SECURITON

Packaging Machines

SecuriHeat ADW, SecuriHeat d-LIST

Case study | SecuriHeat ADW, SecuriHeat d-LIST | Packaging Machines

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1 Introduction

Packaging machines are found in a wide range of industrial sectors, and the nature of modern trade and supply chains mean that they are an integral and essential element of many production lines. Advanced, custom-designed packaging is important to major industries including pharmaceutical, agriculture, food and beverages, industrial chemicals, cosmetics, logistics, building supplies, personal care, retail and electronics. The packaging industry is constantly evolving, impacted by technology advancement, demographic changes, economic development and consumer demands.

Unsurprisingly, the industry is enormous. The global packaging market is forecast to grow at an average 3.9% between 2023 and 2028. By 2050, it's projected to reach US$ 2.23 trillion. Key drivers are automation, sustainability, E-commerce growth and processed food consumption. The industry is rapidly evolving, especially as packaging machines are generally designed to also reduce operating costs and increase productivity to meet the requirements for automation, customization, production speed, and production cost. Should a packaging machine be rendered inoperable by fire, the entire production process will likely stall – indeed, with many machines running 24/7, even short interruptions due to maintenance or false alarm are highly undesirable.

Packaging machines are usually sited within built environments such as industrial, manufacturing productions and logistic distribution. The precise definitions of such occupancy classifications vary according to country or regional building and fire codes but the fundamentals of fire safety codes for these facilities are the same: Common building and fire codes prescribe fire safety measures focused on basic life safety within the building. General fire detection design for these areas, as well as the relevant codes and standards, is discussed in detail in various Securiton Design Guides, such as Early Warning Fire Detection for Industrial Manufacturing Sites. This Case Study looks specifically at packaging machines as a form of key asset object protection. Fire detection for object protection is generally carried out beyond the requirements of general fire safety codes, with the objective of detecting an incident early enough to avoid major damages and costly uninsured business interruptions. The requirements of local fire safety codes and standards must naturally still be met, and the object protection design may be a part of that fire safety solution where appropriate.

Many packing materials, such as plastics and polymers, paper and paperboard, are flammable. The characteristics of the manufacturing environment where packaging machines are installed, often consist of production and processing areas with large fuel loads and high hazard materials. Industrial, manufacturing and logistic distribution building structures are large open spaces with electrical and mechanical equipment and a challenging ambient environment. They can include dust, oil mists, combustible or flammable atmospheres, and extreme high or low temperatures. Fire hazards arise mainly from things like electrical faults and malfunctions, thermal processes and the presence of many inherently flammable packaging materials. Flammable materials, accumulated waste, and dust in the areas near packaging machines can rapidly spread a fire.

The complex layout of factories or logistic distribution buildings can impact the effectiveness of general fire detection. Many industrial and manufacturing facilities have warehouse-like building structures with natural or forced ventilation which dissipates or otherwise prevents smoke reaching fire detectors installed at ceiling level. To achieve the earliest possible alarm and response to a fire around a business-critical piece of machinery, it is therefore advisable to consider a supplementary detection system offering risk-based object protection of packaging machines.

Securiton's linear heat detectors, SecuriHeat ADW and SecuriHeat d-LIST, both offer a robust, reliable and quick acting fire detection system well suited for all types of packaging machines. While SecuriHeat d-LIST is designed as a fully addressable heat detection solution equivalent to spot-type heat detectors offering precise localisation, SecuriHeat ADW is better suited to smaller machines or self-contained production lines where it offers a low-cost reliable fire detection solution, covering up to 2 times 400 m (1,312 ft) sensing tube length per control unit.

The purpose of this Case Study is to provide fire safety and protection consultants, qualified fire system specifiers, design engineers or technicians, with recommendations for the application and use of SecuriHeat LTHD to protect packaging machines. The scope of this Case Study covers detailed recommendations, design considerations and practices for SecuriHeat line-type heat detectors (LTHD).

The Case Study also provides key requirements on Inspection, Testing and Maintenance (ITM) of SecuriHeat LTHD, 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

Packaging machines are found in a wide range of industrial sectors, from pharmaceutical, agriculture, food and beverages, industrial chemicals, cosmetics, logistics, building supplies, personal care, to retail and electronics. The global packaging machine market is primarily driven in core aspects of automation, sustainability, E-commerce growth and processed food consumption. These result in the adoption of every faster and robotic operated production processes, changes of packaging materials and diverse packing solutions, as well as needs for specialised and large-scale packaging machines.

The reliable operation of all packaging machines is critical to general fire safety and hazard risk management in industries that employ them, from industrial, manufacturing to logistic fulfilment facilities. While technology advancement reduces the probability of a fire from occurring, automated packaging processes have inherent fire hazards, from electrical malfunctions, overheating components from fast moving machinery to flammable packaging materials. These complex production systems should be in optimal operational condition 24/7 without interruption. From building and life safety, as well as business continuity and asset protection perspectives, the consequences of the fire hazards and risk of fires in and around packaging machines can be significant.

