ACTIVE FIRE PROTECTION GUIDE
Detection Systems: Point Detectors

This document has been produced by the RISCAuthority Active Suppression & Detection working group to provide information and outline guidance on the application of Point Detectors in Fire Detection and Alarm Systems.

Summary

Refer to AFPG-30 Detection Series Overview, and all core Standards listed as installation requirements may change.

Point detectors:

- are the primary means of alerting people and attached systems to the potential outbreak of a fire. They may be designed primarily for the protection of life or business and property (and combinations thereof). If a system is intended to fulfil the objectives of more than one category of system, then the system needs to conform to the recommendations for each of the categories (see AFPG-30).
- are the most common type with each unit measuring a single, or combination of many, fire fingerprinting indicators.
- should be discerning enough to detect fire robustly and quickly and not trigger on false or unwanted influences.

The avoidance of false and unwanted alarms (FaUwA) is best addressed by the correct equipment selection and placement within the protected space. Combined multi-sensor detectors have the potential to eliminate the FaUwA problem if used more widely.

Within British and European Standards there are currently no fire tests for immunity (scenarios that detectors should not respond to), and until it changes, it is unlikely that poor FaUwA performance by single species point detectors will improve (test regimes for the oil and gas industry do include immunity tests).

It is vital to check local Fire Service turn-out policy for automatically generated alarms – some will not turn out until confirmed by another means.

Property protection vs. life safety sprinkler systems

For information on the differences between life safety and property protection detection systems, please refer to AFPG-30.

Types of detector

Point detectors are the most common form of detector used for the protection of buildings and include:

- Smoke detectors
- Heat detectors
- Carbon monoxide detectors
- Flame detectors
- Combined multi-sensor detectors (combinations of the above in a single unit).

All detectors connect to common electrical infrastructure that interprets signals, communicates alarms, and controls other fire systems (see AFPG-30).

The suitability of each point detector type depends upon the environment in which they are being placed to achieve the correct balance of reliability and speed of response. They are generally ceiling mounted to best access rising smoke, heat, and gases, or gain line of sight visibility of an area for flaming.

Point detector selection – general principles

Each type of detector responds to a particular fire product and therefore the relative speed of response of the detector is dependent upon the type of fire being detected.

Smoke detectors: As smoke is normally present at an early stage in most fires, smoke detectors are considered the most useful type available for giving early warning. When smoke enters the chamber of the detector, the signal between an emitting source (radioactive or optical) and receiver, is reduced allowing detection. Performance requirements for point smoke detectors are laid out in BS EN 54-7 and BS EN 54-27 (Duct smoke detectors), design, installation, commissioning; and maintenance requirements are given in BS 5839-1 and BS 5839-6 for commercial and domestic premises respectively.

The sensing element of a smoke detector must be within 25-600mm of the ceiling. They have an assumed radius of function of 7.5m and must be arranged so there are no blind spots (an effective separation of 10.6m and 5.3m to a wall). In corridors less than 2m wide they may be installed at their full radius separation (15m). For ceilings with an apex that is less than 600mm, they may be installed as for a flat ceiling. For higher apexes, the device should be installed at the highest point. The maximum installed height for a smoke detector is 10.5m.

Heat detectors: Most fires, in their later stages, emit detectable levels of heat. Therefore, in areas where rapid fire spread is unlikely and environmental conditions preclude the use of smoke detectors (such as kitchens), heat detectors are a common alternative. Performance requirements for point heat detectors are laid out in BS EN 54-5, and design, installation, commissioning, and maintenance requirements are given in BS 5839-1 and BS 5839-6 for commercial and domestic premises respectively.

The sensing element of a heat detector must be within 25-150mm of the ceiling. They have an assumed coverage of 5.3m radius and must be arranged so there are no blind spots (an effective separation of 7.5m and 3.6m to a wall). For ceilings with an apex that is less than 150mm, they may be installed as for a flat ceiling. For higher apexes, the device should be installed at the highest point. The maximum installed height for a heat detector is between 7.5 and 9m dependent upon type.

Carbon monoxide detectors: Fires tend to produce carbon monoxide in situations in which there is insufficient ventilation to enable fire to burn rapidly and as such the detector is well suited to provide early warning of slow smouldering fires. Slowly developing and smouldering fires produce large quantities of carbon monoxide before detectable smoke aerosols and particulates reach smoke detectors in sufficient quantities to detect the fire. These detectors can often be used in applications in which heat detectors are insufficiently sensitive, but smoke detectors may cause false alarms from sources such as steam from a shower or smoke from burnt toast.

