

a guide to

Fire Alarm Systems Design

# BS5839

## Part 1:2002

incorporating Amendment No.2

## The Regulatory Reform (Fire Safety) Order (RRO) became law on 1 October 2006

### Legally you must comply!

#### What is the RRO?

Fire authorities no longer issue fire certificates and those previously in force will have no legal status. The Regulatory Reform (Fire Safety) Order (RRO) replaces most fire safety legislation with one new order. It means that any person who has some level of control in premises must take steps to reduce the risk from fire, consider how to contain a fire should one break out and then also make sure people can safely escape if there is a fire.

- **All fire alarm designs should be based on a Fire Risk Assessment**
- **All Fire Risk Assessments should be carried out by a competent person**
- **Fire Risk assessments must be reviewed annually**

#### Where does the order apply?

Virtually all premises and nearly every type of building structure and open space.

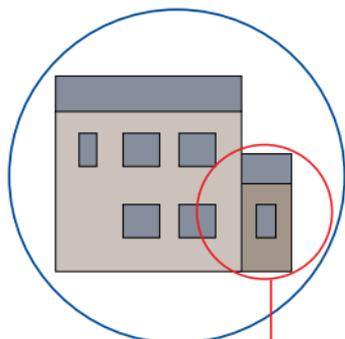
If you would like to find out more about how Apollo products can help you comply with the RRO please contact us on 023 9249 2412 or visit our website on [www.apollo-fire.co.uk](http://www.apollo-fire.co.uk)

#### What constitutes a Fire Risk Assessment?

- Identifying fire hazards such as sources of ignition, fuel or oxygen
- Identifying all people at risk in and around the premises
- Evaluating the risk of a fire starting or the risk to people from a fire
- Removing or reducing fire hazards or risks to people from a fire
- Protecting people by providing fire precautions
- Recording any major findings
- Preparing an emergency plan
- Informing and instructing any relevant people
- Providing training for staff and guests
- Reviewing the fire risk assessment regularly and make changes where necessary
- Keeping accurate fire risk assessment records

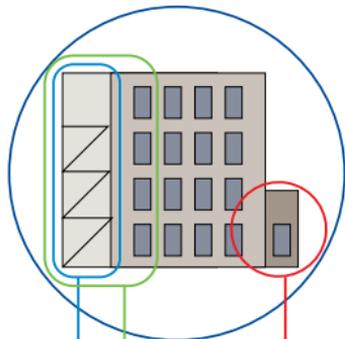
**All fire alarm designs should be based on a Fire Risk Assessment**

This guide is intended to be an aid to designers and installers of fire detection systems. It is not to be used as a substitute for BS5839 which should be read in full. In order to help identify the relevant sections, each diagram includes a reference to BS5839 Part 1.



P1

P2



L4

L3

L1

L2

**Fire Alarm and Detection systems are categorised in the following way:**

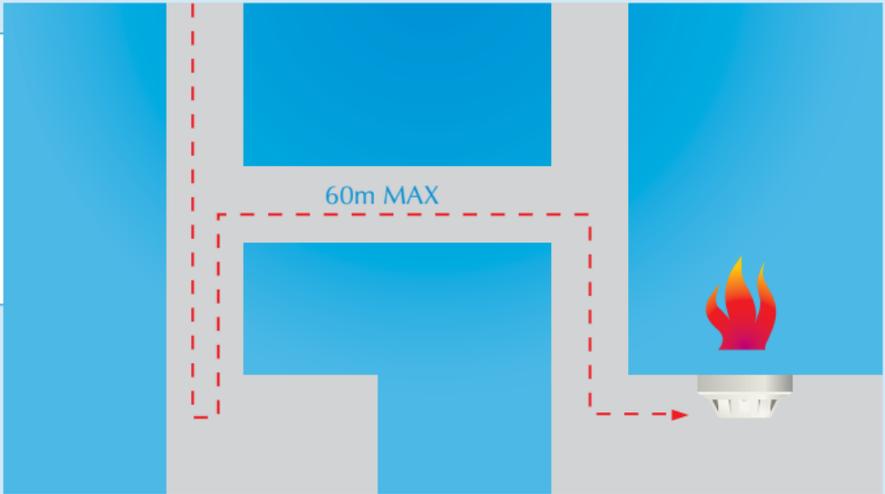
#### **Property Protection Fire Systems**

