Kentec

BS 5839

PART 1:2025

Fire Detection and Fire Alarm Systems for Buildings

Understanding the Regulatory Reform (Fire Safety) Order 2005 (FSO)

The Regulatory Reform (Fire Safety) Order (FSO) came into force on 1 October 2006 and remains the cornerstone of fire safety legislation in England and Wales. Under the FSO, fire certificates are no longer valid, and the responsibility for fire safety has shifted to those in control of premises—typically employers, building owners or occupiers.

Your legal duty:

If you are responsible for a building, you are required by law to:

- Identify and reduce fire risks
- Implement measures to contain a fire, should one break out
- Ensure safe evacuation for all occupants

This includes providing effective fire detection and alarm systems, aligned with the latest standards—including BS5839-1:2025.

What is a Fire Risk Assessment?

A Fire Risk Assessment (FRA) is central to meeting your obligations under the FSO. It must be:

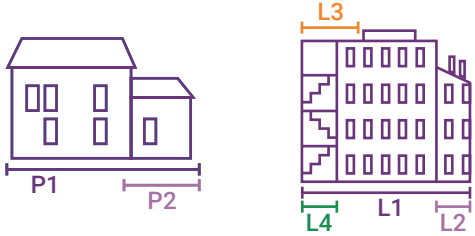
- Carried out by a competent person
- Reviewed regularly to remain up to date

A suitable and sufficient FRA should:

- Identify potential fire hazards (ignition, fuel and oxygen sources)
- Identify people at risk—staff, visitors, vulnerable occupants
- Evaluate the likelihood of fire and its impact on people
- Remove or reduce risks
- Specify fire protection measures
- Include an emergency plan
- Provide staff training and instruction
- Keep detailed, up-to-date records at all times

The findings should directly inform the design and coverage of your fire detection and alarm system.

Fire Alarm / Fire Detection Categories



P Automatic Fire Detection designed to primarily protect property.

P1 AFD installed throughout all areas (usually with remote monitoring).

P2 AFD installed only in specific areas (usually with remote monitoring).

L AFD designed to primarily protect human life.

L1 AFD installed throughout all areas, except some low fire risk areas such as toilets, toilet lobbies, bathrooms or small cupboards (less then one square metre).

L2 AFD installed in defined areas in addition to L3. Also includes any rooms where there are sleeping occupants.

L3 AFD installed in escape routes (as L4) and in rooms opening onto those routes this may include voids.

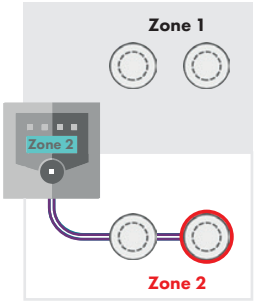
L4 AFD installed in escape routes comprising circulation areas and spaces such as corridors and stairways. Also includes the provision of a detector at the top of any shaft or flue like structure.

L5 A non-prescriptive system in which the protected area(s) is designed and specified to satisfy a specific fire risk objective (other than that of L1 to L4).

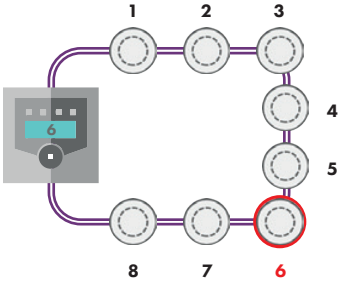
M System designed to be operated manually (no AFD) Categories L1, L2, L3 and L4 all include Manual Call Points. To add Manual Call Points to P1, P2 or L5, add /M e.g. P1/M.

Conventional vs. Addressable

Conventional



Addressable



Conventional - A conventional fire detection system employs 'spurs' of detectors grouped into Zones. When a detector is in alarm/fault only the Zone is reported at the CIE.

Addressable - An addressable (intelligent) fire detection employs a loop of sensors and other devices which are all individually addressed numerically. When a sensor is in alarm/fault the address of that device (and in most cases, a textual description) is reported at the CIE.

Non-Addressable
Facilities for up to 10 people to sleep

Addressable
Facilities for more than 10 people to sleep

Where occupants of a building are going to need assistance from staff to evacuate the building (e.g. in residential care premises and hospitals), the fire detection and fire alarm system should be **addressable** if the building has facilities for **more than ten people** to sleep.

