13] TCO: Total Cost of Ownership (of an Early Warning Fire Detection system)

Sensitivity	BS/EN 54-20 [39][14]	NFPA 76 [40]
Class A or VEWFD	Very high sensitivity: An ASD system is capable of providing very early warning of a potential fire condition, particularly in high-risk areas with the benefits of staged responses.	Systems that detect low-energy fires, before the fire conditions threaten mission critical service, benefits of staged responses with a sampling hole sensitivity alert of 0.66% obs/m (0.2% obs/ft).
Class B or EWFD	Enhanced sensitivity: An ASD system is for applications where an additional degree of confidence is required for the protection of a particular risk such as with unusually high airflow.	Systems that use smoke, heat, or flame detectors to detect fires before high heat conditions threaten human life or cause significant damage to mission critical service.
Class C or SFD	Normal sensitivity: An ASD system designed to give equivalent performance to standard point detection systems meeting the requirements of EN 54-7 [41].	Systems that use fire detection-initiating devices to achieve certain life safety and property protection, in accordance with applicable standards such as NFPA 72 [31].

Table 4 Similarity in Early Warning Fire Detection definitions for smoke detection

3 Reliable & Early Warning Fire Detection

When combining prescriptive and risk-based approaches to design a fit-for-purpose fire detection system for a food processing facility, it is important to select advanced Securiton detection product portfolio, including Securiton Early Warning Fire Detection (SecuriSmoke ASD and REK), SecuriBeam LTSD and SecuriHeat LTHD. These products allow for a fully flexible design with quantifiable and reliable detection performance. Advantages include a wide range of models; a central control unit that can be remotely installed outside the protected zone; and suitable accessories to cater for diverse environmental conditions within various food industries.

This chapter outlines design recommendations and methods using SecuriHeat ADW line-type heat detector (LTHD) and SecuriSmoke ASD (with option of REK) products to protect food processing plants as follows:

1 Securiton detection product portfolio
2 Design criteria and remarks
3 Detection design schemes and considerations

3.1 Securiton Detection Product Portfolio

This Design Guide focuses on Securiton SecuriHeat ADW LTHD and SecuriSmoke ASD systems, for food processing facilities as described in the previous chapter.

Table 5 illustrates how SecuriHeat ADW LTHD system detection performance associated with environmental conditions and typical applications, are defined.

Design Parameters		
BS/EN 54-22 [38] [15]		
Response Class	**Detection Range °C (°F)**	**Application**
A1I	54-65 (129-149)	Rooms up to 7.5m high
A2I	54-70 (147-158)	Rooms up to 6m high
Environment Group	**Temperature Range °C (°F)**	**Application**
(E)1	-5 to +40 (23 to 104)	Indoor; Stable and Clean Conditions; Commercial and industrial
(E)2	-10 to +55 (14 to 131)	Indoor; Varying and polluted environment; Commercial and industrial
(E)3	-25 to +70 (-13 to 158)	Outdoor; Harsh conditions

[14] ISO 7240-20 and AS 7240-20 are derived from BS/EN 54-20.
[15] ISO 7240-20 [15] and AS 7240-20 [15] are derived from BS/EN 54-20.

Design Parameters

NFPA 72 [31]

Temperature Class	Response Temperature	Maximum Ceiling Temperature	Spacings supported (*per FM Approval)
Ordinary	58-79 (136-174)	47 (117)	4.6 m (15 ft*) 6.1 m (20 ft*) 7.6 m (25 ft*) 9.1 m (30 ft*) 12.2 m (40 ft*)
Intermediate	80-121 (176-250)	69 (156)	
High	122-162 (252-324)	111 (232)	

Table 5 Environment Group and typical applications for LTHD per codes and standards

Table 6 shows how SecuriSmoke ASD and REK portfolio EWFD systems detection performance and other design parameters such as sensitivity classes with corresponding sampling pipe length and number of sampling holes, are defined.

Model	Key performance parameters[16]			
Sampling holes, pipe length, spacing/Sensitivity				
	Total # of holes (Class)			
Class	A	B	C	**Aggregated pipe length**
SecuriSmoke ASD 531	6	8	12	75 m (246 ft)
SecuriSmoke ASD 532	8	12	16	120 m (394 ft)
SecuriSmoke ASD 533	16	50	50	200 m (656 ft)
SecuriSmoke ASD 535-1/3	18	56	120	300 m (984 ft)
SecuriSmoke ASD 535-2/4	36	112	240	2 x 300 m (984 ft)
SecuriSmoke ASD 535 (HD)	2 x 36	2 x 112	2 x 240	2 x 300 m (984 ft)
REK 511-1S	1.2% obs/m (0.366% obs/ft)			Point type addressability for sampling holes located downstream to REK
REK 511-3S	0.3% obs/m (0.091% obs/ft)			
Rating and operational data				
SecuriSmoke ASD	IP54 (IP66 for SecuriSmoke ASD 535 HD)			
	Operating temperature			**# of Relays: Built-in (Expanded – Module)**
SecuriSmoke ASD 531	-10 to +55°C (14 to 131°F)			2 (5-1xRIM36)
SecuriSmoke ASD 532	-20 to +60°C (-4 to 140°F)			2 (10-2xRIM36)
SecuriSmoke ASD 533	-20 to +60°C (-4 to 140°F)			3 (10-2xRIM35)
SecuriSmoke ASD 535	-30 to +60°C (-22 to +140°F)			3 (10 – 2 x RIM35)
REK	0 to +50°C (32 to 122°F)			1 (NA)
Hazardous Areas				
SecuriSmoke ASD	Equipment category IIA, IIB or IIC when suitable flame arresters are used (DFA 25-1, 25-2, 25-3); Stainless steel pipe and fittings			

Table 6 SecuriSmoke ASD and REK products

[16] Highlight performance parameters as per EN54-20 (ASD), and REK point-type detector sensitivity per EN54-7. SecuriSmoke ASD sampling hole class sensitivity and corresponding hole coverage are as shown in Table 9.

Some areas of food processing facilities, or as part of detection-suppression integration, heat-based detection and control may be desirable for certain fire hazards, for instance the use of Securiton SecuriHeat LTHD as in-rack detection to work with in-rack pre-action sprinkler systems in high-bay warehouses. food processing industries also require other form of detection for general offices and support areas. Securiton's other related detection portfolio is listed in Table 7 for reference.

Model	Type	Function[17]
SecuriBeam	Linear Type Smoke Detector (LTSD)	Detect and Control, All
Smoke Switch LRS	Duct Type (Smoke)	Detect and Control, Non-hazardous
Fire Door Control	Open/Close	Control, Non-hazardous
Smoke with Temperature and/or CO	Multi-criteria point type	Detect, Non-hazardous
MCP	Manual Call Point	Control, Hazardous
Smoke Detectors	Point type (Smoke)	Detect, Hazardous
Temperature Detectors	Point type (Heat)	Detect, Hazardous

Table 7 Securiton detection portfolio (point type and others)

3.2 Design Criteria

This chapter describes product and application design criteria for SecuriHeat ADW line-type heat detector (LTHD) and SecuriSmoke ASD Early Warning Fire Detection systems.

3.2.1 SecuriHeat ADW LTHD

SecuriHeat ADW detects temperature changes and can alert and alarm almost instantly to any potential fire incident or developing fire event. The ADW sensing tube is a sealed system, immune to dust and moisture. It can resist high pressure washing as well as many common cleaning chemicals, although the latter should be checked on a case-by-case basis. A summary of SecuriHeat ADW key design parameters is shown in Table 8 below. Note that the term "main control unit" is also used throughout this Design Guide to describe the SecuriHeat ADW 535 main system, often known as "evaluation unit".

In general, relevant codes and standards, such as EN 54-22 [38] and EN 54-5 [42], for the design of a heat detection system to meet prescriptive requirements are referenced as the basis for SecuriHeat LTHD system design. The sensing tube can be flexibly installed for open areas under ceilings, on the side of walls or placed for localised object protection in likely areas of overheating due to hazards such as electrical faults, mechanical frictions or presence of flammable lubricants and liquids. The main control unit can be located inside or outside the protected area or away from protected objects, for easy access with no business interruption.

The ADW 535 HDx is suitable for use in potentially explosive atmospheres of zone 2 and zone 22 in compliance with VDE 0165 and IEC 60079-10. Both the stainless steel and the copper tubing are suitable for hazardous areas while stainless steel sensing tubing is commonly used in cleanroom-like food processing environments that involve frequent washdowns with detergent or chemical substances.

In some areas, such as warehouse loading docks, areas of outdoor and semi-outdoor applications, the ambient temperature may likely change over time. Around doors or under exposure to the sun it could do so quite rapidly. Therefore, it is essential that a heat sensor is able to distinguish between ambient heat and a fire. The ADW 535 offers optimal protection from false alarms with its in-built intelligent DHW algorithm (Dynamic Heat Watch) and self-checks constantly via an integrated pressure generator.

[17] Products listed as "Detect" or "Control" (suitable for "All", 'Hazardous' or 'Non-hazardous' environments) function are connected to building FACPs such as Securiton SecuriFire Fire Alarm Systems.