- P1 AFD installed throughout all areas
- P2 AFD installed only in defined areas

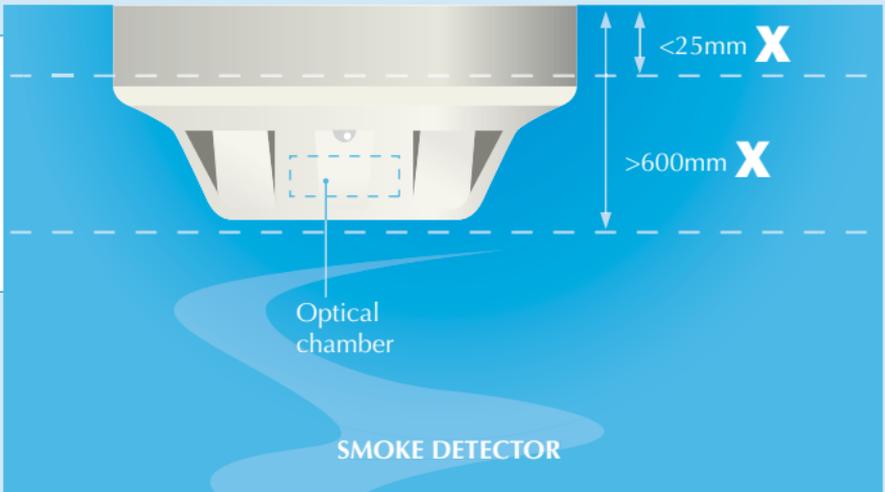
#### **Life Protection Fire Systems**

- L AFD designed to primarily protect Human Life
- L1 AFD installed throughout all areas
- L2 AFD installed in defined areas in addition to L3
- L3 AFD installed in escape routes and rooms opening onto these routes
- L4 AFD installed in escape routes comprising circulation areas and spaces such as corridors and stairways
- L5 A non-prescriptive system in which protected area(s) and/or the location of detectors is designed to satisfy a specific fire risk objective (other than that of L1 to L4)
- M System design to be operated manually (no AFD)

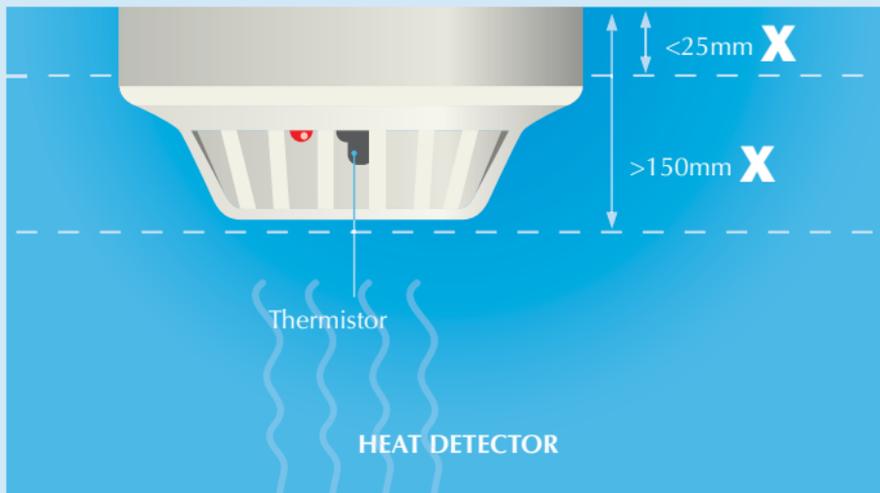
\*AFD Automatic Fire Detection



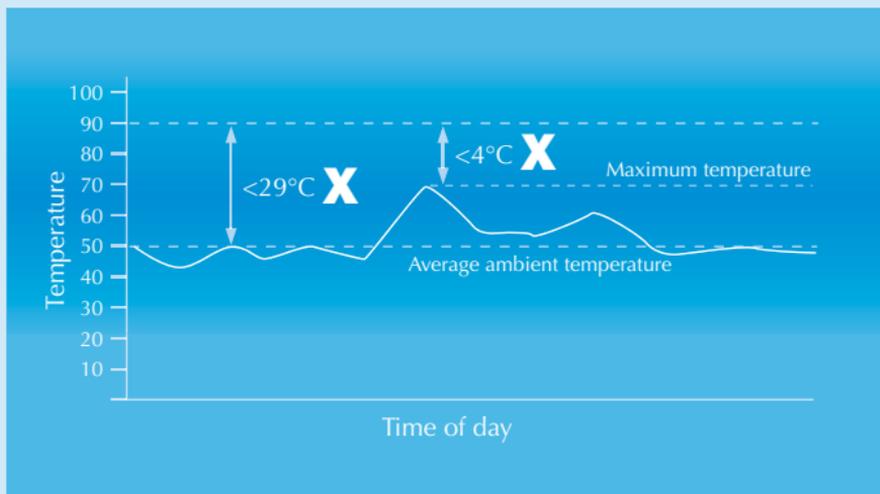
A person searching a zone for a fire in a non-addressable fire system should not have to travel more than 60m to identify the source of a fire.