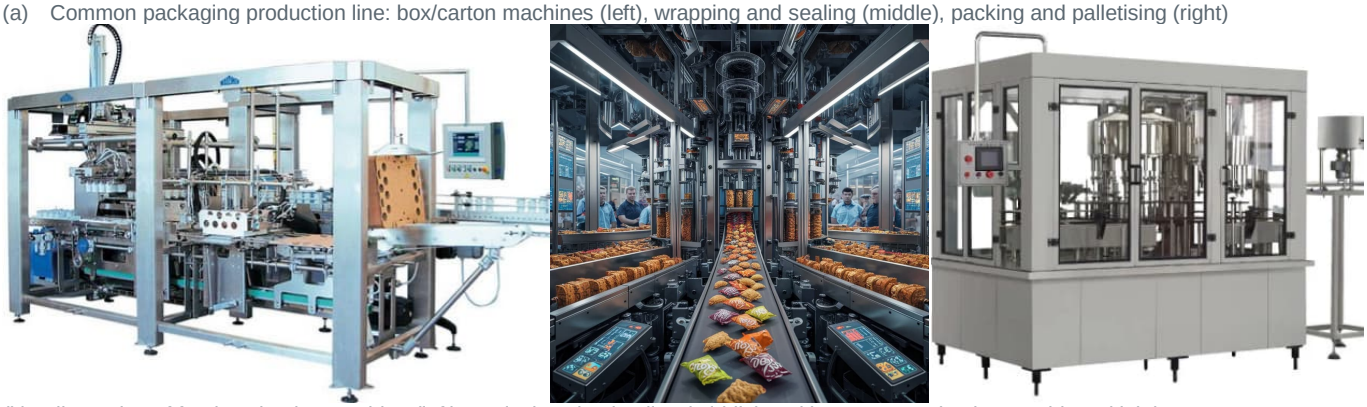
2.1 Packaging machines

Many different packaging machines have been developed to meet the requirements of their specific applications. While there are no standardised categorisations, they can be grouped based on functionalities such as box/carton machines, filling machines, pharmaceutical packaging, wrapping and sealing, labelling and packing, and palletising [1]. Within each industry, there are specific types of packaging technology and methods deployed. For example, in the food, chemical and pharmaceutical industries, packaging can involve cups, tubs and bottle filling and capping, as well as plastic wrap-around and/or palletising. The global pharmaceutical packaging market size alone was valued at US$ 110.55 billion in 2024, and it is growing at an estimated average annual rate off 6.16% [2].

For the purpose of this Case Study, the following examples are used to illustrate typical packaging machines, as illustrated in Figure 1:

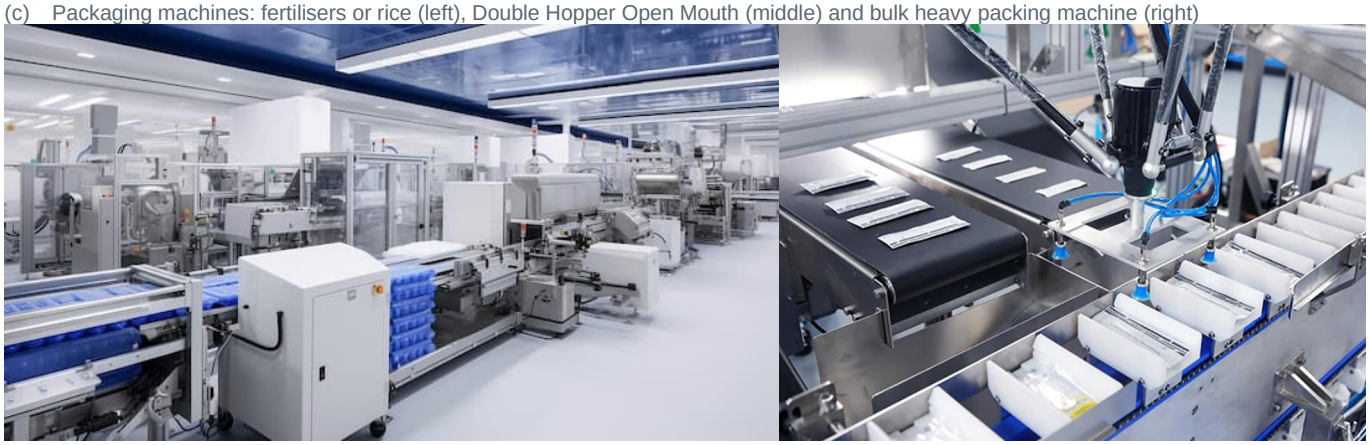
(a) Common packaging production line: box/carton machines (left), wrapping and sealing (middle), packing and palletising (right). These machines can be set up in complex production processes involving conveyors, fast spinning machines, and fire load-intensified packing automation.
(b) Examples of self-contained food packaging machine (left), vertical packaging line (middle) and beverage packaging machines (right). These are generally high speed, continuous processing involving high electrical current, fast moving machinal parts with lubricants, solvents and other potentially flammable chemicals involved.
(c) Packaging machines used for bulk materials handling, such as fertilisers or rice (left), ‘Double Hopper Open Mouth’ with integrated packaging (middle) and bulk heavy packing machine (right). These can be operated in challenging ambient environments (e.g. dusty), or among expensive equipment operating with high electrical current and chemical substances throughout the production processes.
(d) Pharmaceutical packaging line consisting of inspection, filling and labelling, carton and cardboard box packaging. Complex packing machines and production line with automated packing machinery. Presence of large quantity of packing materials, coupled with fast moving mechanical parts, electrical and electronic equipment are often installed in very close proximity.

(a) Common packaging production line: box/carton machines (left), wrapping and sealing (middle), packing and palletising (right)



(b) Illustration of food packaging machine (left), vertical packaging line (middle) and beverage packaging machines (right)

(c) Packaging machines: fertilisers or rice (left), Double Hopper Open Mouth (middle) and bulk heavy packing machine (right)



(d) Pharmaceutical packaging line consists of aspects of inspection, filling and labelling, carton and cardboard box packaging

Figure 1 Examples of packaging machines

2.2 Fire risk, consequence and safety

Packaging machines use significant amount of packing materials such as plastics and polymers, paper and paperboard, glass, aluminium foil and others. The characteristics of the manufacturing environment where these machines are installed often consist of production and processing areas with large fuel loads and high hazard materials. Industrial, manufacturing and logistic distribution building structures are large open spaces with electrical and mechanical equipment and a challenging ambient environment. They can include dust, oil mists, combustible or flammable atmospheres, and extreme high or low temperatures.