Model	Key design parameters
SecuriHeat ADW 535	
Classes	EN 54-22: A1I, A2I, BI, CI, DI, EI, FI, GI NFPA 72: Ordinary, Intermediate, High
Sensing tube length	EN 54-22: 10-115 m (33-377 ft) NFPA 72: 10-200 m (33-656 ft) Outside standard: 10-200 m (33-656 ft)
Tube type	Stainless Steel (TU 5/4 SS), Copper (TU 5/4 Cu)
Number of Sensing tube and branch	1 or 2 Sensing tube (channel), 1 T-piece per channel
Rating and operational data	
Operating temperature (Main Control Unit)	-30 to +70°C (-22 to +158°F)
Operating temperature (Sensing tube)	Stainless steel, copper: -40 to +300°C (-40 to +572°F)
# of Relays: Built-in (Expanded – Module)	2 per channel (up to 10 with 2 x RIM36)
Product type approval standards and compliance level	
EN 54-22	See above Maximum spacing 7.0 m (23 ft)
UL 521 – ULC-S530-M91	According to EN 54-22 Classes A1I to GI
FM 3210 / NFPA 72	See above Spacings 4.5 m (15 ft), 6.0 m (20 ft), 7.6 m (25 ft), 9.0 m (30 ft), 12.0 m (40 ft)
Hazardous Areas (SecuriHeat ADW 535 HDx only)	II 3G Ex ec nC IIC T4 Gc II 3D Ex tc IIIC T135°C Dc

Table 8 SecuriHeat ADW 535

3.2.2 SecuriSmoke ASD EWFD

Airflow and detection sensitivity are the two main factors that affect SecuriSmoke ASD sampling hole spacing. Table 9 summarises some key design criteria for deploying Early Warning Fire Detection to protect food processing industries.

To provide clarity, below are some key terminologies related to:

- **Transport Time:** time for (smoke) aerosols to transfer from a sampling hole to the ASD detector
- **Maximum Transport Time:** maximum time for (smoke) aerosols to transfer from the furthest sampling hole to the ASD detector
- **Response Time:** time between the generation of combustion aerosols at their source and the indication of their presence at the ASD detector
- **Reaction Time:** time between (smoke) aerosols reaching a defined level of obscurity (e.g., End-of-test EOT condition) and the notification of their presence at the ASD detector

Pipe network layout and length of single or aggregated pipe length also determine the transport time from each sampling hole to the detector, hence a maximum transport time from the furthest sampling hole(s). Both sampling hole sensitivity and transport time are calculated with SecuriSmoke ASD PipeFlow design tool. PipeFlow offers to calculate a pipe layout in two modes:

1. EN 54-20 (also its derivatives ISO 7240-20 [43] and AS 7240.20 [44]): PipeFlow optimises its calculation for transport time, balance (same air volume at each sampling hole) and takes the characteristic curves of all EN 54-20 test fires [39] into consideration. PipeFlow then indicates the sensitivity to which the detector must be set in order to allow for each sampling hole to reach the required sensitivity according to the selected class.
2. NFPA: PipeFlow optimises its calculation for the required transport time for VEWFD, EWFD or SFD.

Design recommendations described in this chapter assume the transport time meets the respective sampling hole or detector unit sensitivity level in Table 9 for target Class A (VEWFD), Class B (EWFD) or Class C (SFD) design.

Model	Key design criteria		
NFPA/FM Global	**VEWFD**	**EWFD**	**SFD[18]**
Hole sensitivity	3.28% obs/m (1.0% obs/ft)	4.92% obs/m (1.5% obs/ft)	Point type over number of holes
Hole coverage	18.6 m² (200 ft²)	37.2 m² (400 ft²)	83.6 m² (900 ft²)
Transport time	<60 sec	<90 sec	<120 sec
EN/AS/ISO/BS	**Class A**	**Class B**	**Class C#1**
Hole sensitivity[19]	0.4% obs/m (0.12% obs/ft)	1.16% obs/m (0.35% obs/ft)	6.67% obs/m (2.0% obs/ft)
Hole coverage[20]	15-25 m² (166-269 ft²)	25-35 m² (269-388 ft²)	Up to 7.5 m (25 ft) radius
Transport time[21]	<60 sec	<90 sec	<120 sec
Reaction time[22]	<60 sec	<60 sec	<60 sec

Table 9 Key design criteria (SecuriSmoke ASD)

Parameters	Key design considerations		
EN 54-20 Class	Class A	Class B	Class C
ASD Sampling Type and Smoke Characteristics	Smoke is not visible due to low quantity of smoke and/or high dilution caused by air movement or LOS[23]	Smoke is visible but insufficient to be detected by point or beam technologies (per [39] or [45])	Smoke visible and sufficient to be detected by point or beam technologies (per [39] or [41])
Primary Detection (sampling where smoke is likely to travel)			
	Best	Appropriate (Small areas only)	Not appropriate
Secondary Detection (positioning sampling holes per the codes for point detectors)			
	For Early warning applications	For challenging applications	Appropriate
Localised Sampling (custom protection of specific equipment)			
	Appropriate for high risk	Appropriate for low risk	Not appropriate
In-cabinet Sampling (localised sampling)			
	Appropriate for high risk	Appropriate for low risk	Not appropriate
Duct Sampling			
	Appropriate for high risk	Appropriate for low risk	Not appropriate

Table 10 Sensitivity requirements vs. detection requirements (FIA Code of Practice [46])

ASD Type 1	ASD Type 2	ASD Type 3	ASD Type 4
10.5-18 m (34.4-60 ft)	15-26 m (49.2–85 ft)	25-43 m (82-141 ft)	40-43 m (131.3-141 ft)

Table 11 Recommended ceiling heights

In general, simply follow relevant codes and standards for the design of smoke detection systems to meet prescriptive requirements. Two key considerations in design are:

1 Sensitivity requirements versus detection requirements in relation to the height of the ceiling.
2 The smoke detector spacing (or ASD sampling hole spacing as equivalent) in relation to the airflow.

[18] SFD/Class C refers to point type detectors, usually tested to an alarm sensitivity of 2.0 dB/m (36.9% obs/m (11.247% obs/ft)).
[19] For Securiton ASD products. Individual hole sensitivity can be determined using SecuriSmoke ASD PipeFlow design tool.
[20] Hole spacing is more a mixture of DtS (per point type detectors in BS 5839-1 or VdS 2095) and PBD (BS 6266, FIA Code of Practice or VdS 2095 Appendices) provisions with adjustments based on airflow and design to required sensitivity Class A, B or C.
[21] Transport Time of AS7240-20 conformed Class A, B and C are 60 sec, 90 sec and 120 sec respectively in AS1670-1.
[22] Reaction Time of 60 sec after EOT refers to EN54-20 test requirements for relevant tests to Class A, B or C sensitivity.
[23] LOS: Large Open Space

Table 10, Table 11 and Table 12 illustrate the design parameters commonly referred to when designing Early Warning Fire Detection with SecuriSmoke ASD in accordance with the codes such as FIA Code of Practice [46]. Smoke detector spacing based on air change rate (ACH) per NFPA 72 [31] or FM DS 5-48 [47].

Note that individual countries may have different provisions regarding height limits or multilayer detection prescribed as DtS. Examples of maximum height for the use of ASD in Germany is 20 m (65.5 ft) (DIN VDE 0833-2), in the Netherlands it is 45 m (147.6 ft) (NEN 2535 [35]) and in France it is 12 m (39.4 ft) (R7 [36]). When the ceiling heights exceed the respective maximum limit, the use of ASD is considered a PBD engineering design which often requires proof with a successful fire test during the commissioning and acceptance phase.

Recommended ceiling heights for ASD types[24] (Table 11) varies from generally applicable (low limit) to ceiling with design for property protection with rapid fire service attendance time of 5 min. Includes sloped ceilings with slopes not greater than 10% of ceiling height (high limit).

Air changes per hour (ACH)	Spacing [m^2 (ft^2)]
60	12 (125)
30	23 (250)
20	35 (375)
15	46 (500)
12	58 (625)
10	69 (750)
8.6	81 (875)
7.5	84 (900)
6.7	84 (900)
6	84 (900)

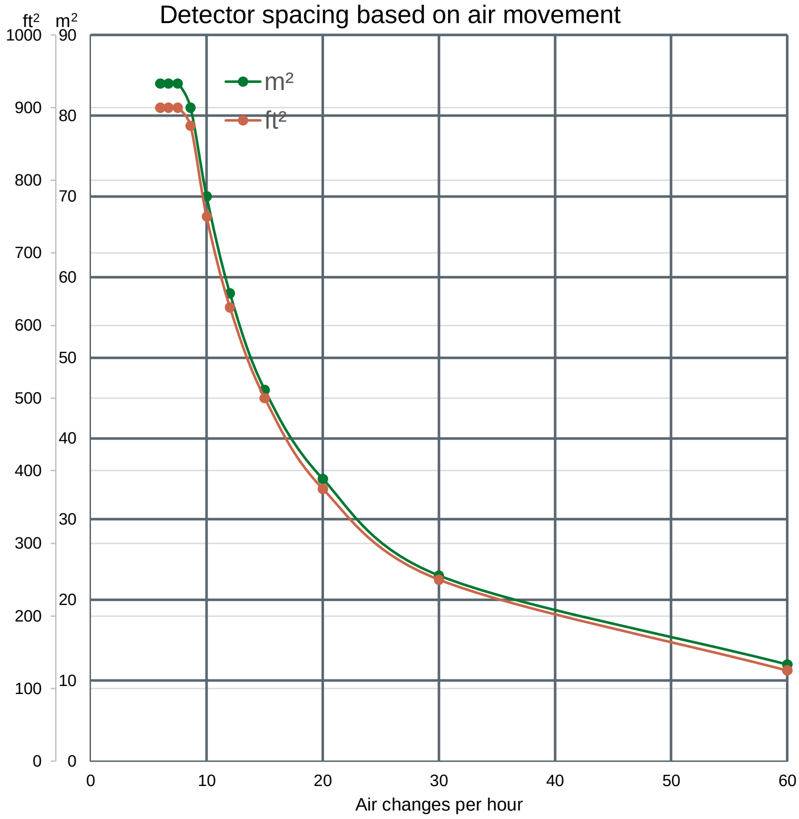


Table 12 Smoke detector spacing based on air change rate (NFPA 72 [31]/FM DS 5-48 [48])

Because each ASD sampling hole in effect represents a single point type smoke detector, the key criteria or variables included in this chapter focus on SecuriSmoke ASD design with regards to:

1 Sampling hole spacing
2 Sampling hole placement
3 Sampling hole orientation (in general perpendicular downwards to the floor unless mentioned otherwise)

[24] ASD Type include: Type 1: Any ASD system approved to EN 54-20; Type 2: ASD system with: at least 5 Class C holes or at least 2 Class B holes; Type 3: ASD system with: at least 15 Class C holes or at least 5 Class B holes; and Type 4: ASD system with: at least 15 Class B holes

3.3 Detection Design: Risk-based

As described in chapter 2.1, there are diverse built environment and operation characteristics in food processing which come with their respective unique fire hazards and risks. It is important to provide a suitable fire detection solution that is reliable and flexible enough to be able to detect fires at their early stage.