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

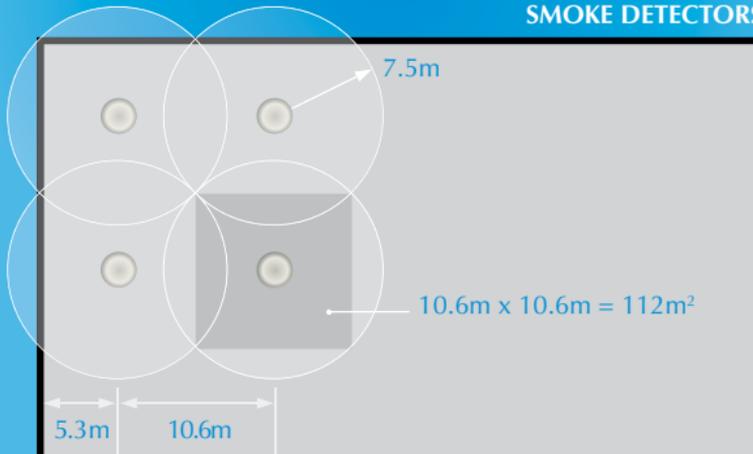


The sensing element of a heat detection device should not be less than 25mm below ceiling, and not greater than 150mm below ceiling.



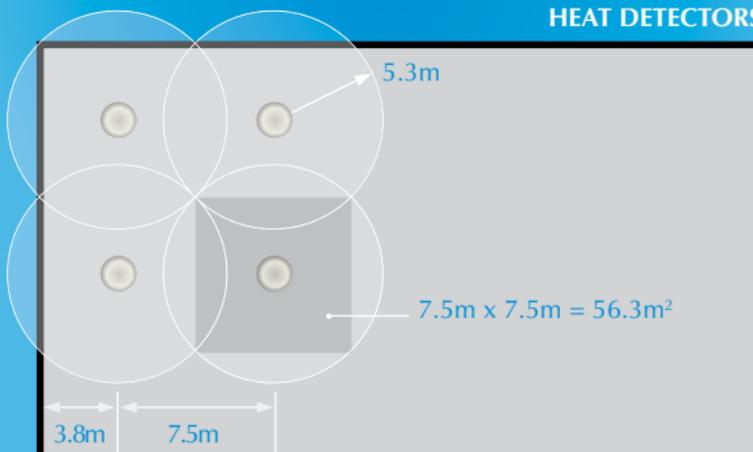
The minimum static response to heat devices should not be less than  $29^{\circ}\text{C}$  above the average ambient temperature, or less than  $4^{\circ}\text{C}$  above the highest temperature the device can expect to experience.

## SMOKE DETECTORS

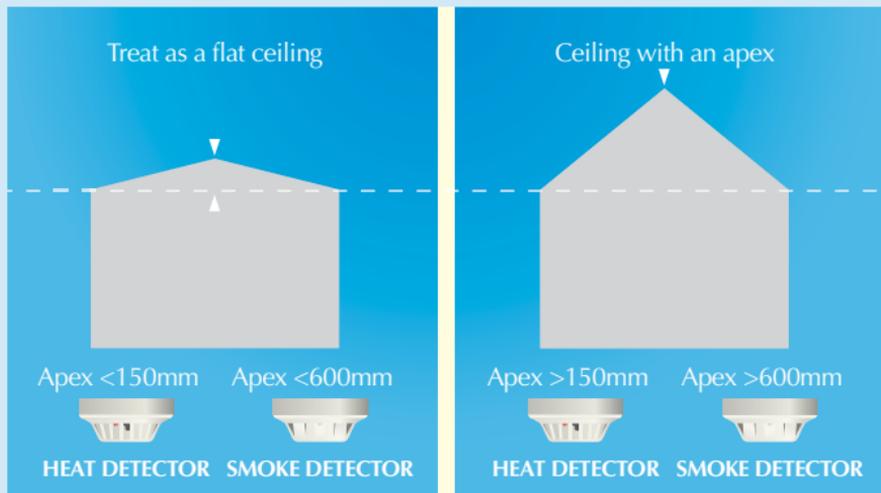


When mounted on a flat ceiling, smoke detection devices have an individual coverage of 7.5m radius. However these radii must overlap to ensure there are no 'blind spots'. Therefore individual coverage can be represented by a square measuring 10.6x10.6m giving an actual area coverage of 112m<sup>2</sup> per device.