Fire hazards arise mainly from the following:

- Electrical faults with faulty wiring and overloaded circuits or malfunctions from overheated components and worn-out components can spark and ignite surrounding materials.
- Thermal processes such as sealing jaws and shrink tunnels can ignite packaging materials. For example, sealing jaws can become extremely hot, from 210°C (410°F) to 900°C (1,652°F), in shrink wrap machines. This can hence cause materials to smoulder or ignite.
- The presence of many packaging materials, such as plastics, paper, textiles, and chemicals used in packaging, which are inherently flammable and can quickly fuel a fire.
- Flammable substances, accumulated waste, and dust in the surrounding areas can rapidly spread a fire.

As part of fire prevention, production processing with packaging machines has built-in safety measures, such as allowing wrapped goods sufficient time to cool down before storage or further handling to prevent smouldering. But these inherent hazards and risks cannot be removed entirely. Indeed, they may be amplified by poor housekeeping such as accumulating flammable debris, inadequate maintenance leading to malfunctions, and human error from insufficient training or improper use. Normally unoccupied areas, or those with a complex processing set-up, can lead to a much-delayed response to a potential fire incident. To mitigate risks, ensure proper ventilation, regular cleaning and maintenance, proper training on equipment, a fire-safe environment free of flammable materials, and appropriate automatic fire detection and fire suppression systems.

Fires originating from or around large packaging machines endanger the survival of the business, because they may cause the loss of key production assets and consequential interruption to business operation leading to failure to fulfil contracts and reputational damage. The standard fire safety systems for building and life safety code compliance do not fully mitigate these risks. Therefore, a reliable supplementary fire detection system designed to protect key assets on the production line, or other valuable equipment at risk, is recommended in order to ensure fire incidents can be managed to avoid or minimise operation interruption and damages. Widespread evacuation and power-shutdowns will also be avoided. Even as the fire situation progresses, fire services can be notified automatically and arrive at the scene much earlier before the fire spreads.

Minimising business interruption and damage to plant and buildings is likely to be the prime advantage of targeted, reliable supplementary fire detection for the specific protection of packaging machines. Although building and life safety code compliance should also ensure this, ample time for worker evacuation is also important benefit of such additional object protection fire detection.

3 Challenges to reliable fire detection

The complex layout of industrial manufacturing production or logistic distribution buildings can impact the effectiveness of general fire detection. Many industrial and manufacturing facilities have warehouse-like building structures with a typical ceiling height of 11.5-12 m (38-40 ft). Even for smaller scale production areas, the ceiling height is often 7-8 m (23-26 ft). For these buildings that rely on natural ventilation or use mechanical ceiling fans to disperse heat, smoke stratification can form during the initial stage of a fire development. This will prevent hot smoke reaching fire detectors installed at ceiling level. Alternatively, factories that use forced ventilation will see smoke rapidly dissipated. Therefore, to achieve the earliest possible alarm and response to a fire around a business-critical piece of machinery, it is advisable to consider a supplementary detection system offering risk-based object protection of packaging machines.

Such a system is installed specifically to automatically detect fires originating from, or within the close proximity of, large packaging machines. Working in tandem with general area fire protection, the object protection system will be designed to detect fires in and around the machinery before hot smoke or heat from these fires reaches general detection systems which are typically located at ceiling height. It can therefore sound the alarm and power-down, also potentially actuate suppression systems, earlier.

When choosing the equipment for such a detection system, consideration is required regarding false alarms, expected working lifespan and service and maintenance intervals. All of these can be affected by the environment where machines are installed: these may be harsh and challenging through dust and smoke, or sometimes subject to ambient conditions including seasonal temperature fluctuations, direct sunlight or reflection, and other weather elements. In addition, because packaging machines are important for continuous business operation, unnecessary operation interruptions are highly undesirable and must be avoided. The frequency of the maintenance regime and need to access a fire detection system are also important considerations. Non-intrusive access and low maintenance requirements of a fire detection system can keep TCO[1] low.

SecuriHeat d-LIST is an ideal solution to address the key challenges of ensuring a reliable fire detection for packaging machines (see Table 1). It is an electronic sensor cable system that has been specially designed for EN 54-22 [3] and can be used as an integrating or non-integrating line-type heat detector. Other key advantages include its relatively high sensitivity; its real-time system fault self-check and alarm; and the fact that it is free of routine maintenance, fully weather resistant, discreet and easy to install. Alternatively, SecuriHeat ADW can be adopted as a cost-effective option for smaller size or self-contained packaging machines that require only single or dual fire zone coverage.

Challenge	Securiton advantages
Large Open Space or Multi-levels with Vertical Openings	SecuriHeat LTHD meet design requirements of flexible placements of sensing cables/tubes for ceiling level detection and localised heat detection where hazards or hot smoke propagation are identified in the event of a fire.
Diluted hot smoke and heat dispersion due to forced, changing or natural ventilation	Use of SecuriHeat LTHD for heat detection, integrated with sprinkler actuation. The detection systems have the sensitivity and flexibility to react to relatively small fires even in an open area. Sensing cable/tube spacing may be reduced yet still maintain optimal cost advantage.
Wide ambient temperature range	SecuriHeat LTHD products can operate in wide range of ambient conditions. The SecuriHeat d-LIST sensing cable operating temperature range is -40°C to +85°C (-40°F to +185°F), while the SecuriHeat ADW sensing tube operating temperature range is -40 to +300°C (-40 to +572°F).
Complex design considerations (include difficult or hazardous ambient conditions)	SecuriHeat d-LIST offers two levels of alert and alarm per detection zone, facilitate both earlier incident alert to tackle potential fires to minimise damage and disruption, and fire alarm to be integrated with pre-action sprinklers for timely fire suppression and fire services notification. Small cable diameter and small minimum bending radius with flexible junction box connection for easy install, troubleshooting and services. SecuriHeat ADW offers two levels alert and alarm per detection zone, facilitate earlier incident alert to minimise damage and disruption, and fire alarm to be integrated with pre-action sprinklers for timely fire suppression.