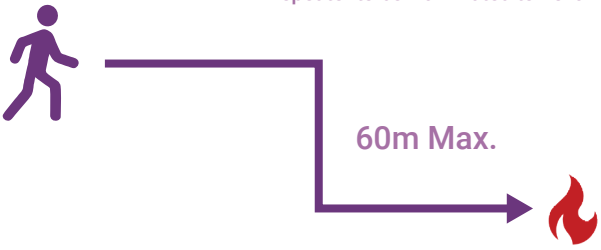
Residential care homes should be connected to an ARC. The lack of an ARC connection is not regarded as an acceptable variation. An ARC Connection Sticker should be displayed on the fire alarm control panel.

Zone Plans / Search Distance

- Required adjacent to all CIE
- Minimum 15 Lux required
- Became mandatory under the latest BS 5839-1 revision (2025)

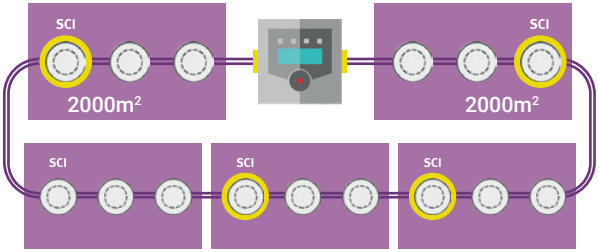
It is important to ensure that a suitable, correctly orientated zone plan is provided adjacent to all CIE (including any repeat control and/or indicating equipment), unless the CIE incorporates a suitable display (e.g. an illuminated mimic diagram).

Whether the mimic is illuminated or not, BS5266 requires the control panel and repeater to be illuminated to 15 lux.



A person searching a Conventional Zone for a fire should not have to travel more than **60m** from the point of entry into the Zone to identify evidence of a fire.

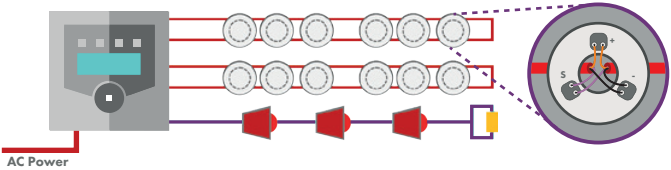
SCIs and Zones / Critical Signal Path



Short Circuit Isolators (either on the loop or within the CIE) should be installed to limit the loss of fire cover caused by a single fault to 2000m².

The loss of fire cover caused by two simultaneous faults should be limited to 10,000m² maximum.

This will therefore restrict the cover provided by any analogue loop to 10,000m² maximum.



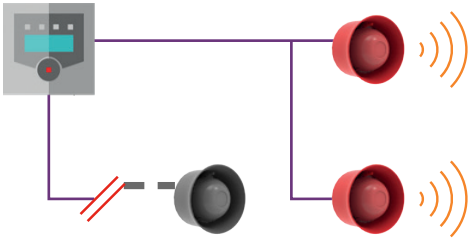
Cables used for the Critical Signal Path and the final LV (low voltage) mains supply to any fire detection equipment are now required to be fire resistant and coloured externally in a single, common colour (red is preferred).

The LV supply to all parts of the system should be provided with a suitable means of safe isolation, i.e. a method that requires verification that isolation has been successful.

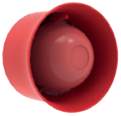
Non-critical cabling may still be non-fire resistant, for example door retainer circuitry which may fail to safe.

The functional earthing (FE) conductor of fire alarm installation wiring systems should be identified by the colour pink (e.g. by pink insulation or sleeving), or by alphanumeric marking “FE”.

Alarm Device Circuits / Sounders & Pressure



Alarm Device Circuits should be arranged so that, in the event of a single fault, at least one sounder, sited within the vicinity of the CIE, will continue to operate.