## HEAT DETECTORS



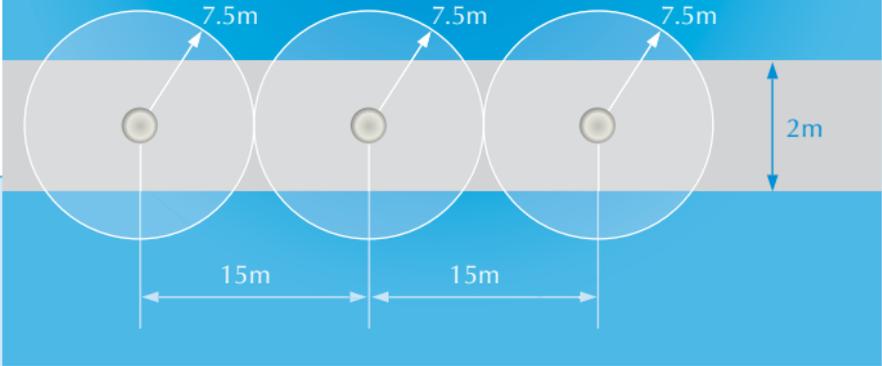
When mounted on a flat ceiling, heat detection devices have an individual coverage of 5.3m radius. However these radii must overlap to ensure there are no 'blind spots'. Therefore individual coverage can be represented by a square measuring 7.5x7.5m giving an actual area coverage of 56.3m<sup>2</sup> per device.



For ceilings that feature an apex: as long as the height of the apex from the rest of the ceiling 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 apices, a device should be installed at the highest point. The distance to adjacent devices can be increased by 1% per degree of angle of the roof up to a maximum of 25%.

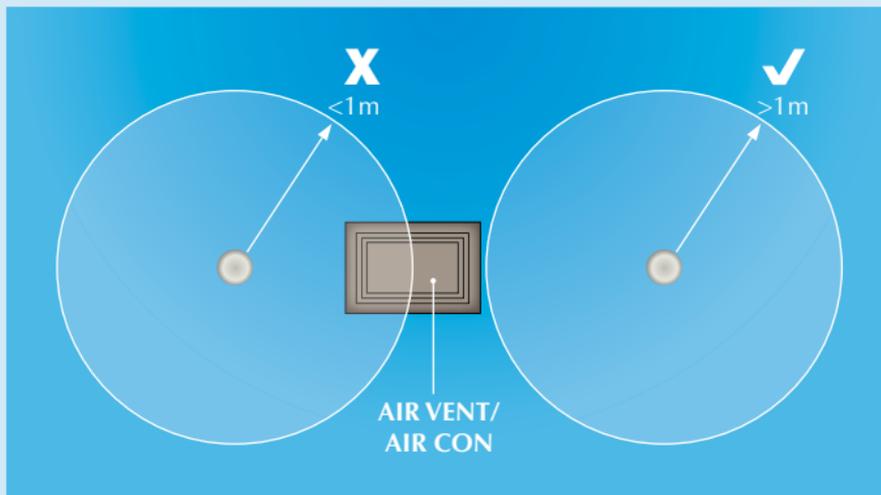
Response	Category L or (P more than 5 mins)		Category P 5 mins or less	
	Max Height			
Detector Type	General Area	10% of Area	General Area	10% of Area
Heat RoR	9m	10.5m	13.5m	15m
Heat Fixed	7.5m	10.5m	12m	15m
Smoke/CO point	10.5m	12.5m	15m	18m
Optical beam	25m	25m	40m	40m
ASD normal	10.5m	12.5m	15m	18m
ASD enhanced	12m	14m	17m	21m
ASD very high	15m	18m	21m	26m