[1] Total Cost of Ownership

Challenge	Securiton advantages
	Unique features such as option of 1 or 2 inbuilt detector models, non-magnetic and non-rusting sensing tubes with almost infinite product life works in tough-est environments. SecuriHeat ADW is available as HD (Heavy Duty) product variant with suitable accessories for inside hazard classified area installation.
Obstructed or difficult access	SecuriHeat d-LIST works with high precision temperature sensors embedded in tough cable for pinpoint monitoring where specific addressable detection and alarm are needed. SecuriHeat ADW sensing tubes can be positioned in virtually all environments. They can be bent to shape to cater for open space and object localised detec-tion, including concealed spaces.
False alarms	SecuriHeat d-LIST can uses highly sensitive rate-of-rise detection combined with different alarm thresholds for maximum reliability (algorithm specific and maximum alarm parameter sets). SecuriHeat ADW adopt unique highly sensitive rate-of-rise detection combined with fixed threshold alarm for maximum reliability. The Dynamic Heat Watch feature allows the system to discern between ambient heat rises and a real fire system through verifying rate-of-rise anomaly after initial detection.
Low TCO and easy access for maintenance	Routine service and testing are done from the main detector unit. Easy to clean with pressure washers and common chemicals. The whole detec-tion system and sensing cables require no or minimal routine maintenance.

Table 1 Challenges to and solutions for Packaging Machines protection with Reliable Fire Detection

4 Optimised design & Use case

SecuriHeat LTHD products can be used as a supplementary detection method suitable for all types of packaging machines. SecuriHeat d-LIST cable sensor system can be used in all packaging machines, large and small, to cater for designs where addressable heat detection and alarm control are required. With individual sensors embedded in a sealed, reinforced cable, it can be used to closely monitor machines or parts thereof, according to known fire risks. The cable is flexible enough to be bent around machinery and at up to 350 m (1,148 ft) of cable per channel, a single device can monitor substantial production lines. The control unit can be located away from the production floor for easy service access.

The cost-effective SecuriHeat ADW is an integrated line type heat detectors with a response behaviour based on heat differential and/or maximum heat. It is suitable for smaller or self-contained packaging machines require single or dual fire zone coverage. The product self-check feature and the periodic, automatic test are other advantages for use in applications where the legally prescribed functional and maintenance checks are performed outside the protected zone due to machinery hazardous operations in busy manufacturing or production areas.

This chapter outlines design recommendations and methods using SecuriHeat LTHD products to protect industrial equipment in packaging machines as follows:

1 Design codes of practice.
2 Design criteria for risk-based local detection with SecuriHeat LTHD products.
3 Application scenarios for production line object protection.
4 Features and benefits.
5 Integrated verify, control and respond.
6 Minimal system access for ITM.
7 Support with peace in mind.

4.1 Codes of practices

According to general codes and standards, built environments such as industrial and manufacturing facilities must comply with life and building safety provisions (e.g., NFPA 1 [4], NFPA 101 [5] and NFPA 5000 [6]) as prescribed per international and local codes in accordance with relevant building occupancy classification or property uses. Although prescriptive building and life safety codes stipulate the need for fire detection in addition to other fire safety measures in a building, these requirements may allow for enhancements or refinements based on a proper risk management assessment and operational characteristics of the building use at the time of the assessment.

The risk assessment and design considerations require fire engineering professionals to work within the prescriptive constraints of the applicable building codes while applying the best engineering practices to address industry and building occupancy specific needs[2]. In particular, the risks, the requirements for uninterrupted business operation, and the critical need for early detection of a fire inside these facilities shall be adequately addressed. In this regard, Performance-based Design (PBD) (e.g. [7]) with a risk-based approach (e.g. NFPA 551 [8], ISO 16732-1 [9]) to the optimisation of fire detection, fire protection and human interaction to supplement prescriptive baseline design, is key to meeting both actual detection requirements and applicable local AHJ directives for building and life safety.

Although there might be marginal differences from one country to another in Deem-to-Satisfy (DtS) prescriptive building and fire 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.

To select a suitable fire detection system, relevant design and alarm codes must be applied. Examples of these include NFPA 72 [10], BS 5839-1 [11], VdS 2095 [12], and others like AS 1670.1 in Australia [13], NEN 2535 in Netherland [14], R7 in France [15] and DBI 232 in Denmark [16]. Taking into account requirements from all relevant codes and standards, industry codes of practice and government regulations for safety, an approach combining risk and PBD is a fitting fire engineering methodology to devise a suitable fire detection solution to safeguard packaging machines. As an example, for the design and installation of LTHD, NFPA 72 [10] stipulates that LTHD cables or tubing installed must be no more than 50.8 cm (20 in.) from the ceiling. However, this standard requirement is limited because it applies to only flat ceilings and is not affected by the total ceiling height. Other research and performance testing may be referred to for better linear heat cable placements (e.g., [17]).

An adequate fire detection system that automatically alarms local fire services can make a huge difference in minimising the damage that a potential fire can cause. The ability to detect and alert early also allows local building management or facility operators to control the initial outbreak or to remove potential hazards that would help the fire grow. Early detection of a fire help avoid business interruption and facilitate orderly and safe evacuation as the fire evolves. When a suitable fire detection system can be designed and installed at a low TCO[3], the system can achieve building and life safety objectives as well as protection of business assets.

Table 2 illustrates how SecuriHeat LTHD system performance, as well as other design parameters such as environmental conditions and typical applications, are defined. Note that SecuriHeat LTHD products meet all response classes and all environment groups per EN 54-22 [3]; and key temperature classes and the range of spacing options per NFPA 72 [10].