65 dB(A) @
500 Hz to 1000 Hz

+5 dB(A) @
500 Hz to 1000 Hz

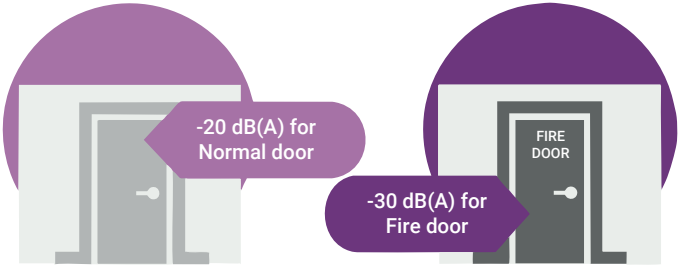
Sufficient sounders, operating within the frequency range of 500 Hz to 1000 Hz, should be installed to endure that a sound pressure of 65 dB(A) is achieved.

Add 5 dB(A) above a background noise (if lasting more than 30 seconds) at all accessible points with all doors closed.

This may be reduced to 60 dB(A) in stairways or enclosures less than 60m^2 excluding corridors.

Sounders and Sound Pressure

For areas where people are sleeping, sounder devices should produce a minimum of 75 dB(A) at the bed-head with all doors closed.
This will probably require a sounder within the room.



A reduction in sound pressure of approximately 20 dB(A) may be expected through a normal door, and approximately 30 dB(A) through a fire door.

The latest revision of BS 5839-1 provides guidance on integrating lockdown alarms into fire alarm systems, emphasising the need for a distinct tone to avoid confusion. Addressable fire detection systems are ideally suited to the handling, controlling and managing a lockdown (invacuation) facility, providing the sounders are capable of producing a distinctly different tone to the general fire alarm.

Visual Alarm Devices (VADs)

EN54 Part 23 specifies the light output required for VADs should be:

- 0.4 lux (0.4 lumens/m2)
- Not designed to wake sleeping people
- And the colour can be red or white light

Note: Cannot be mixed within an individual product. The use of one colour throughout a building is best practise, unless specific colours are needed for a specific event type, such as evacuation for example.

The standard also defines three VAD categories:

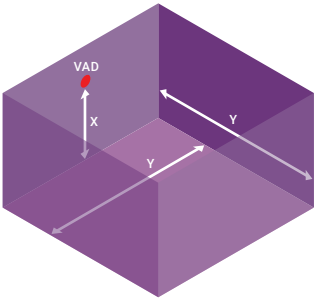
- C - Ceiling Mounted VADs
- W - Wall Mounted VADs
- O - Open Category devices

Wall Mounted Device Rating:

- W - X - Y
- W = Wall
- X = Mounting Height
- Y = Length & Width

Example:

- W - 2.4 - 5



A wall mounted VAD might be rated W-2.4-5, where "W" stands for wall.

The numbers represent the coverage volume, in the shape of a cube where the first number is the maximum height on the wall the VAD can be mounted, and the second number is the length and width of the coverage.

So in this example, we can see that this device is a wall-mounted VAD, which can be fitted up to 2.4 metres and provides a 5 metre square coverage base.

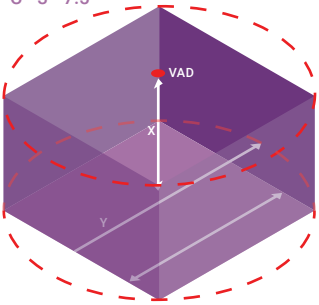
Visual Alarm Devices (VADs)

Ceiling Mounted Device Rating:

- W - X - Y
- W = Wall
- X = Mounting Height
- Y = Length & Width

Example:

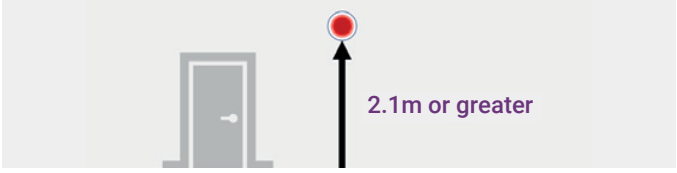
- C - 3 - 7.5



A ceiling mounted VAD uses a similar rating formula, with two numbers representing the coverage volume, this time in the shape of a cylinder, where the first number is the maximum ceiling height to which the VAD can be mounted, and the second number is the diameter of the coverage.

Note: Ceiling heights can only be classified as 3, 6 or 9 metres.

So in this example, a VAD rated as C-3-7.5 shows us that it is designed to be fitted at a 3 metre ceiling height and that the light volume will be a circle of 7.5 metres diameter.