## SMOKE DETECTORS

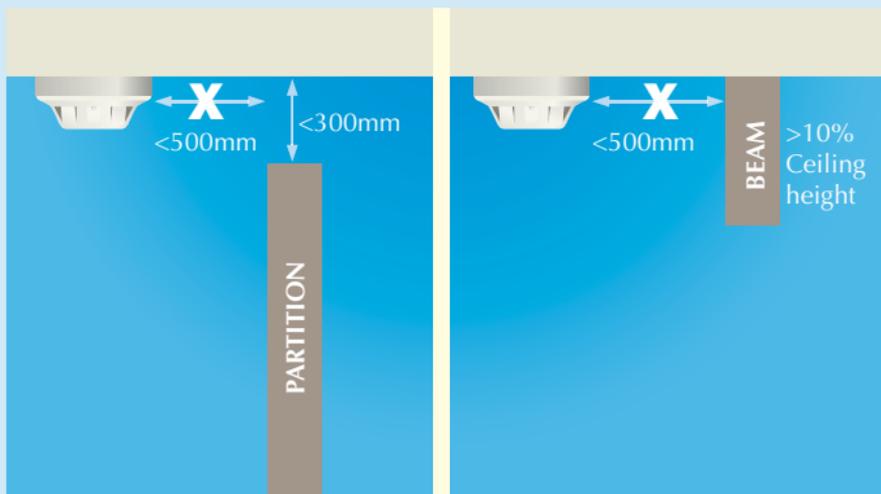


In corridors less than 2m wide the horizontal spacing of detectors may be increased, the areas of coverage need not overlap as in the case of a room. Any corridor over 2m wide is deemed a room and device spacing should follow the standard for rooms (see page 6).

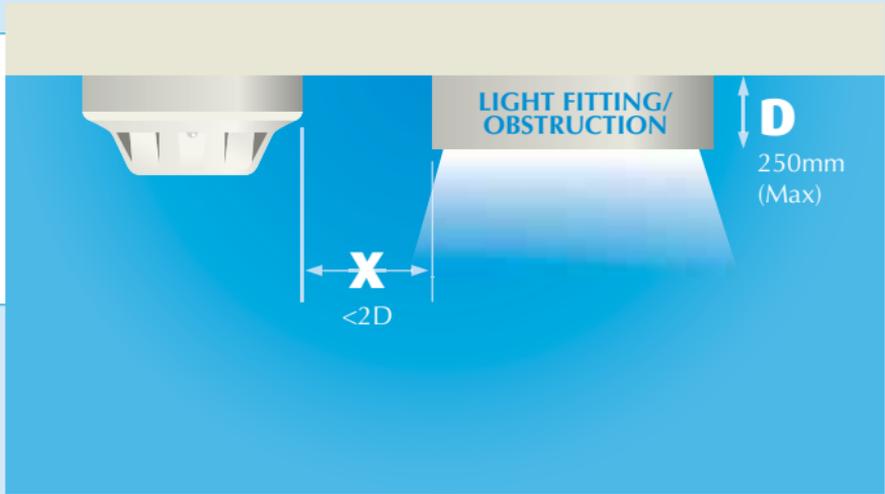
Please note, heat detectors are not recommended for use in corridors that are escape routes.



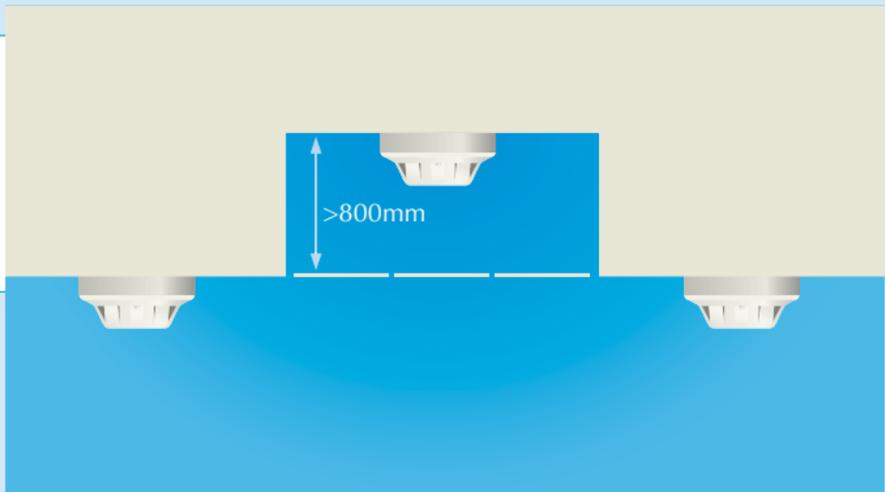
Do not site detectors less than 1m from air inlets or air circulating units.