Design Parameters	BS/EN 54-22 [3][4]		NFPA 72 [10]	
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 (129 - 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)		

[2] Each country or state/province may have its own (or adopted) building and fire code or directives. Examples are the Muster-Verwaltungsvorschrift Technische Baubestimmungen (MVV TB) in Germany, The Regulatory Reform (Fire Safety) Order 2005 in the UK and National Building Code of India 2016.

[3] TCO: Total Cost of Ownership (of an Early Warning Fire Detection system)

[4] ISO 7240-20 [4] and AS 7240-20 [4] are derived from BS/EN 54-20.

Design Parameters	BS/EN 54-22 [3][4]		NFPA 72 [10]
Environment Group	**Environment Group**	**Temperature Range °C (°F)**	n/a
	(E)1	-5 to +40 (+23 to +104)	
	(E)2	-10 to +55 (+14 to +131)	
	(E)3	-25 to +70 (-13 to +158)	
Typical Applications and Boundary Conditions	E1: Indoor; Stable and Clean Conditions; Commercial and industrial E2: Indoor; Varying and polluted environment; Commercial and industrial E3: Outdoor; Harsh conditions		

Table 2 Design and performance parameters for LTHD per codes and standards

4.2 Design criteria

Both SecuriHeat ADW and d-LIST can be used for protecting packaging machines. Although fire detection to protect packaging machines takes a risk-informed PBD approach, the building areas hosting these machines are mandated to satisfy the requirements of local fire safety codes, relevant codes and standards which can all be useful references as the basis of design. A brief summary of Securiton design literature is included in Section 4.3.3 below.

A summary of SecuriHeat d-LIST key performance parameters is shown in Table 3 below.

Model	Key performance parameters
SecuriHeat SCU 835 (d-LIST) classes and sensors cable	
Classes	Integrating: A1I, A2I, BI, CI Non-integrating: A1N, A2N, BN, CN
Cable length	SEC-15 cable 2 x 350 m (1’148 ft) per controller
Addressable sensors # (Zone)	2 x 100 sensors (in 1-32 zones) Sensors embedded in the cable at intervals of: 1, 2, 3, 4, 5 or 10 m (3.3, 6.6, 9.9, 13.0, 16.5 and 33.0 ft.)
Rating and operational data	
Rating	SCU 835 Sensor Control Unit (evaluation unit): IP65 SEC-15 cable: weather-proof fully sealed system
Operating temperature	SCU 835 Sensor Control Unit: -25°C to +70°C (-13°F to +158°F) SEC-15 cable: -40°C to +85°C (-40°F to +185°F)
Measuring temperature range	SEC-15 cable: -40°C to +120°C (-40°F to +248°F) Temperature resolution of 0.1°C (0.18°F)
Sensing Cable Attributes	Cable diameter: 15 mm (0.59 in); min. bending radius: 250 mm (9.8 in)
Detection and actuation	Maximum temperature and temperature changes (differential or integration algorithm)
# of Relays	4 Built-in; Expanded to 16 with REL 835 Module
Product type approval standards and compliance level	
EN 54-22:2015+A12020	Integrating and non-integrating LTHD; response classes above
UL 521; NFPA compliant	Response Classes: LOW, ORDINARY, INTERMEDIATE

Table 3 SecuriHeat d-LIST SCU 835 controller and SEC-15 cable

A summary of SecuriHeat ADW products key performance parameters is shown Table 4 below.

Model	Key performance parameters
SecuriHeat ADW classes and tube	
Classes	see Table 2
Sensing tube length	EN 54-22: 2 x 10 - 140 m (33 - 459 ft) copper tubes NFPA 72: 2 x 10 - 200 m (33 - 656 ft) copper tubes
Tube type	Copper (TU 5/4 Cu)
Rating and operational data	
IP device approvals	IP65
Operating temperature (main control unit)	-30 to +70°C (-22 to +158°F)
Operating temperature (sensing tubes)	Copper: -40 to +300°C (-40 to +572°F)
# of Relays: Built-in (Expanded – Module)	2 (10 – 2 x RIM36)
Product Type Approval Standards and compliance level	
EN 54-22	Classes A1I to GI
UL 521 – ULC-S530-M91	per EN 54-22 Classes A1I to GI
FM 3210 / NFPA 72	Classes Ordinary, Intermediate, High

Table 4 SecuriHeat ADW product key performance parameters

4.3 Application Scenarios

These scenarios describe SecuriHeat d-LIST and ADW used for localised object detection with a PBD approach to enhance detection performance and address specific risks from risk-based safety assessment to detect fire at its incipient stage, avoid property loss due to fire damages and ensure business continuity.

There are many different types and size of packaging machine, and detection alarms may need to be addressable within a specific fire zone or risk locations for faster response or targeted power-downs. Additional considerations are given to address different fire risk scenarios and ambient conditions to ensure suitable product type-approved equipment and materials are deployed.

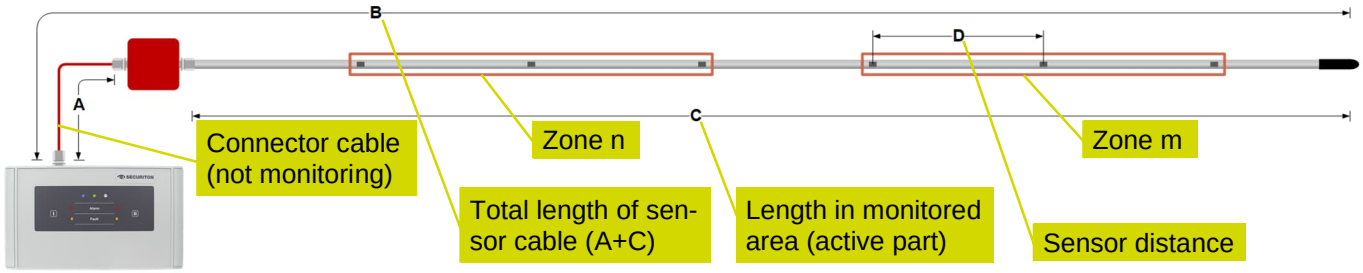
4.3.1 Risk-based local detection: SecuriHeat d-LIST

The main areas of protection are around or inside packaging machines. The objective of SecuriHeat d-LIST design is to effectively provide localised object detection around the packaging machines, or inside in the case of self-contained machines. Obstructed objects, such as conveyor safety guiderails, must be considered. It is also necessary to match FFFS[5] zoning for the purpose of water release control where applicable.