Visual Alarm Devices (VADs) such as strobes and beacons may be ceiling or wall mounted, but for wall mounting the minimum of 2.1m from finished floor levels applies.

It is advisable to fit synchronised VADs, otherwise unsynchronised VADs may be perceived as an increased flash rate and may induce a photosensitive epileptic seizure.

Alarm Device Cabling / Manual Call Points

All fire alarm cables, below the height of 2m from the finished floor level should be mechanically protected, unless enhanced cable is used.

If a cable passes through a floor, sleeving up to 300mm minimum should be provided.

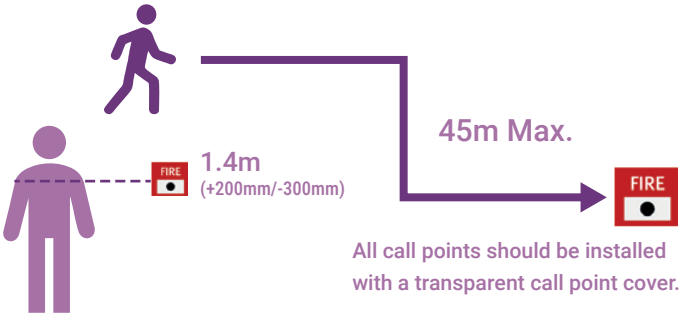
Non-combustible fixings should be used throughout.

No one should have to travel more than 45m to reach the nearest Manual Call Point, or 25m in areas where a higher fire hazard is recognised, for example kitchens, paint booths etc.

In open spaces, or at the design phase if the internal layout hasn't been finalised, the straight line distance between any point in the building and the nearest manual call point should not exceed 30m.

Manual Call Points should be positioned 1.4m (+200mm/-300mm) from finished floor level and if sited below 1.1m a variation will be required.

They may be semi-recessed if readily visible but if required to be seen from the side (for example, in a corridor) they should be 15mm proud of the wall.

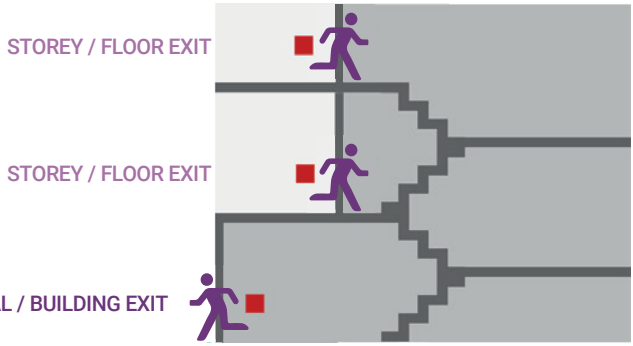


All call points should be installed with a transparent call point cover.

Manual Call Points / Device Spacing

Manual Call Points should be positioned at:

- All storey exits from stairways but programmed to display, at the CIE, as being within the storey zone or accommodation zone, not the stairway zone.
- All final exits to open air and arranged to display, at the CIE, as being within the stairway zone.



"Fires not close enough to a detector or in an area not covered by a smoke alarm system, accounted for 47% of false alarm incidents." - ONS, 2017

Detection device spacing is crucial, not only to comply with the standard but to provide complete protection.

The standard is very specific about spacing devices across ceilings, within voids and in roof spaces.

Let's look at some of the key points worth knowing.

Positioning detectors in the wrong place could either:

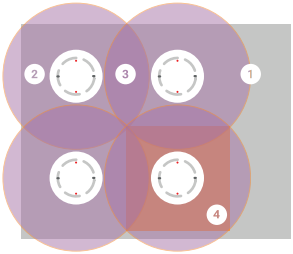
- Create false alarms, or
- Stop them responding properly.

Detector Positioning

For smoke detectors, individual detector coverage is 7.5m radius, but because these radii must overlap, the actual distance between the detector and the walls must be 5.3m and between detectors must be 10.6m.

Therefore individual smoke detector can be measured in abutting squares of 112 square metres (this is regularly approximated to 100 square metres).