The concept of the risk-based protection method is to detect smoke or heat where it originates and propagates or where the protected areas pose very challenging environmental or hazardous conditions. This chapter describes the following risk-based detection methods:

1 SecuriHeat ADW Applications for both ceiling and localised detection
2 Return air grills & duct detection

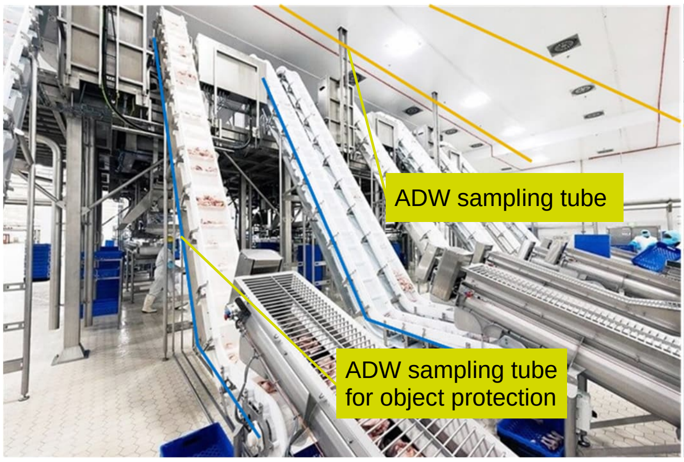
3.3.1 SecuriHeat ADW Applications

This chapter focuses on SecuriHeat ADW applications specifically in the areas where SecuriHeat ADW LTHD is a desirable reliable fire detection solution. These applications include:

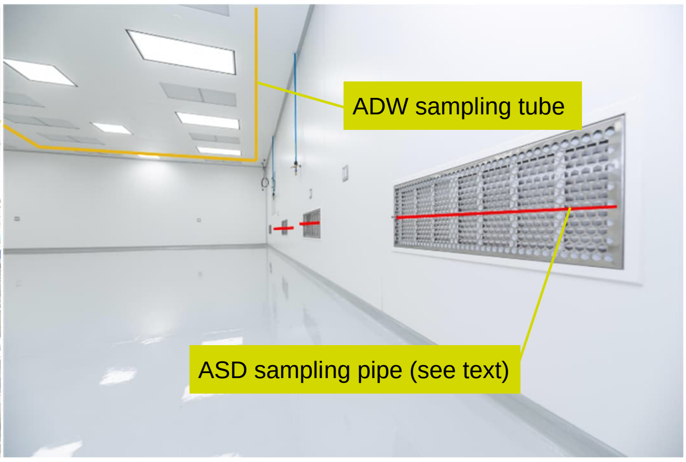
- Cleanroom grade food processing areas where cleaning with extensive washdown mandatory requirements
- Localised processing machinery and equipment protection
- Areas with challenging environmental conditions or hazardous areas

Figure 3 below illustrates:

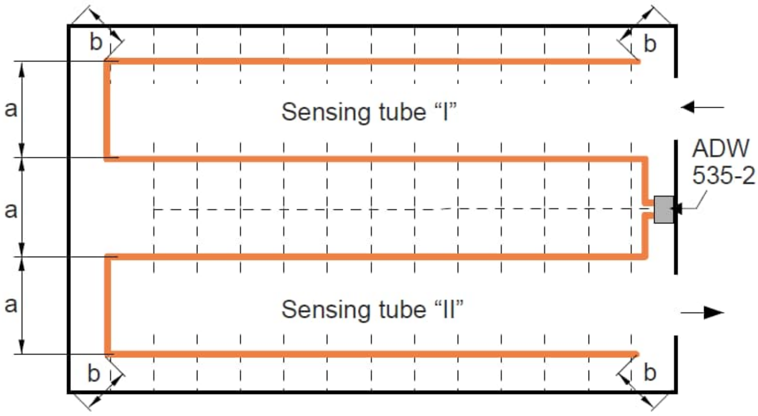
(a) SecuriHeat ADW sensing tube layout at ceiling level or combined with object protection in cleanroom grade food processing. When combining ceiling level protection with object protection, external temperature sensors from the same SCU control unit may be used, provided the system limits are observed.
(b) Example of ISO Class 7 cleanroom with low level return air grills
(c) Example of ceiling detection design per EN 54-22
(d) Example of ceiling detection design per NFPA 72
(e) SecuriHeat ADW Main Control Unit installed outside cleanroom
(f) SecuriHeat ADW application in challenging environment or hazardous areas



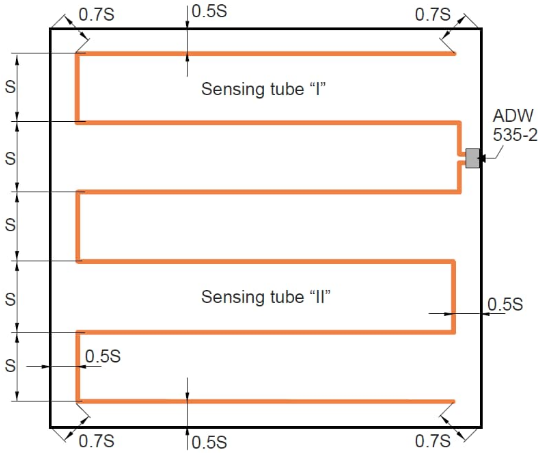
(a) SecuriHeat ADW Sensing tube layout at ceiling level or combined with object protection in cleanroom grade food processing



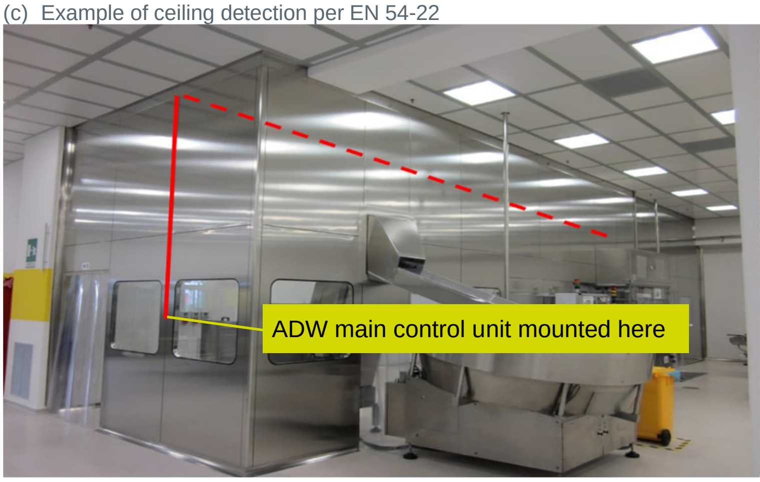
(b) Example of ISO Class 7 cleanroom with low level return air grills



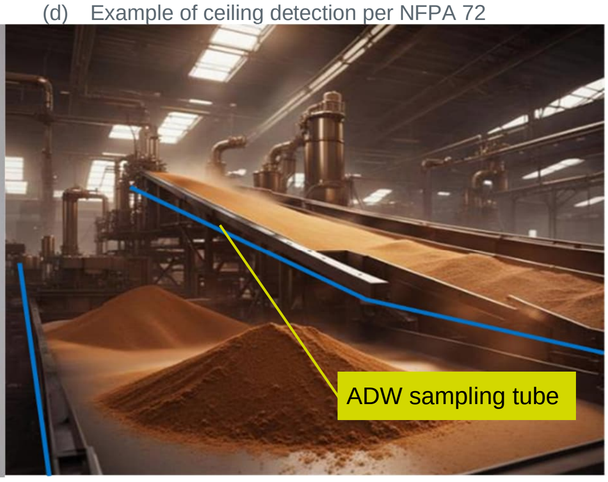
(c) Example of ceiling detection per EN 54-22



(d) Example of ceiling detection per NFPA 72



(e) SecuriHeat ADW Main Control Unit installed outside cleanroom



(f) SecuriHeat ADW used in hazardous areas

Figure 3 Fire detection placement SecuriHeat ADW (risk-based protection)