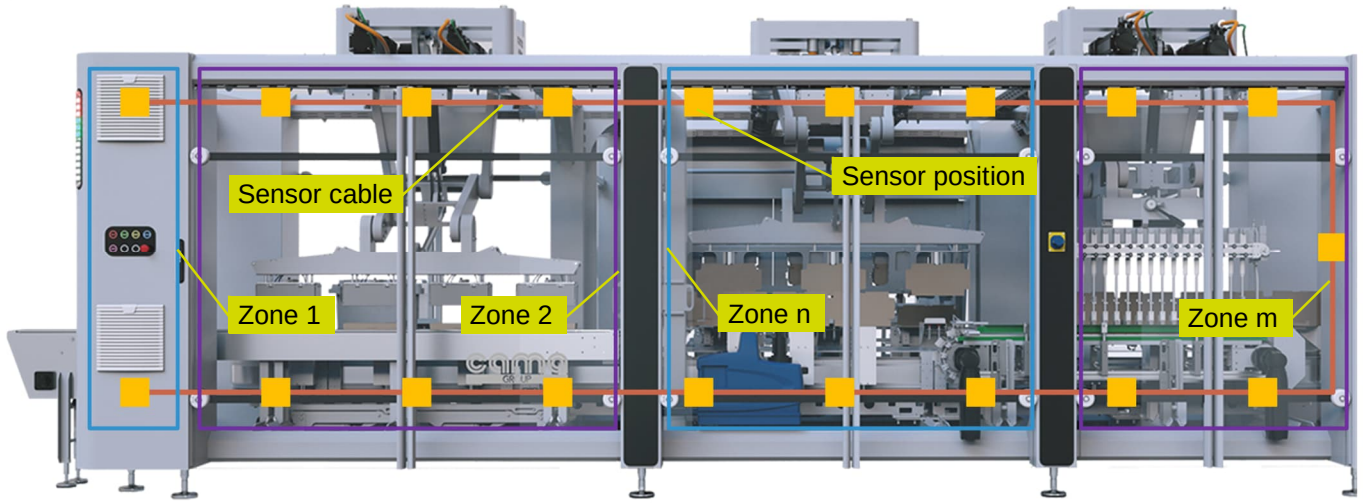
Key advantages of d-LIST include very long sensing cable for large area coverage, and large number of standard sensors built in at flexible interval selections as well as branched out with individual sensors for addressable fire detection for fire zone alarm and risk-based detection of fire for added alarms at specific risk locations. Even when protecting large production line machineries, the main SecuriHeat d-LIST control units themself can be located outside of the hazardous or busy manufacturing operation areas, for easy access with no business operational interruption.

Figure 2 below illustrates:
(a) SecuriHeat d-LIST flexible system design with stable, precise zoning function. This does not require extra cable, maximising efficiency.
(b) SecuriHeat d-LIST sensor cable layout design as one alarm zone per specific section of the machine.
(c) SecuriHeat d-LIST sensor cable layout with connection box CBO 15 for branched sensor cable layout design.