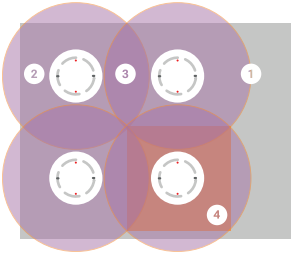
1. 7.5m
2. 5.3m
3. 10.6m
4. 10.6m x 10.6m = 112m²



For heat detectors, individual detector coverage is 5.3m radius, but again, because these radii must overlap, the actual distance between the detector and the wall must be 3.8m and between detectors must be 7.5m.

Therefore individual heat detector coverage can be measured in abutting squares of 56.3 square metres (this is regularly approximated to 50 square metres).

1. 5.3m
2. 3.8m
3. 7.5m
4. 7.5m x 7.5m = 56.3m²



Heat detectors should not be used in areas designed as sleeping accommodation.

Detector Positioning

BS 5839 states that when used in a time-controlled system, such as those employing “day/night modes”, where the optical sensing element of a multi-sensor is disabled during the day, it is vital that the detectors are spaced as heat detectors.

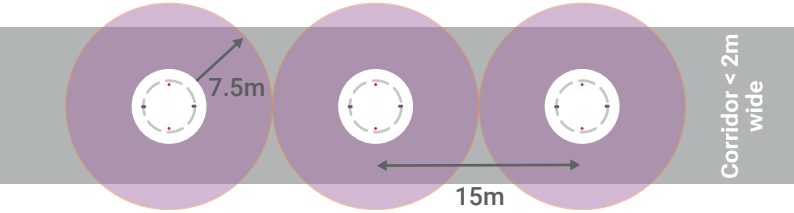
Conversely, If there is no intention of disabling the smoke sensing element of a multi-sensor during normal operation, they can be spaced as smoke detectors.

The latest revision of BS 5839 Part 1 states that heat detectors **should not be used in areas designed as sleeping accommodation, such as hotel rooms**. Rather it is recommended to utilise smoke sensors or better still, multi-sensors with CO detection, approved to EN54 Part 26, such as Kentec’s KS-MULTI-CO, because of their inherent better immunity to false alarms.

Detector Positioning - Corridors

In corridors less than 2m wide the horizontal spacing of smoke detectors may be increased, the areas of coverage need not overlap as in the case of a room.

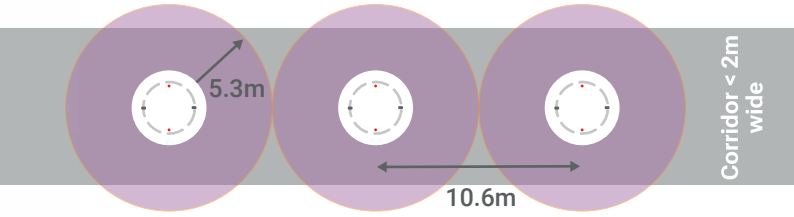
Note: In corridors CO sensors can only be used in-conjunction with smoke sensors.



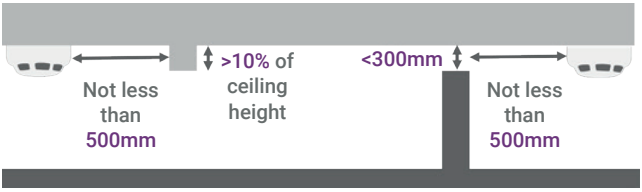
The standard does not recommend using heat sensors in escape routes, unless covered by a variation.

In corridors less than 2m wide the horizontal spacing of heat detectors may be increased, the areas of coverage need not overlap as in the case of a room.

If a corridor is deemed part of an escape route heat detectors should not be installed due to the possibility of smoke hazard.



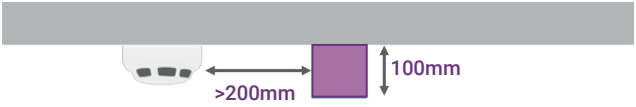
Ceiling Obstructions / Air Inlets



Ceiling obstructions, if deeper than 10% of the ceiling height, or floor mounted obstructions (e.g partitions) where the top is less than 300 mm from ceiling should be treated as walls.

No detection device should be mounted within 500mm of any wall or obstruction treated as a wall.