Variable	Design recommendation
Spacing	▪ For ceiling level protection (orange lines in Figure 3 (a) and (b)), refer to chapter 3.2.1 for detail design criteria in regards spacing. ceiling height limits and Response classes per product type approvals and design standard compliance. ▪ Examples of ceiling level sensing tube layout are illustrated in Figure 3 (c) and (d). ✓ per EN 54-22 [38], Maximum spacing (a = 7.0 m (23 ft)); Maximum spacing to far corner of wall (b = 50% of a) ✓ per NFPA 72 [31], Spacings (S = selection of 4.5 m (15 ft); 6.0 m (20 ft), 7.6 m (25 ft), 9.0 m (30 ft), 12.0 m (40 ft)); Maximum spacing to far corner of wall is 70% of S, Maximum spacing to side wall is 50% of S ▪ For object protection such as conveyor, sensing tube forms a single line across entire transverse length of a single width conveyor surface, run across locations with potential fire hazards such as motors (blue lines in Figure 3 (a)). If needed, additional Detection Coils (Appendix A:) can be added for specific location detection and alarm.
Placement	▪ Sensing tube is positioned under the ceiling per design standard requirements for code compliance, or PBD approach for enhanced detection coverage (for instance a reduced spacing between sensing tubes) ▪ Sensing tubes are secured on the inside of the conveyor mounting frame to avoid unintentional damage.
Orientation	▪ Sensing tube at ceiling level can be positioned taking into account other ceiling fixtures such as lighting, HVAC vents ▪ Sensing tube generally runs parallel along the conveyor but is flexible enough to be bended to go around obstacles, safety barriers or other fittings when needed.
Additional notes	▪ SecuriHeat ADW Main Control Unit can be installed outside cleanroom grade food processing rooms (Figure 3 (e)). ▪ For challenging environments, particularly hazardous areas with potentially explosive atmospheres (Figure 3 (f)), ADW 535HDx must be installed outside the protected area. Only Securiton authorised accessories and modules, such as RIM 36, XLM 35 and SIM 35 can be installed. Any corresponding receiver modules (opposite side) of XLM 35 and SIM 35 must be outside the protected areas ▪ A test coil may be installed for functional test away from the protected areas or outside the protected rooms (Appendix A:) ▪ Where needed, additional detection coils may be used for localised detection (Appendix A:) ▪ An external temperature sensor (Appendix A:) should be used to compensate temperature differenced between the monitored area and the location of the main control unit ▪ Choice of Max-Alarm, Diff-Alarms threshold respectively; Integration Alarm to enable Pre-signals for early alert for local response ▪ Select HDx version of main control units for EX-zone 2/22 applications. Appendix A: shows some of the common accessories for SecuriHeat ADW LTHD.

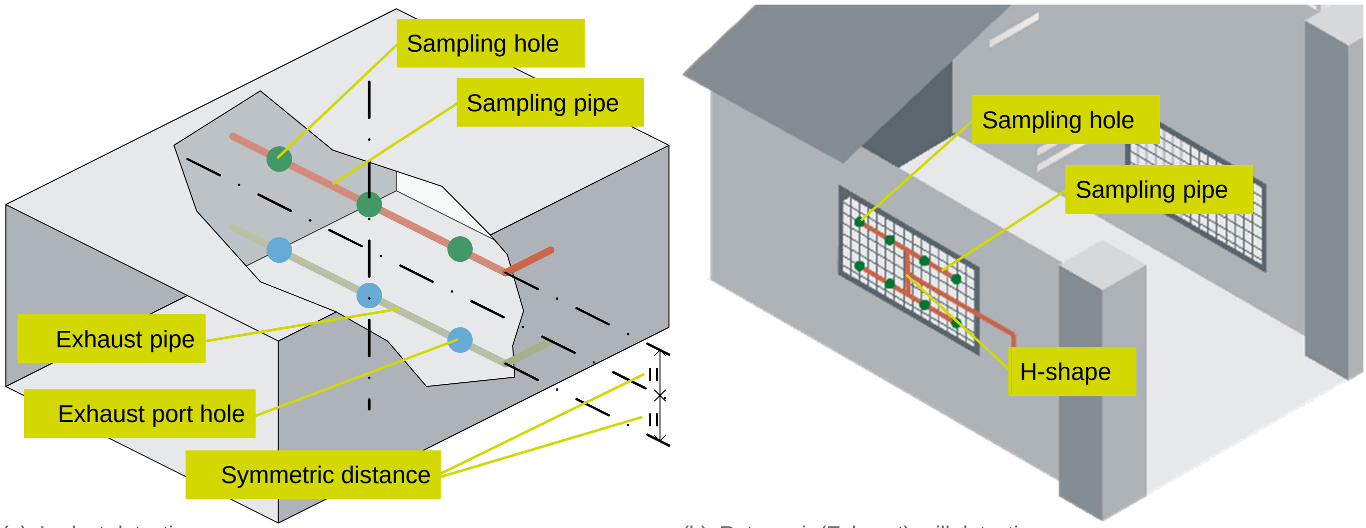
3.3.2 Return Air Grills & Duct Detection

While SecuriHeat ADW is ideal for cleanroom grade food processing areas, SecuriSmoke ASD EWFD can be used in areas where smoke detection is also desirable due to specific fire risk and hazardous profile. As such, SecuriSmoke ASD for return air grills (as illustrated by the red lines in Figure 3 (b)) or duct detection is suitable for providing EWFD when its operation and performance are not affected by the regular cleaning washdowns required for the protected rooms.

NFPA 72 [31] specifically requires that ASD should not be used in airflow environments above 1.52 m/s (300 ft/min), unless a smoke detector is recognised for use in specific airflow environments. Both BS 6266 [49] and NFPA 72 recognise the challenges of detecting smoke in high-airflow environments and stipulate reductions in spacing of detection points in such conditions. Special applications such as detection of smoke inside ducts, in front of return air grills or large exhaust fans in open spaces are strictly limited to the types of detection technology approved as suitable for high airflow environments.

SecuriSmoke ASD can be used for high airflow duct detection (approved to UL268A [50] with maximum airflow of up to 20.3 m/s (4,000 ft/min). Figure 4 (a) is a cross-section view of a duct with the sampling pipe and pipe from the exhaust port inside the duct, when using SecuriSmoke ASD for in-duct smoke detection. The SecuriSmoke ASD 532 model [51] is generally recommended as a cost-effective solution for in-duct detection. In this case, the total length of the sampling pipe and exhaust port pipe should be no more than 20 m (~65 ft).

Figure 4 (b) illustrates how ASD sampling points are positioned in front of a return air grill in an open space area.



(a) In-duct detection (b) Return air (Exhaust) grill detection

Figure 4 Fire detection placement (duct or exhaust detection)

Variable	Design recommendation
Duct (sampling pipe)	See Figure 4 (a)
Spacing	In-duct detection: 2 to 4 or more sampling holes are used, hole spacing ranges from 10 to 80 cm (~4 to 30 in)
Placement	In-duct detection: Inside the duct, perpendicular and symmetric to the central line of the duct in relation to the pipe from exhaust port below It is recommended (per NFPA 72 [31]) that duct smoke detectors/sampling points be located in a duct section that is between 6 and 10 equivalent duct diameters from bends or openings
Orientation	▪ Facing the incoming airflow using Securiton sampling funnel SF ABS
Duct (exhaust pipe)	See Figure 4 (a)
Spacing	Exact same number of holes and identical spacing as in the sampling pipe above
Placement	In parallel and symmetric to the central line of the duct in relation to the sampling pipe, spacing is no less than 10 cm (4 in)
Orientation	Facing the incoming airflow using Securiton sampling funnel SF ABS
Return Air (Exhaust) grills	See Figure 4 (b)
Spacing	Maximum area coverage of 0.4 m^2 (4.3 ft^2) of the air grille (or exhaust fan) cross section area per sampling hole When two or more rows of sampling pipes are needed for larger grills or fan cross-section area, sampling pipes are designed to form a H shape
Placement	Installed across with pipe stand-off to the surface of the grill (fan) cross section area at ~250 mm (~10.0 in)
Orientation	▪ Facing the incoming airflow using Securiton sampling funnel SF ABS

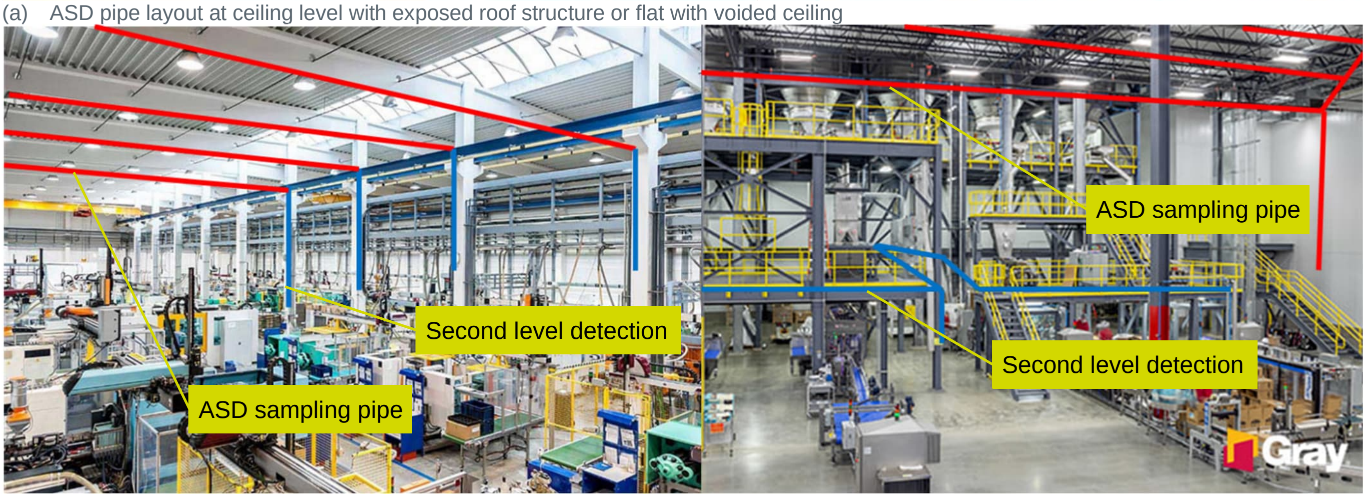
3.4 Detection Design: Large Open Spaces & Special Applications

Being manufacturing facilities, food processing plants often consist of many large open spaces. A SecuriSmoke ASD Early Warning Fire Detection system can be used for ceiling level detection to meet prescriptive code and Performance-based Design (PBD) safety requirements as well as enhanced detection performance designs to meet risk-based fire safety objectives, avoid losses due to fire damages and ensure operational continuity. Since food processing premises come in various sizes and shapes, with varying ceiling heights and even vertical openings for these with mezzanine structures, additional fire detection to supplement open area ceiling level detection is a key consideration to achieve Early Warning Fire Detection, in particular when the ceiling height exceeds the applications and uses approved for detection products per local codes and standards.