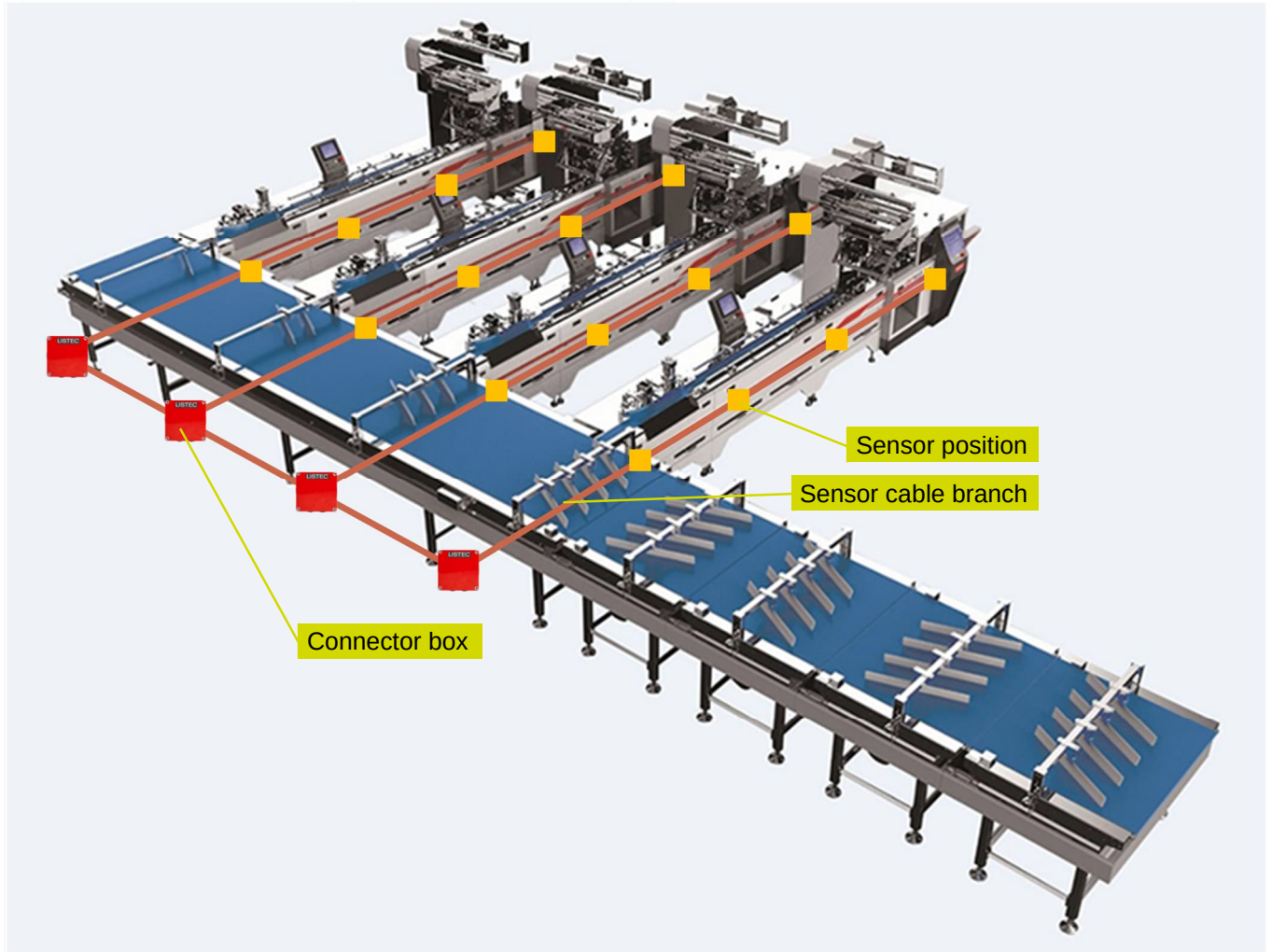
[5] FFFS: Fixed Fire Fighting Systems



(a) Typical SecuriHeat d-LIST sensor cable arrangement



(b) SecuriHeat d-LIST sensor cable layout design as one alarm zone per specific section of the machine



(c) SecuriHeat d-LIST with connection box CBO 15 for branched sensor cable layout design

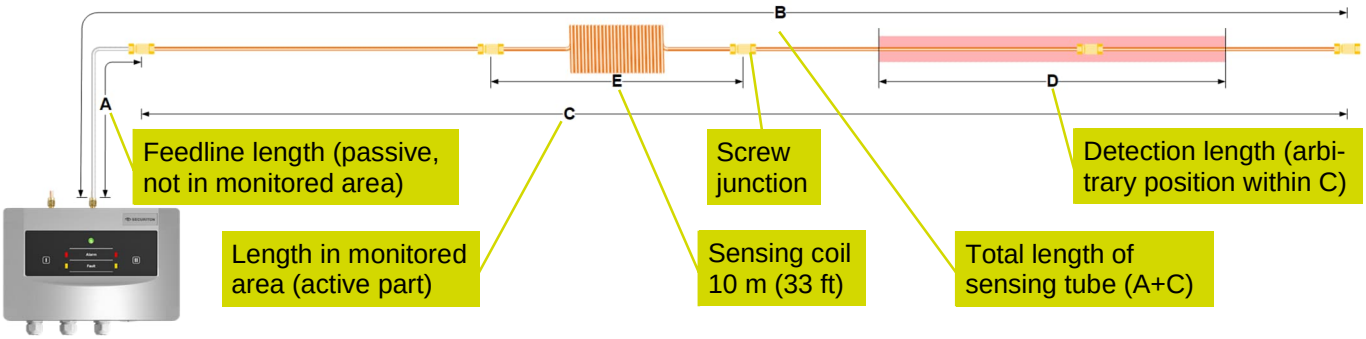
Figure 2 Fire detection placement SecuriHeat d-LIST (risk-based local detection)

Additionally, it should be noted that:

- Sensor cables run close to (but not touching) known fire hazards such as motors and belt conveyor rollers, which are known friction points.
- Sensor cables run generally straight but are flexible enough to be bended to go around obstacle and other fittings like safety guiderails, or other mechanical and electronic equipment as necessary.
- In a risk-based design (Figure 2 (b) and (c)) additional external sensors can be added to areas with a high risk of overheating. Such unique object fire hazards include motors, electrical distribution, conveyors and areas of high-speed mechanical moving parts.
- When running sensor cables through or close to each protected machine, sensors can be allocated at locations with the most fire risks and grouped into desirable alarm zones. The detection and alarm thresholds can be configured for a maximum of 32 different zones.
- When use SecuriHeat d-LIST as part of fire detection for code compliance, the area of coverage includes the entire zone is aligned with relevant fire code requirements, such as compartmentation, fire alarm notification or need for FFFS system integration.
- SecuriHeat d-LIST allows installers to add branches and connect controllers easily with connector boxes (CBO 15).
- Choice of Max Alarm, Difference respectively; Integration Alarm to enable Pre-signals in order to investigate and manage fire incidents earlier.

4.3.2 Risk-based local detection: SecuriHeat ADW

SecuriHeat d-LIST is usually the best option for protecting packaging line equipment due to its scalability without loss of sensitivity and the capacity to protecting a large area a considerable distance from the main control unit with addressable alarms. In some cases, however, the lower cost SecuriHeat ADW can be used for smaller packaging lines or close protection of self-contained machines. It offers a fire alarm per 10 - 200 m (33 - 656 ft) sensing tube length with two zones per detector unit – but sensitivity declines as more tubing is used. This can be compensated for by using sensing coils close to identified fire hazards (see Figure 3 (a)). Figure 3 (b) illustrates fire detection placement of SecuriHeat ADW for a smaller packaging line or self-contained machine, as well as object protection (e.g. hopper).



