ACTIVE FIRE PROTECTION GUIDE
Detection Systems: Linear Heat Detection

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

Summary

Refer to AFPG-30 Detection Series Overview.

Linear heat detectors:

- are most commonly found in specialist commercial and industrial applications and can be installed to meet both life safety and property protection/business interruption objectives.
- are used in applications where the use of point detectors would be too inefficient to provide the necessary detection spatial resolution.
- exhibit particular benefit when used in vehicle tunnels, cable trays/tunnels, conveyor belts, roof voids, aircraft hangars, underground car parks, and substantial and complex confined spaces.

Very different levels of technology can be used from traditional simple metal cable devices that report fire when any part of the cable exceeds a threshold temperature, to fibre-optic based systems that can report temperature every metre for many kilometres. Simple metal cable-based systems are integrated into detection systems in the same manner as for a point detector.

Fibre-optic based technologies can accurately locate fire and even support a 'robotic response' if designed accordingly. The wealth of data generated can be superimposed on site layout drawings to provide exceptional 'situational awareness' of fire events and their development. Modern fibre-optic systems can be a good alternative to video and IR array detection systems in highly cluttered environments.

Property protection vs. life safety detection systems

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

Types of detector

Linear heat detectors come in 2 principal forms:

- Line-type heat detectors – metal cables (LTHD)
- Fibre-optic heat detectors (FOHD).

All detectors are capable of being connected to common electrical infrastructure that interprets signals, communicates alarms, and controls other fire systems (see AFPG-30). LTHD must be used within a fire zone, but FOHD systems can be calibrated to cover many fire zones.

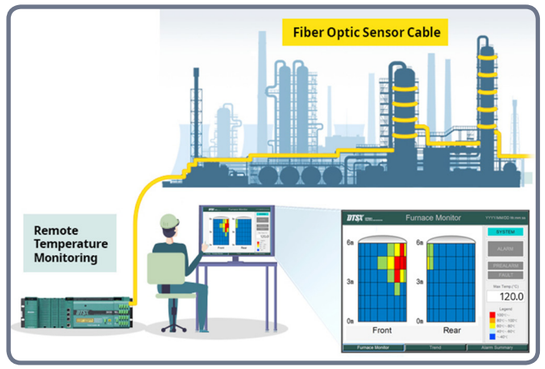
The suitability of each linear heat detector type depends upon the resolution of detection required, the necessary speed of response, whether the environment demands frequent re-calibration, and whether they are easily replaced upon destruction.

Line-type heat detectors: come in two forms, 'non-integrating' and 'integrating' that can run in lengths up to 500m. Non-integrating heat detectors typically consist of a length of electrical cable with insulation of fixed melting point. At the nearest point to the fire, the insulation will melt, causing the wires inside to short which is interpreted as an alarm signal by the panel – they need to be replaced following function (non-resettable). Integrating line-type detectors are similar, but the insulation does not melt (resettable). Instead, the change of the electrical resistance of the whole cable is measured which varies with temperature.

BS 5837-1 requires that no point in the protected space is further than 5.3m from a line detector, they should be mounted 25-150mm below the ceiling, and that any part of the line that runs within 500mm of any feature that will interrupt gas flow should be discounted from providing detection. Where installed to protect specific machinery or plant, they are to be located to optimise effectiveness.

BS EN 54-28 and BS EN 54-22 describe the performance requirements for linear heat detectors of the non-resettable type and resettable type respectively.

Fibre-optic heat detectors: The light transmission properties of fibre-optic cable change with temperature and this facet can be exploited to produce linear heat detectors of great length (up to 20km) and high accuracy (establishing temperatures every 1m along the cable). Using a pulsed laser as the light source, the backscattered light is analysed to produce data for the entire length of the cable. Alarm criteria may be made at a defined maximum temperature, defined maximum temperature rise, or rise above (difference) the mean cable temperature. With such data provision, a single cable may be 'virtually' split into any number of reporting zones (1000s) and is suitable for giving enhanced situation awareness as data may be plotted over building schematics to assist with interpretation of the fire event and spread. Due to the great flexibility and high sensor/£ ratios achievable, these systems are extensively used in large complex manufacturing facilities, high value/life-risk tunnels, maritime, and oil and gas applications.



They are commonly used where reliability is required under severe environmental conditions like:

- dirt, dust, corrosive atmospheres
- high humidity
- dynamic temperature fluctuations
- solvent vapours and radioactive radiation
- ATEX classified areas.

General installation criteria are as for traditional line-type systems, although their greater capability will be defined within the manufacturer's guide.

Other requirements for all linear heat 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 54-22 and BS EN 28).

Challenges and considerations

Speed of response: Integrating line-type resettable detectors can be slow to respond as the distance of cable used is increased. In measuring the resistance across the whole cable length, it can take a very large spot temperature to change the mean resistance of the whole cable.

Management of false and unwanted alarms: By their very nature, heat detectors, correctly chosen and set, are relatively tolerant of false and unwanted alarms. Additional guidance is 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
- providing 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.*

EN54 Part 22: *Fire detection and fire alarm systems. Resettable line-type heat detectors.*

EN54 Part 28: *Non-resettable line-type heat detectors.*

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.

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.