Another aspect of overall fire safety of at food processing facilities is to provide suitable protection to critical support infrastructure scatted around the main factory buildings.

Ceilings[25] in can be a mixture of slightly sloped, flat or irregular when architecturally designed. Exposed ceilings[26] are those ceilings with all the structural and MEP[27] systems (when installed) left exposed. Some ceilings are constructed with beam/joist for extra loadings required. Ceiling structures, supported with steel beams and columns, are common for food processing facilities.

(a) ASD pipe layout at ceiling level with exposed roof structure or flat with voided ceiling



(b) Layered ASD pipe layout at various levels with ceiling detection (red) and supplementary detection (blue)

(c) SecuriSmoke ASD can be used for warehouses and storage protection

[25] In the context of this document the term 'ceiling' refers to the upper limit of each level in a building structure. For instance, in large warehouses with multi-level mezzanines, ceiling refer to individual areas or compartments at individual level.
[26] Exposed ceilings are also known as open ceilings or open plenums
[27] MEP: Mechanical, Electrical and Plumbing

(d) High IP rating enclosure and very dusty environment (e.g., sugar plant) or classified hazardous areas (spices processing)


(e) Examples of SecuriSmoke ASD protecting critical electrical and plant rooms

Figure 5 Fire detection placement ASD (underside ceiling detection schemes)

Figure 5 above illustrates how SecuriSmoke ASD can be used in various applications. Table 13 below is a list of Securiton industries and application design literature and references for these SecuriSmoke ASD EWFD design practices as well as other special applications may be found in food processing industries environment.

Illustration (Figure 5)	Securiton Design Guide/Case Study
(a) ASD pipe layout at ceiling level with exposed roof structure or flat with voided ceiling. (b) Layered ASD pipe layout at various levels with ceiling detection (red) and supplementary detection (blue) (c) SecuriSmoke ASD can be used for warehouses and storage protection (d) High IP rating enclosure and very dusty environment (e.g., sugar plant) or classified hazardous areas (spices processing) (e) Examples of SecuriSmoke ASD protecting critical electrical and plant rooms	Distribution Logistics and Warehousing Industry [52] Refrigerated Storages [6] Large Open Spaces [53] Intrinsically Safe and Hazardous Areas [54]

Other Special Applications	
Support Operations	Loading Docks [55]
Equipment & Object Protection	EWFD for Electrical and IT Cabinet Protection [56]
Infrastructure	Power Transmission and Distribution [57] EWFD for Cable Pathway Spaces [58] Commercial roof-mounted photovoltaic (PV) systems [59]

Table 13 List of Securiton application design literature and references

4 Securiton 360° Fire Protection Solution

The Securiton 360° Fire Protection Solution (illustrated in Figure 6) is built on its advanced Securiton Fire Alarm Systems (FAS). SecuriFire is not just reliable in operation with its modular, decentralised system architecture, it is also versatile and expandable to cater for current and future needs to connect all approved fire safety devices such as signalling, alarming, display and control units.

SecuriHeat ADW LTHD systems are networked through RS485 and Ethernet or via SecuriLine extension card into a FAS of the SecuriFire family (Relay contacts for other FAS). The networked main control units from one or multiple sites can be centrally monitored and managed from a remote location, such as an on-site control room or authorised off-site location or certified remote monitoring centre.

SecuriSmoke ASD detectors are networked through RS485 or TCP/IP. The networked detectors from one or multiple sites can be centrally monitored and managed from a remote location, such as an on-site control room or any authorised off-site location or certified remote monitoring centre.

In general, two methods to monitor and manage SecuriSmoke ASD detectors:

- use Securiton UMS software to manage ASD detectors independently networked and connected to the UMS or connected via SecuriLine to a FAS of the SecuriFire family which in turn is connected to the UMS
- manage SecuriSmoke ASD detectors through an enterprise BMS software

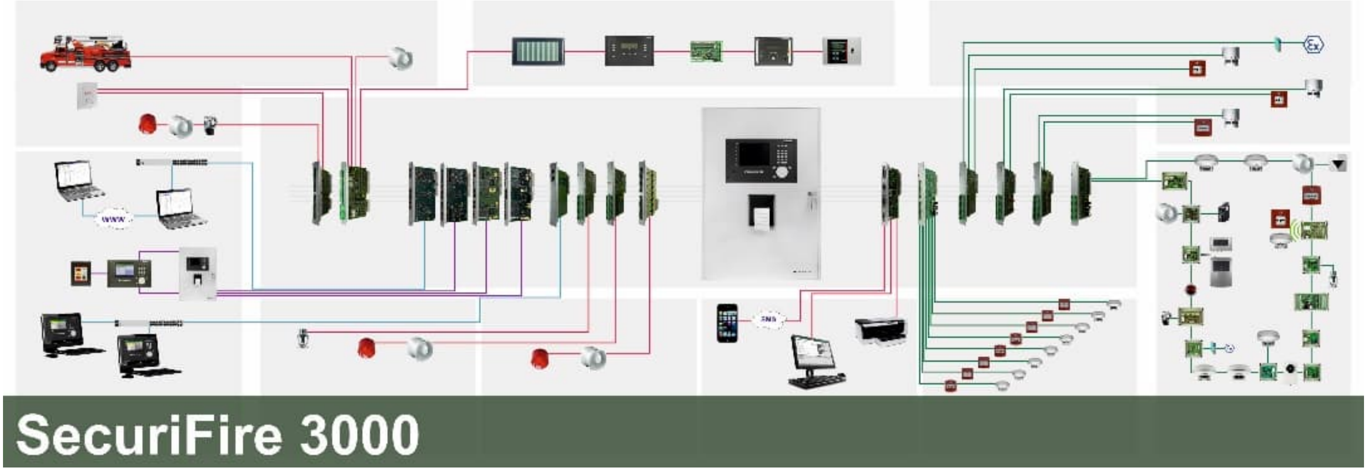


Figure 6 Securiton 360° Fire Protection Solution (FACP and Connections)

4.1 Features and Benefits

Securiton equipment is certified in accordance with ISO standards 9001, 14001 and 45001 and thus meets globally applicable standards with regard to quality management, environmental management, and occupational health and safety management systems.

Securiton’s SecuriHeat product portfolio provides comprehensive line-up for both addressable and non-addressable applications. SecuriHeat ADW LTHD system offers unobtrusive, easy to install heat detection that is immune to harsh environments, include high frequency, high pressure washdowns with detergents or chemicals; can easily be cleaned and maintained. It is compatible with the principles of Intrinsically Safe Design and can be used in combination with SecuriSmoke ASD in the most demanding Performance -based Designs fire detection solutions.

Below is a summary of benefits of SecuriHeat ADW systems and SecuriSmoke ASD products:

Features	Benefits
SecuriHeat ADW LTHD	
Copper, stainless steel or Teflon tubing	Resistant to harsh indoor and outdoor conditions
ADW unit away from sampling tubes	Easy access for services while ensuring operation continuity; Simplify intrinsically safe design
Dynamic Heat Watch algorithm	Elimination of false alarms
Fully automatic system monitoring	Minimal service required, hence low Total Cost of Ownership (TCO)
Durable sensing tube	Operate in extreme and challenging environments
2-level of alert and alarm	Enable integrated and orderly verify, control and response
SecuriSmoke ASD EWFD	
Early and reliable smoke detection	Ensure safe egress for life safety
ASD unit away from sampling pipes	Easy access for services while ensuring operation continuity; Simplify intrinsically safe design
Automatic on-demand fault alarms	Minimal service required, hence low Total Cost of Ownership (TCO)
5-level of alerts and alarms	Enable fully integrated and orderly verify, control and response
Optimal alarm settings supported with design tool for code compliance	Eliminate false alarms in challenging environments
Dynamic use of aspirating technology to address unique operating conditions	Consistent detection performance in areas with pressure difference (e.g., in-duct sampling vs. room detection), high or low temperature or humidity
Seamlessly integrated with fire alarm system (FAS) and building management system (BMS) components	SecuriSmoke ASD is designed as a key component of a total fire prevention and protection solution
Use for applications with challenging environments	Aspects of SecuriSmoke ASD product design for use in applications with challenging ambient environments include high IP enclosure and wide temperature range suitable for natural ventilated build environment installation; complete sealed sampling air path, separated sampled air from detector electronics; conformal coatings of PCBs and special coating treatments to connectors and contacts. Use of suitable accessories to manage dusty or high humidity where condensation could occur.