(a) Typical SecuriHeat ADW sensing tube arrangement

(b) Illustration of ADW sensing tube placement in packaging machinery (left) and object protection using sensing coils (right)

Figure 3 SecuriHeat ADW placement in production line machinery (risk-based local detection)

Additionally, it should be noted that:

- The ADW detector unit can be installed either in the same protected area or outside if a convenient utility area is available.
- In case there is a temperature difference between the protected area (where the sensing tubes are installed) and the mounting location of the SecuriHeat ADW control unit, an external temperature sensor should be installed to compensate for this difference.
- When use SecuriHeat ADW as the only fire detection for code compliance, the area of coverage includes the entire zone in accordance with relevant fire code requirements, such as compartmentation, fire alarm notification or need for fire extinguishing integration.
- Choice of Max-Alarm, Diff-Alarms threshold respectively; Integration Alarm to enable Pre-signal for early alert for rapid local site response.
- When integrating with other building control systems, only Securiton authorised accessories and modules, such as RIM 36, XLM 35 and SIM 35 can be installed.
- To avoid leaks in the sensing tube due to mechanical stress, use a length of flexible Polyamide tube as a feedline between the ADW unit and the sensing tube (see Figure 3 (a)).

4.3.3 General building protection and object protection

Packaging machines are generally sited in factories and warehouses. The building occupancy and use classifications of these as are set out in international and national codes and standards and mandated by local Authority Having Jurisdiction (AHJs). For general building protection and for relevant applications around packaging machines which are not dealt with in detail in this Case Study, Table 5 below is a list of other Securiton industries and application design literature, available for free from www.securiton.com/en/industries-applications

Related Built Environment	Securiton Design Guide/Case Study
Warehouse and logistics hubs	Distribution Logistics and Warehousing Industry [18]
Production areas	Industrial Manufacturing [19]
Classified hazardous areas	Intrinsically safe and hazardous areas [20]
Challenging environments	Harsh environments (dusty and corrosive) [21]
Electrical equipment	EWFD for Electrical and IT Cabinet Protection [22]

Table 5 List of Securiton application design literature

4.4 Features and benefits

Securiton AG as a whole 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 LTHD products provide comprehensive line-up for both addressable and non-addressable applications. SecuriHeat d-LIST and ADW offer unobtrusive, easy to install heat detection that is immune to harsh environments and can easily be cleaned and maintained. They are compatible with the principles of Intrinsically Safe Design and can be used in combination with SecuriSmoke ASD in the most demanding Performance-based Designs where Early Warning Fire Detection is crucial for fire and life safety, as well as protection of asset and business continuity.

Key features and benefits of SecuriHeat d-LIST and ADW products are summarised as followings.

Feature	Benefits
SecuriHeat d-LIST	
Individually assessable sensors	Rapid pinpointing of incipient fires
Sealed cable with choice of sensor spacings	Easy installation, no maintenance required
Extremely durable cables	Operate in extreme environments
SecuriHeat ADW	
Copper, steel or Teflon tubing	Resistant to harsh outdoor conditions to achieve best cost/benefit
Dynamic Heat Watch algorithm	Elimination of false alarms
Fully automatic system monitoring	Minimal maintenance
2-Level of Alarms	Pre-signal: Verify and control (manually initiate the suppression) Alarm: Initiate fire alarm; call fire brigade; initiate suppression

For large packaging machines that require a number of SecuriHeat ADW or d-LIST or combination of the two, detectors may be connected to a laptop for easy service and troubleshooting. SecuriHeat d-LIST and ADW follow identical design approach regarding system integration with building FAS. If a pre-action type sprinkler system or a water mist system is used, SecuriHeat detectors can also be configured to actuate the release of the fire extinguish systems.

4.5 Integrated verify, control and respond

SecuriHeat d-LIST features two levels of alert (‘Pre-signal’) and alarm signal (‘Alarm’). Typically, alert from one sensor escalating to alert from adjacent sensor or alarms from the originally alerted sensor provide timely alert to an overheating or incipient fire situation, while alarm signal is used for fire alarm as well as pre-action sprinkler actuation. Table 6 summarises the use of multilevel alarms from SecuriHeat d-LIST.

Level	Signal	Typical use
1	Pre-signal	Verify and control (manually initiate the suppression)
2	2nd sensor pre-signal	Automatic stop of operations and machinery; call emergency team
3	Alarm	Initiate fire alarm; call fire brigade; initiate suppression

Table 6 Alert and alarm levels for SecuriHeat d-LIST

SecuriHeat ADW 535 provides one level of alert (‘Pre-signal’) and one fire alarm signal (‘Alarm’). Alerts escalating to alarms from an overheating component or incipient fire provide the early warning needed to prevent the incident from fire ignition or limit the fire spreading out. Table 7 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 7 Alert and alarm levels for SecuriHeat ADW

4.6 Minimal system access for ITM

Due to the advanced automatic sealing test and automatic self-test functions of SecuriHeat ADW 535, 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.

The SecuriHeat d-LIST sensor cable and the external sensors are maintenance free, because they are completely shielded against external influences. In addition, the individual sensors are tested for their function in each measuring cycle. Individual sections of the cable can be replaced easily in case of mechanical damage.

4.7 Support with peace of mind

SecuriHeat d-LIST and ADW products are supported by a range of software tools.

Support for	Support tool
SecuriHeat ADW	
Design	ADW HeatCalc allows the planning of security systems at a very early stage.
Install and commission	EasyConfig for simple systems. The practical ADW Config software tool is used for more complex systems and application-specific adaptations.
Monitor and manage	ADW HeatCalc and ADW Config. Extensive analysis functions and setting options ensure safe, cost-effective operation of your system.
SecuriHeat d-LIST	
Design, install, monitor and manage	SCU 835 can be operated and configured using the d-LISTconfig graphical user interface. Connection is possible via RS485, RS232, USB as well as the Ethernet interface.

Application support includes:
- Partner accreditation program
- Application and field engineering support
- Worldwide reach through a network of partners, with branch offices or local employees on every continent

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