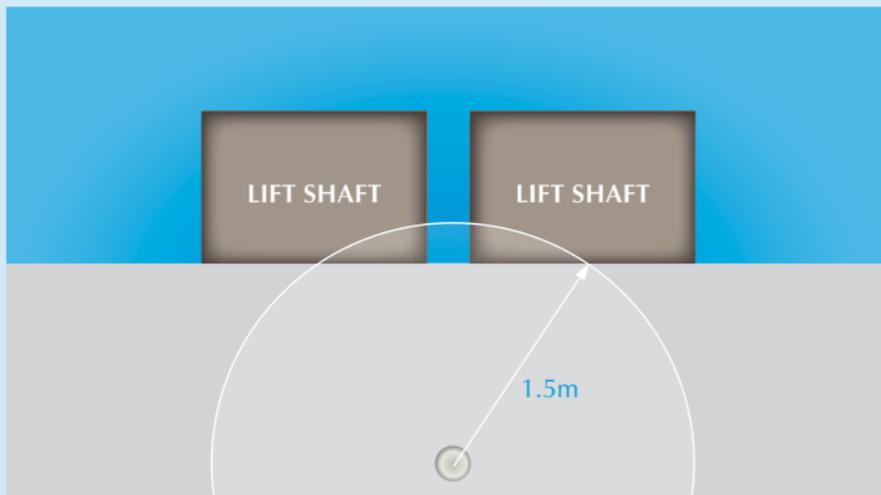
A device should not be mounted within 500mm of any obstruction. If the top of a solid partition is less than 300mm from ceiling then treat it as a wall. Similarly, ceiling obstructions such as beams should be treated as walls if deeper than 10% of the ceiling height



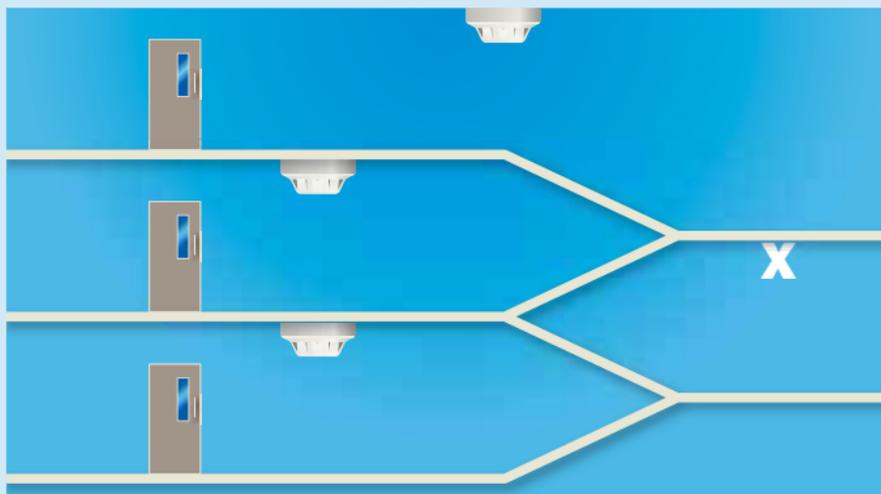
Never mount devices closer than twice the depth of light fittings or other obstructions on the ceiling.



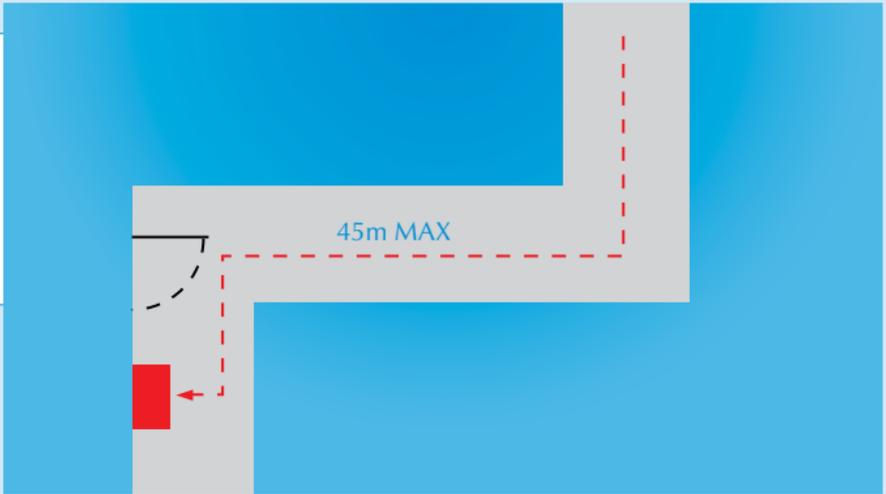
Voids less than 800mm in height need not have independent coverage, unless fire or smoke is able to spread from one area to another through the void or risk assessment shows AFD (Automatic Fire Detection) to be necessary.