4.2 Integrated Verify, Control and Respond

SecuriHeat ADW 535 provides one alert (‘Pre-signal’) and one fire alarm (‘Alarm’) signal. Alert escalating to Alarm from an overheating component or incipient fire provide the early alert needed to prevent the incident from fire ignition or limit the fire spreading out. Table 14 summarises the use of 2 level of alarms from SecuriHeat ADW.

Level	Signal	Typical use
1	Pre-signal	Verify and control (manually initiate the suppression)
2	Alarm	Initiate fire alarm; call fire brigade; initiate suppression

Table 14 Alert and alarm levels for ADW

One of the advantages of using SecuriSmoke ASD detectors is the five levels of alerts (‘Pre-signal1’, ‘Pre-signal2’, ‘Pre-signal3’) and alarm signals (‘Alarm’, ‘Alarm2’). These alarm signals can be used for power-down equipment and building system control, detection to suppression or pre-action sprinkler actuation.

Table 15 below shows the typical use of SecuriSmoke ASD multilevel alarms.

Level	Signal	Typical use
1	Pre-signal1	Verify and control (manual extinguishing as needed)
2	Pre-signal2	Manual control or shutdown of HVAC and operation to affected areas if required; call emergency team or Central Control
3	Pre-signal3	Auto control or shutdown of HVAC and related BMS; Initiate smoke and fire management and other related processes; evacuate sections or levels of fire alarm origin
4	Alarm	Actuate clean agent suppression where applicable; initiate main building fire alarm; evacuate entire building and affected surrounding areas call fire brigade
5	Alarm2	Actuate pre-action sprinkler

Table 15 Alert and alarm levels and their typical use for SecuriSmoke ASD

Table 16 illustrates various suppression actuation schemes with SecuriSmoke ASD or the combination of SecuriSmoke ASD with other Securiton detection systems such as SecuriHeat Line Type Heat Detection.

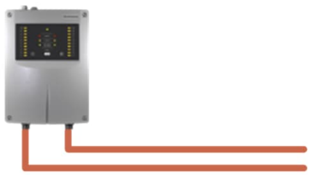
Scheme	Illustration	Remarks
A		2 x SecuriSmoke ASD 531, 532 or 533 for full redundancy or cross zone coincidence design
B		Single SecuriSmoke ASD 535-2/4 with one set of pipe network, each smoke sensor set to different sensitivity
C		Single SecuriSmoke ASD 535-2/4 with two independent pipe networks, each smoke sensor set to different sensitivity
D		Use REK in place of 2nd ASD in Scheme A, or localised suppression
E	Scheme A, B or C plus 	Any of SecuriSmoke ASD with REK
G	Scheme A to C + SecuriHeat ADW 	Combine with SecuriHeat Line Type Heat Detection

Table 16 SecuriSmoke ASD, REK and SecuriHeat for control and suppression actuation

4.3 Non-intrusive System Access for ITM

Due to the advanced automatic sealing and automatic self-test functions of SecuriHeat ADW 535 LTHD, the detection system is largely maintenance free. However, local codes and standards may require a periodic function check. For a safe execution of the functional test without entering the potentially hazardous area or disrupting operations inside the protected areas, make use of the conveniently located test coil (see Appendix A:).

With SecuriSmoke ASD detectors the non-intrusive access to the system while the protected areas, in this case food processing industries with high occupancy loads and long operating hours, remain in full operation, is another advantage. Examples of relevant codes and standards for fire detection and alarm systems Inspection, Testing and Maintenance (ITM) include ISO 7240-14 [60], NFPA 72 [31], BS 5839 [32] and AS1851 [61]. In general, codes and standards also make references to the manufacturer's design, installation, and operation manual listed with relevant product-type approvals such as UL, EN or FM Approval. Testing methods refer to NFPA 76 [40], FIA CoP [46], or local applicable requirements.

Table 17 below is a simplified ITM schedule for SecuriSmoke ASD product services. Refer to Securiton product manuals for more details.

Service Item	Fault/Alarm	Trimestrial	Yearly
Cleaning the detector housing exterior (air outlet)	(✓)[28]	?	✓
Cleaning of sampling pipe tube network, accessory parts, airflow sensors	(✓)	?	✓
Replacement of dust filters	(✓)	✓[29]	✓
Cleaning of air flow sensor	(✓)	✓[29]	✓
Check correct seating (no leakage)	(✓)	?	✓
Check of fault and alarm release	✓	?	✓
Update maintenance protocol	✓	?	✓
Analyse event memory	✓	?	✓
Analyse airflow issues (caused by operational changes)	✓	?	✓

Table 17 Typical Inspection, Testing and Maintenance (ITM) Schedule for SecuriSmoke ASD

4.4 Support with Peace of Mind

Apart from range of software tools as described in chapter 5 below, other Securiton application support includes:

- Partner accreditation program with training of the partner's staff in sales, engineering, troubleshooting and maintenance of Securiton products. Securiton is also operating a comprehensive online training platform in combination with in-depth training courses, conducted either at Securiton headquarter or locally at the partner's premises.
- Application and field engineering support for specific project needs, with worldwide reach through a network of partners as well as subsidiaries and investment companies, with Securiton regional offices or dedicated local employees around the world.

[28] ✓ indicates 'shall do'; (✓) indicates 'as needed'; ? indicates 'only if required by local codes and standards'

[29] As per manufacturer recommendation for protected areas with high level of dust present or natural ventilated areas subject to dusty air particulates.

5 Remote Monitoring & Software Tools

SecuriHeat ADW LTHD and SecuriSmoke ASD EWFD products are supported with range of software tools (see Appendix C:). This chapter describes briefly the software tools for design, configuration or remote monitoring and management of SecuriHeat ADW LTHD and SecuriSmoke ASD and related products.

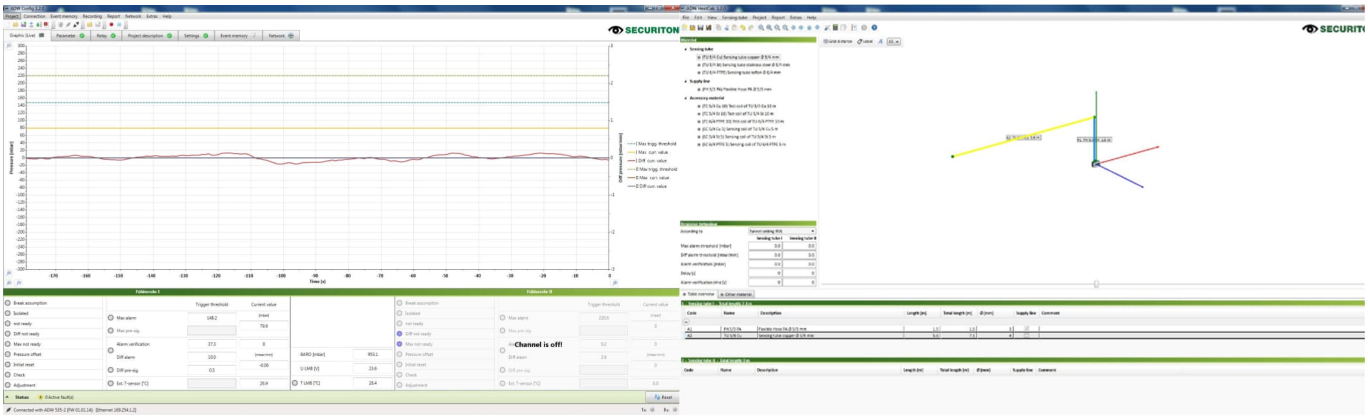
5.1 System Integration: SecuriHeat ADW

For food processing industries with extended uses of SecuriHeat ADW, detectors can be connected to a laptop for easy services and troubleshooting, and during the normal operation, networked SecuriHeat ADW main control units are connected to a building FAS via RS485, Ethernet with SecuriLine expansion card. If a pre-action type sprinkler system or a water mist system is used, SecuriHeat ADW detector can also be configured to actuate the release of the fire extinguish systems.

Figure 7 below illustrates SecuriHeat LTHD:

(a) ADW Config graphical user interface: used for general Configuration, Commissioning and Maintenance, with or without pre-calculated parameters from ADW HeatCalc, with ability to view and export events, display real-time readings, etc.

(b) ADW HeatCalc graphical user interface: used to calculate design parameters such as response based on the actual design Sensing tube layout with the exact type of accessories and locations of their use.