Performance requirements for point carbon monoxide detectors are laid out in BS EN 54-30; and design, installation, commissioning, and maintenance requirements are given in BS 5839-1 and BS 5839-6 for commercial and domestic premises, respectively.

The sensing element of a carbon monoxide detector (which includes a heat detector and electrochemical cell) must be within 25-150 mm of the ceiling. They have an assumed coverage of 5.3 m radius and must be arranged so there are no blind spots (an effective separation of 7.5 m and 3.6 m to a wall). For ceilings with an apex that is less than 150mm, they may be installed as for a flat ceiling. For higher apexes, the device should be installed at the highest point. The maximum installed height for a carbon monoxide detector is 10.5m.

Flame detectors: In situations where a burning liquid, for example alcohol, paint thinner etc. is likely to be the prime source of a fire, and flame is most likely to be the first indication a fire has started, then an infrared (IR) or ultra-violet (UV) flame detector could be incorporated into the system. IR is detected in a bandwidth appropriate to hot carbon dioxide molecules, a by-product of combustion.

Performance requirements for point flame detectors are laid out in BS EN 54-10; and design, installation, commissioning, and maintenance requirements are given in BS 5839-1 and BS 5839-6 for commercial and domestic premises, respectively.

As line-of-sight devices, flame detectors should be installed in accordance with manufacturer's instructions.

Other requirements for all point detectors: A myriad of other rules apply to the location of detectors including inside voids, proximity to ceiling fittings, on perforated ceilings, clear space requirements around, honeycomb ceilings, close beamed ceilings etc. (Refer to BS EN 54-1 and BS EN 54-6).

Arrangement of detectors

To create a working system point detectors are arranged into 'Detection Zones' and 'Alarm Zones' to support accurate fire location and effective evacuation.

Detection Zones: A detection zone should cover no more than 1 storey unless the total floor area is less than 300m^2. Voids in the same fire compartment should be included in the same floor zone. The maximum floor area of a zone should not be greater than 2,000m^2, except for some large open plan areas that incorporate manual call points only, which can be extended to 10,000m^2. The maximum search distance for the firefighters to see the seat of the fire within a zone should not exceed 60m assuming the route taken is the worst possible option. Vertical structures like stairwells, lift shafts etc., should be considered as separate zones. A manual call point within a staircase should be connected to the zone associated with that floor and ideally be mounted on the accommodation side of the corridor exit. Automatic sensors on the stairwell remain as part of the stairwell detection zone.

Alarm Zones: An alarm zone generally coincides with the fire compartment boundaries. There must be a clear break between these alarm zones to ensure alert and evacuation messages are not overheard from adjacent areas. The only other criteria is that an alarm zone may consist of a number of detection zones but not vice versa. Alarm zones are required when phased or staged evacuation is required. It is therefore important that care should be taken to ensure only one message is heard at any one time particularly where two alarm zones are attached.

Challenges and considerations

Management of false and unwanted alarms: Comprehensive recommendations for the management of fire detection and alarm systems for the reduction of false and unwanted alarms are given in RISCAuthority document RC47: *Recommendations for the management of fire detection and alarm systems in the workplace*.

Understanding fire and rescue service response: In the face of budget cuts, Fire Services across the UK are focusing on reducing the resources given to the attendance of false and unwanted alarm activations. The means to achieve this are many and varied and include:

- not turning out until notified by another means such as a 999 call
- call challenging; phoning the premises to see if the alarm is legitimate
- providing a reduced attendance in the first instance
- proving a small vehicle response in the first instance.

Methods adopted are often different for day and nighttime due to sleeping risks and levels of occupation and vary greatly for the type of building occupancy. An improved response may be given to systems that have a greater immunity to false and unwanted alarms.

Applicable standards

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

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

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

BS EN 54-5 *Fire detection and alarm systems Part 5: Heat detectors - Point heat detectors.*

BS EN 54-7 *Fire detection and alarm systems Part 7: Smoke detectors – Point smoke detectors that operate using scattered light, transmitted light or ionization.*

BS EN 54-10 *Fire detection and alarm systems Part 10: Flame detectors – Point detectors.*

BS EN 54-30 *Fire detection and alarm systems Part 30: Multi-sensor fire detectors — Point detectors using a combination of carbon monoxide and heat sensors.*

Schemes

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

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

Best practice

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

Adoption of high integrity combined multi-sensor devices is preferred.

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

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