Any obstructions installed close to the ceiling should be considered a wall if the gap between the top of the obstruction and the ceiling is less than 300mm AND the obstruction is deeper than 10% of the ceiling height.

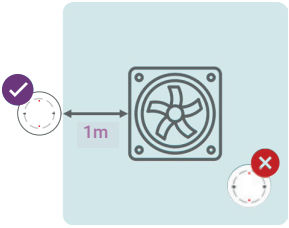


If a ceiling obstruction is less than 250mm, or less than 10% of the ceiling height, such as a strip light fitting, then detection devices should not be mounted closer than **twice the depth of that obstruction.**

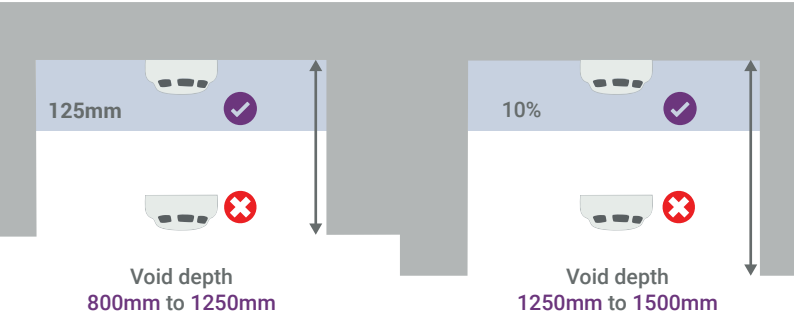
In this example, with a 100mm deep light fitting, the detector should not be closer than 200mm.

Detection devices should not be sited within 1m from air inlets or forced ventilation systems (such as air-conditioning units).

This also applies to wall-mounted air conditioning units where air-flow would affect the build-up of smoke.

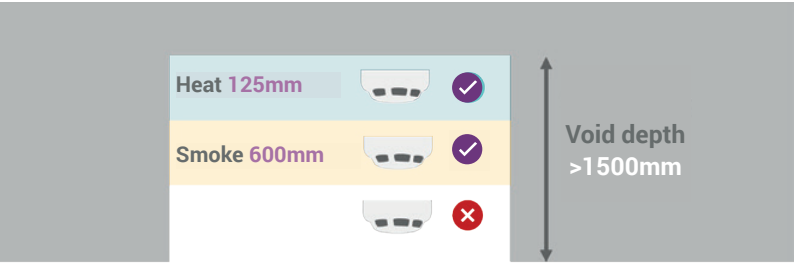


Detection within Voids



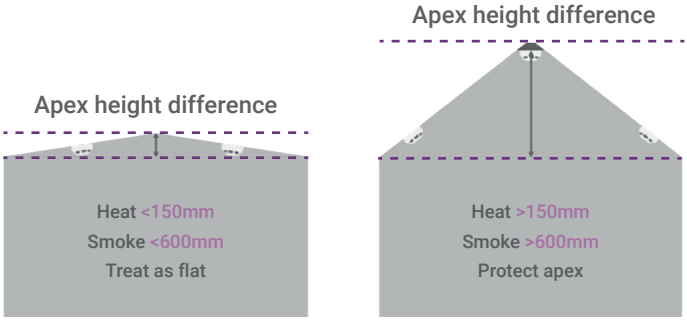
If the system category requires detection in any area, which has a void deeper than 800mm but less than 1250mm depth, detection should be provided in the void and should be sited in the top 125mm. In voids between 1250mm and 1500mm deep, the sensing element of the detector should be sited in the top 10% of the void.

There will be no requirement for void detection if the void is constructed from fire-rated partition.



Voids deeper than 1500mm may be treated as a room when siting detectors below the ceiling - 150mm for heat and 600mm for smoke.

Apex Ceilings



For ceilings that feature an apex: as long as the height difference between the apex and the height of the eaves is less than 150mm for heat detectors or less than 600mm for smoke detectors then these can be treated the same as flat ceilings.

For higher apexes, a device should be installed at or near the apex.

The radius of cover for this detector only may be increased by 1% for each degree of increased cover, up to a maximum of 25% - but this only applies to the apex now.