(a) ADW Config graphical user interface (b) ADW Heatcalc graphical user interface

Figure 7 System integration considerations for SecuriHeat ADW

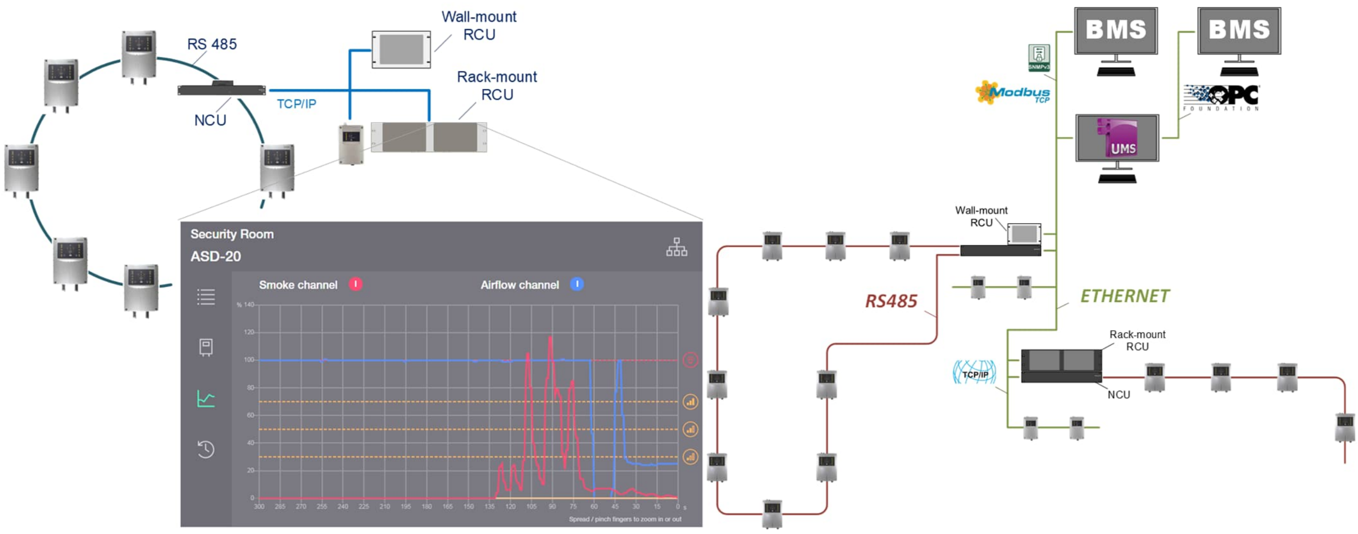
5.2 Rack-mount Standalone FidesNet RCU

Using Securiton FidesNet, multiple ASDs are connected to each other via serial RS485 interface. The FidesPort NCU 900[30] acts also as a gateway for remote access, which supports standard interfaces (such as Modbus TCP or SNMP) to connect to a BMS.

FidesControl RCU 700[31] is a rack-mounted or wall mounted standalone networked SecuriSmoke ASD display, control and management console. It comes with 7" touch screen and offers access to all connected ASD for routine services and emergency response tasks. With the use of an RCU in most cases, it becomes obsolete to physically access the ASD devices themselves – often placed in highly secured areas – or brining in personal laptop computers into such areas. Because the RCU device is designed for one-to-many or many-to-one topologies, more than one RCU to the same FidesNet networked SecuriSmoke ASD can be connected.

Figure 8 (a) illustrates the RCU and NCU for display, control and management of networked SecuriSmoke ASD detectors remotely from the protected areas.

[30] NCU: Network Communication Unit
[31] RCU: Remote Control Unit



(a) Standalone FidesNet RCU display and control (b) Networked SecuriSmoke ASD managed with UMS

Figure 8 Remote monitoring and software tools

5.3 PC-based Universal Management System UMS

The UMS visualises live data from networked SecuriSmoke ASD. A comprehensive overview of the entire ASD population on one or more site(s) can be accessed from a central location, including the detectors current states. All data is visualised in form of lists, on a simple building layout plan or even a complex graphical view. UMS allows configuring and retrieving data from any of the detectors in the network through a user-friendly, intuitive graphical user interface.

Figure 8 (b) illustrates two FidesNet networks of SecuriSmoke ASD devices, each connected to an RCU 700 for local display and control. Both networks are connected to a UMS for overall monitoring and control. The figure also illustrates the possible connection to a BMS.

5.4 Software Tools: SecuriSmoke ASD

To design SecuriSmoke ASD detectors which meet the levels of protection required for an application (in terms of detection sensitivity, sampling hole placement/coverage, transport time limits, etc.), it is essential to use the SecuriSmoke ASD PipeFlow design software (Figure 9). This software helps in generating a design package, which is the basis of design, installation, commissioning and ongoing ITM throughout the product lifecycle.

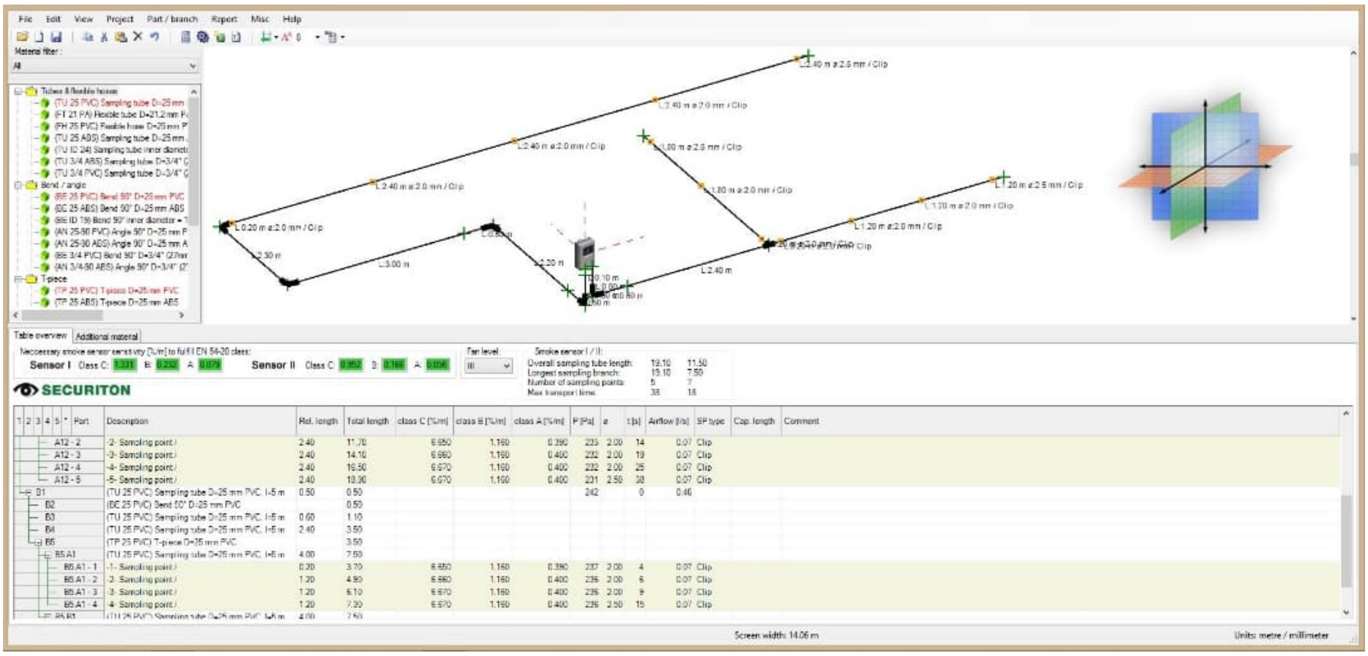


Figure 9 SecuriSmoke ASD design software: ASD PipeFlow

The ASD PipeFlow software tool provides system designers the means and support to design a system in such a way, that SecuriSmoke ASDs are operating in accordance with either EN 54 or NFPA 72 provisions. It furthermore helps to optimise bills of material (BOM) supported with a 3D illustration of the entire pipe network.

During installation, commissioning and ongoing ITM on site, SecuriSmoke ASD Config (Figure 10) is used for quick and easy set-up of individual or networked detectors from a single location, thus significantly improving the efficiency of all required fieldwork. When necessary, Securiton support teams can also connect to the detector network from a remote location for troubleshooting.

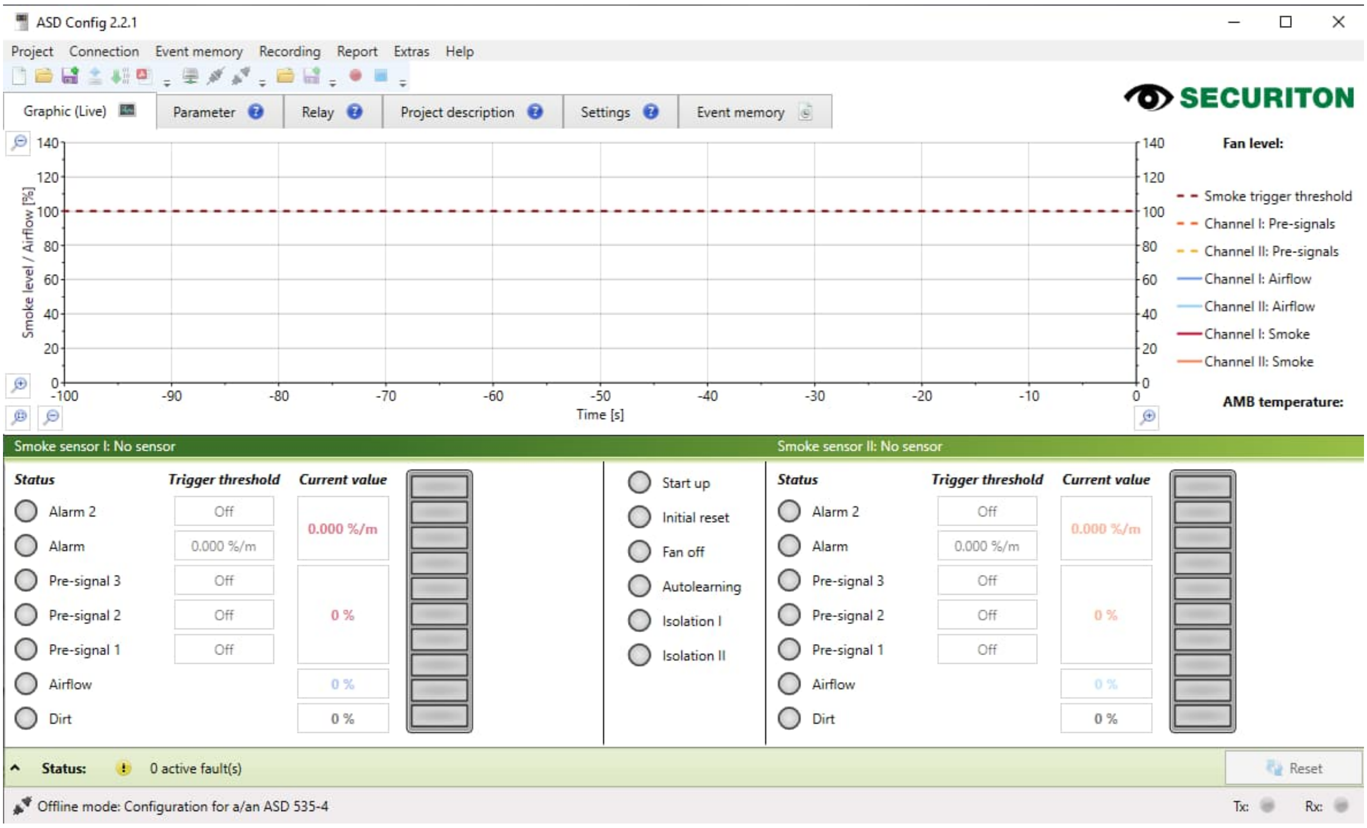


Figure 10 SecuriSmoke ASD configuration software: ASD Config

Securiton SecuriFire Studio (Figure 11) is a powerful and modern software tool supporting engineers during designing, installation, commissioning and ongoing ITM on site or remotely, of SecuriFire FAS installations. It allows for planning, configuring and troubleshooting of an entire networked FAS installation from a single location, consequently reducing significantly both time and labour required for routine ITM tasks.