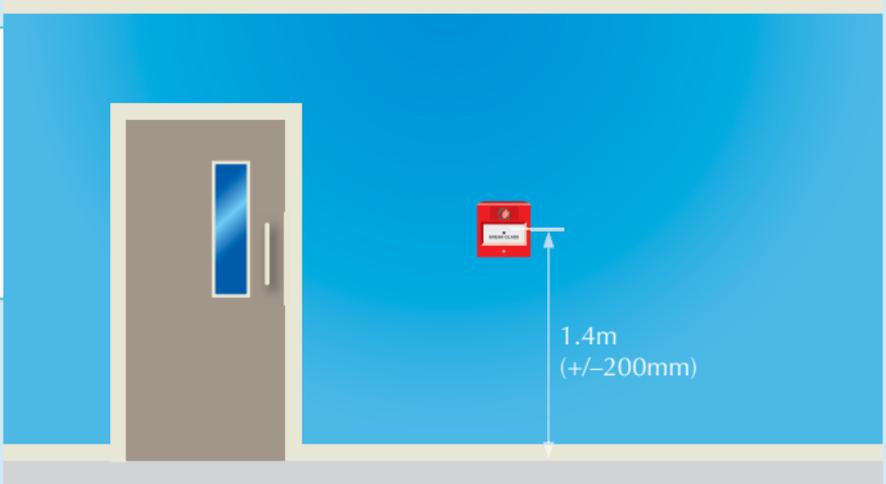
Vertical shafts like lifts and stairways should have a device mounted within 1.5m of any opening.



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



A person should not have to travel more than 45m along an escape route to reach a Manual Call Point (25m if disabled person to operate, or rapid fire development is likely). Manual Call Points should be sited at all stair wells and exits from the building.



The centre of the frangible element of the manual call point should be positioned 1.4m (+/-200mm) from floor level. (Unless a wheelchair user is likely to be the first person to raise the alarm).

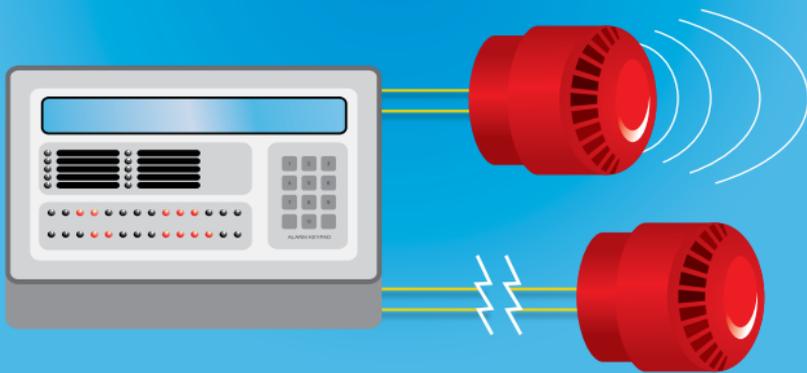


65dB(A)  
@ 500Hz to 1,000Hz



+5dB(A)  
@ 500Hz to 1,000Hz

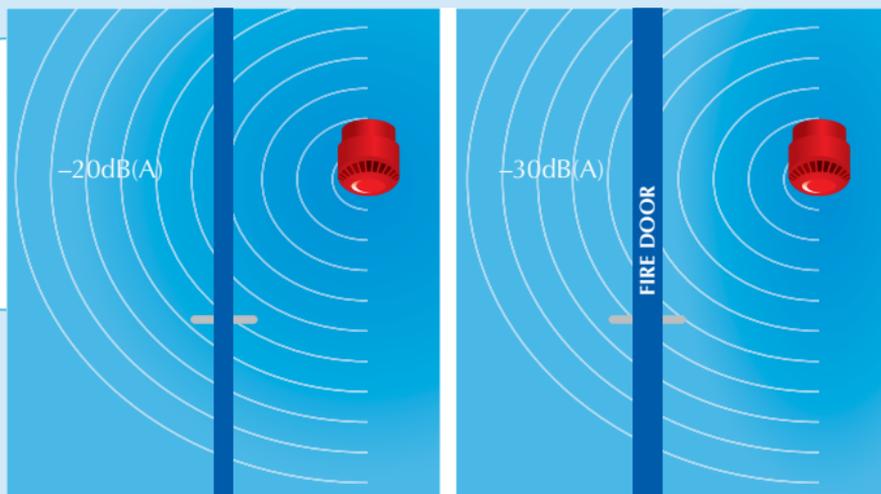
The minimum sound level should be 65dB(A) or 5dB(A) above a background noise which is louder than 60dB(A) (if lasting more than 30 seconds) and at a frequency of between 500Hz and 1000Hz. The maximum sound level should not be greater than 120dB(A) at any normally accessible point. May be reduced to 60dB(A) in stairways, enclosures up to 60m<sup>2</sup> and specific points of limited extent.