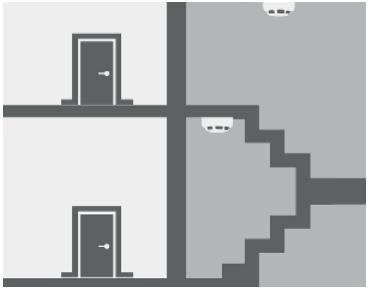
Ceiling Heights

Detection Type	Column 1 Generally applicable maximum ceiling height (m)	Column 2 Max height for 10% of ceiling area (m)
Heat detectors (BS EN 54-5)		
Class A1	9.0	10.5
Other classes	7.5	10.5
Point smoke detectors (BS EN 54-7)	10.5	12.5
Carbon monoxide detectors (BS EN 54-26)	10.5	12.5
Optical beam smoke detectors (BS EN 54-12)		
Normal sensitivity	25.0	28.0
Enhanced sensitivity (alarm at ≤35% attenuation)	40.0 (see Note 1)	43.0 (see Note 1)
Aspirating smoke detection systems (BS EN 54-20)		
General limit	10.5	12.5
Class C with at least 5 holes	15.0	18.0
Class C with at least 15 holes	25.0	28.0
Class B with at least 15 holes	40.0 (See Note 2)	43.0 (see Note 2)
Other fire detectors	As specified by manufacturer	

Note 1 The use of supplemental detection is recommended unless the risk (i.e. probability x consequence) of stratification is minimal.

Note 2 The use of multi-level sampling is recommended unless the risk (i.e. probability x consequence) of stratification is minimal.

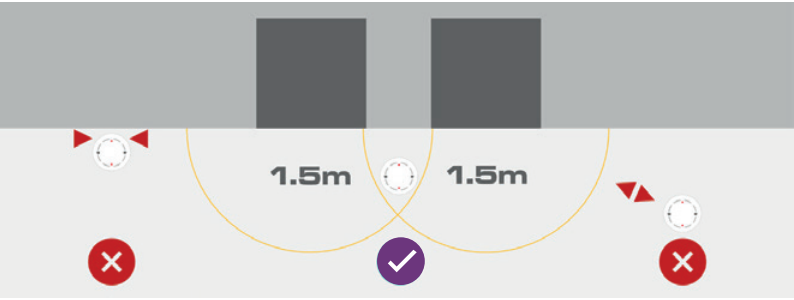
Stairwells / Lift Shafts



Enclosed stairways should have a detector at the top and at each main landing.

Other than in Categories L5 and P2 (and specific areas in L4 - see page 3), any vertical flue-like structure (lift shafts, open risers, etc.) which penetrates one or more ceilings should have a detection device mounted at the top in the vertical structure and at each level (including the top floor) within 1.5m of any access hatch or door opening to the vertical structure.

This example shows two lift shafts, side by side - the correctly positioned detector sits within 1.5m of both openings.



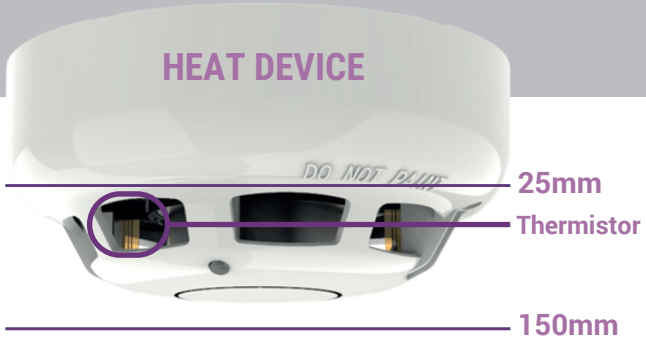
Detector Characteristics

The sensing element of a smoke detection device (the photoelectric smoke chamber) should not be less than 25mm below ceiling, and not greater than 600mm below ceiling.

SMOKE DEVICE

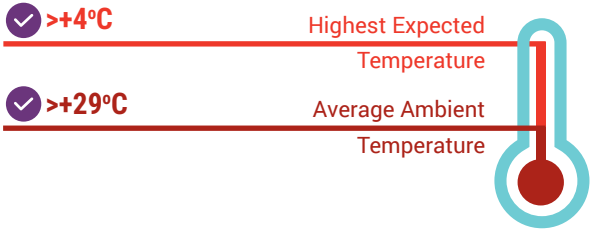
The sensing element of a heat detection device (the thermistor) should not be less than 25mm below ceiling, and not greater than 150mm below ceiling.