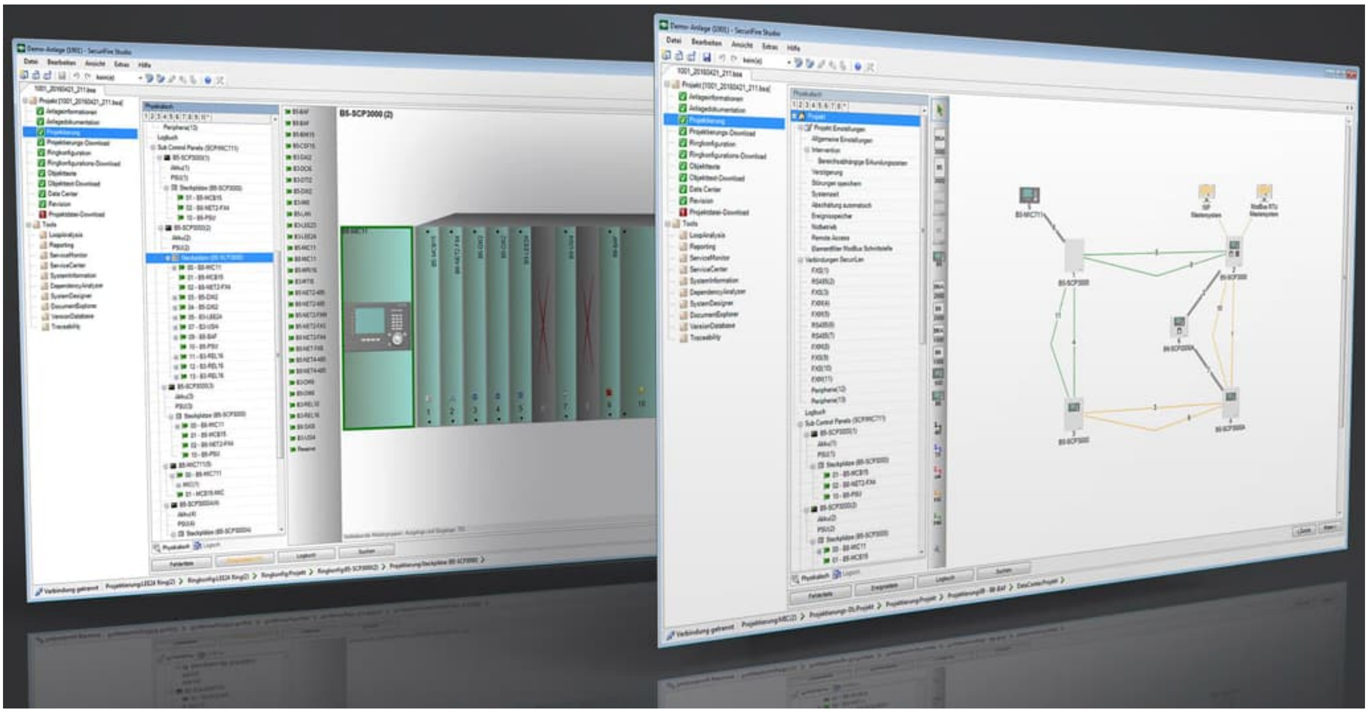


Figure 11 SecuriFire configuration software: SecuriFire Studio

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Appendix A: SecuriHeat LTHD Accessories

This Appendix provides a summary of SecuriHeat ADW LTHD accessories (see Table 18):

1 High humidity or high air temperature
2 Intrinsic safety or potentially explosive

Challenging Environment	Illustration	Description
High humidity or high air temperature or potentially explosive		TU 5/4 Cu Copper sensing tube for all applications.
		TU 5/4 St Steel sensing tube for all applications.
		GC 5/6 EX Grounding Clamp with ATEX certification. To earth the sensing tube in Ex-zone applications.
		SC 5/4 St5 Sensing coil of TU 5/4 St, length 5 m (16.4 ft)
		TC 5/4 St 10 Set Test coil of TU 5/4 St, length 10 m (32.8 ft)
		ART 535-10 External temperature sensor, cable length 10 m (32.8 ft)
		ART 535-30 400 Ex 1 and ART 535-30 400 Ex 21 External temperature sensor to be used in the following cases: ▪ Applications compliant with EN 54-22, Class CI to GI ▪ When the application temperature in the monitored area deviates more than 20 °C (68 °F) from the temperature of the evaluation unit. ▪ Sensor diameter 6 mm (0.24 in), cable length 30 m (98.4 ft)

Table 18 Summary of SecuriHeat accessories for challenging environments

Appendix B: SecuriSmoke ASD Accessories

This Appendix provides a summary of SecuriSmoke ASD accessories (see Table 19) for challenging environments:

1. Corrosive ambient environment
2. Dusty
3. High humidity or high air temperature
4. Intrinsic safety or potentially explosive

Challenging Environment	Illustration	Description
Inside Deep Freezers		HEAT 3.0/3.5/4.0/4.5/5.0 ABS in deep-freeze rooms to prevent the freezing of the aspirating holes
		WCU 535 Wiring connection unit introduction of the supply of the sampling point with heating into the aspirating tube, with internal clamps
Dusty		DFU 911 (large volume) or FBS 25 PC (small volume) dust filter unit increases the service life of the smoke sensors used in the ASD and greatly reduces the likelihood of false alarms
		DTB 25 PC Dirt trap box used in very dusty rooms. Inserted into the sampling pipe before dust filter
		ADB 500 automatic blow-out device 1 sampling pipe is automatically blown out and cleaned, to prevent fault messages caused by clogged aspiration points and also to avoid false alarms.
		MV 25 ABS Manual ball valve for revision and cleaning works with compressed air
High Humidity or High Air Temperature		WRB 25 ABS Water retaining box Used in rooms with high humidity
		WRT 25 ABSRED Water retaining tube Used in rooms with high humidity, must be drained manually
		LK 35 – ABS used as an air cooler when the sampling pipe is in a room >60°C. Can also be used as a water separator in rooms with high amount of air humidity and / or condensing water because of temperature differences
Potentially Explosive		DFA 25-3 (Equipment category IIC) or DFA 25-2 (Equipment category IIB) or DFA 25-1 (Equipment category IIA) Detonation flame arrester for explosion zones
		ASD Housing Ex IP54 Steel used as additional personal protection in explosive areas or serve as a mechanical protection measure
		GC 25 Ex Grounding Clamp for 25mm ASD pipes with ATEX certification. Copper or stanless steel piping
Inlay in concrete		FT 32C Tube for concrete insertion

Challenging Environment	Illustration	Description
		SP 30 PVC To be used together with sampling points SP32T and SP32C for sampling holes on plastering
		SP 32C T Sampling point T-piece
		SP 32C L Sampling point L-piece
		TP 32C T-branch connection
Tamper proof		SP VP 25 St Sampling point vandal proof used for tamper proof recessed ceiling mount

Table 19 Summary of SecuriSmoke ASD accessories for challenging environments

Appendix C: Design, Operation and Management Software

This Appendix provides a summary of software tools for Securiton SecuriSmoke and SecuriHeat ADW detection products (see Table 20)

Product	Function	Description
SecuriSmoke	Design	SecuriSmoke ASD PipeFlow design of air sampling pipe network
	Install and service	SecuriSmoke ASD Config on-site configuration, commissioning and ongoing ITM
	Monitor and manage	Securiton rack-mount standalone FidesNet net system with ASD detectors independently networked and connected to the FidesPort NCU 900 gateway and the FidesNet RCU 900
	Monitor and manage	Securiton UMS software manage ASD detectors independently networked and connected to the UMS or connected via SecuriLine to a FAS of the SecuriFire family which in turn is connected to the UMS
	Monitor and manage	3rd party enterprise BMS software manage SecuriSmoke ASD detectors
SecuriHeat ADW	Design	ADW HeatCalc design of sampling tube network
	Install and Service	EasyConfig for commissioning simple systems directly on the device The practical ADW Config software tool is used for more complex systems and application-specific adaptations
	Monitor and manage	ADW detectors connected via SecuriLine to a FAS of the SecuriFire family which in turn is connected to the UMS

Table 20 Summary of Design, operation and management software (SecuriSmoke and SecuriHeat ADW)

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