HEAT DEVICE



Heat Detection Settings / Multi Sensor

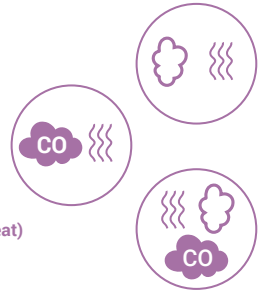
The minimum static response of heat devices should not be less than 29°C above the average ambient temperature, or less than 4°C above the highest temperature the device can be expected to experience.



In BS 5839-1, the definition of a multi-sensor is stated as “fire detector that monitors more than one physical and/or chemical phenomenon associated with fire”.

The standard also acknowledges that a multi-sensor could be:

- EN54-29 (Smoke and Heat)
- EN54-30 (CO and Heat)
- EN54-31 (Smoke, CO and Heat)



The standard also accepts that a multi-sensor can also be used in a single sensor state. Whichever state the multi-sensor is being used in, the detector should meet the performance requirements of the appropriate part of BS EN 54, the designer should record the type and configuration of the multi-sensors. Annexe D, figure D1, provides suitable means for recording the information.

Video Fire Detection / Annexe ‘D’

Video fire detection is now a recognised specialised fire detection technique, specifically for L5 and P2 consultant specified categories.

Annexe ‘D’ in the British Standard for the selection, spacing and siting of detectors, BS 5839 Part 1, details the correct procedure for the selection of detector type, to reduce false alarms.

And to reduce false alarms, every system designer or installer needs to ask themselves these questions when specifying a detector based on position, environment and building use, such as:

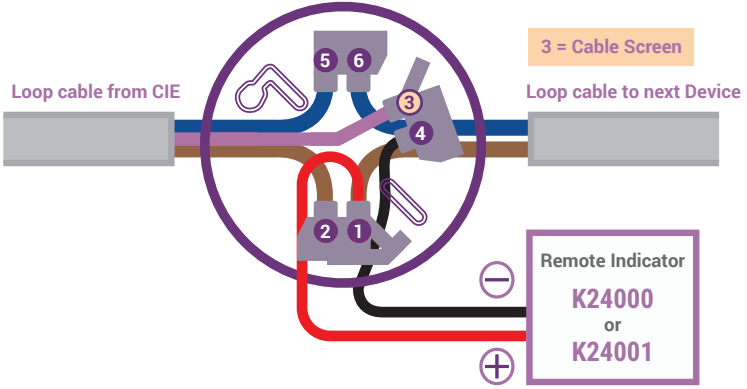
- What is the risk of fire developing in this area?
- Is a fire likely to be a rapidly-developing, high energy type fire or a slowly developing, smouldering fire?
- Under normal conditions, will there be high ambient levels of smoke or steam present?
- Is the area a clean, dry environment or are there high levels of dust, dirt or moisture?
- Is there likely to be a high concentration of cigarette smoke?
- Are there any special risks?
- Is there a high ambient temperature or significant variations in temperature?

The Annexe also explains linking fire alarm systems to security systems to instantly notify the responsible person when an incident occurs and the deactivation of remote monitoring during routine maintenance, both again to help reduce false alarm generation.

Base Wiring a Remote Indicator

The following addressable bases should be wired as shown below including: **KS-BASE-3T** (standard base) and **KS-BASE-3T-SCI** (standard SCI base).

The remote indicator output is taken from **terminals 1 and 4** (if required).



All remote indicators should be tested at least once per year and should be wired with the same grade of cable as the detection circuits (Enhanced/ Standard). This can be reduced to 1mm^2 to facilitate installation.

KS-REM-IND

Analogue Addressable Remote Indicator

The KS-REM-IND is a loop-powered Addressable Remote Indicator, with high-intensity LEDs and a Fresnel lens design which produces a highly visible signal.

The unit can be used on the Standard ESP Base (KS-BASE-3T), the Base Sounder (KS-BSND), the Base Sounder Beacon (KS-BSNDB2-RL or KS-BSNDB2-WL), or the Short-Circuit Isolator Base (KS-BASE-3T-SCI).

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