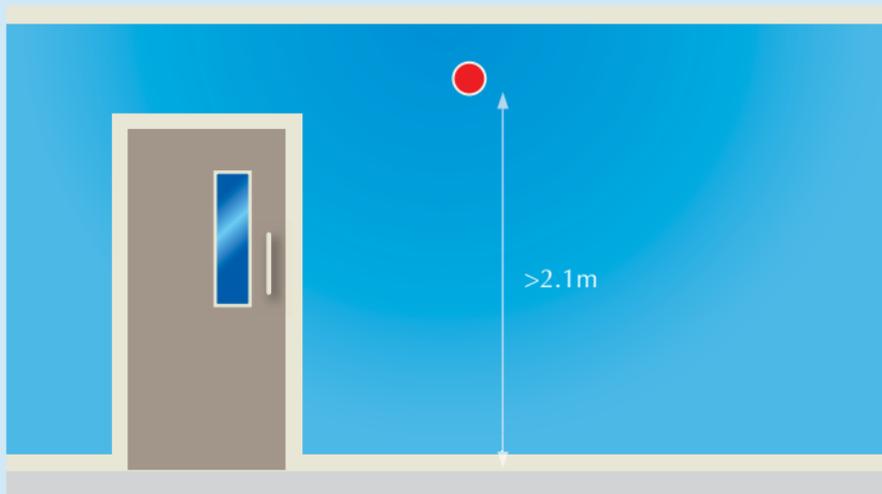
Sounder device cabling should be arranged so that in the event of a fault at least one sounder will remain operational during a fire condition.



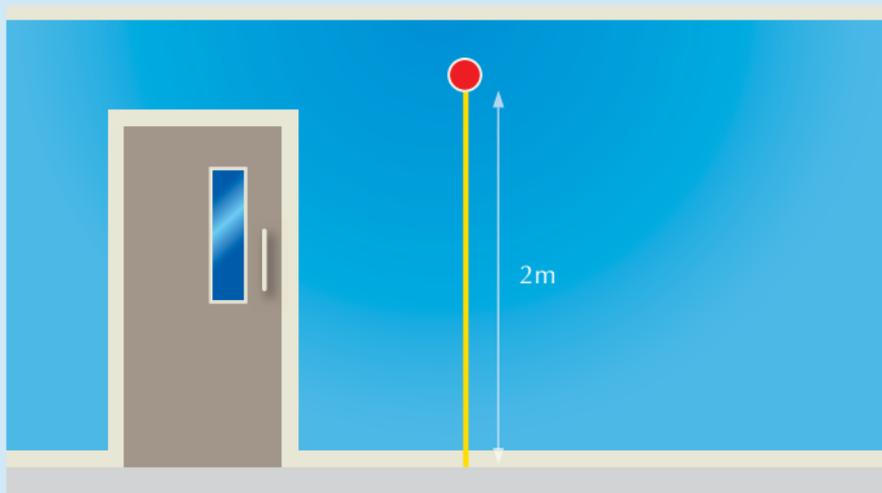
For areas where people are sleeping, sounder devices should produce a minimum 75dB(A) at the bed-head with all doors shut. In buildings providing sleeping accommodation for a significant number of people, all bedrooms should have both audible and visual alarms.



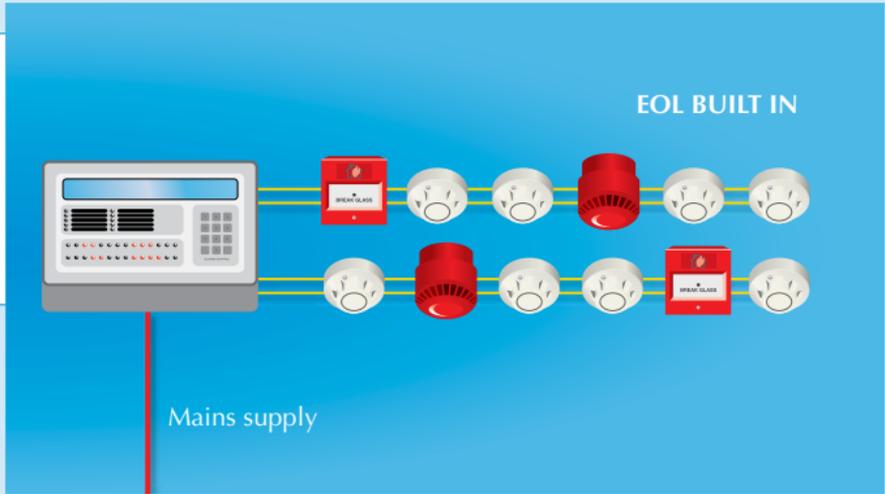
Decibel loss occurs through doors: approximately  $-20\text{dB(A)}$  through a normal door, and approximately  $-30\text{dB(A)}$  through a fire door. **Unless a sounder is installed in a bedroom, it is unlikely that 75dB(A) will be achieved.**



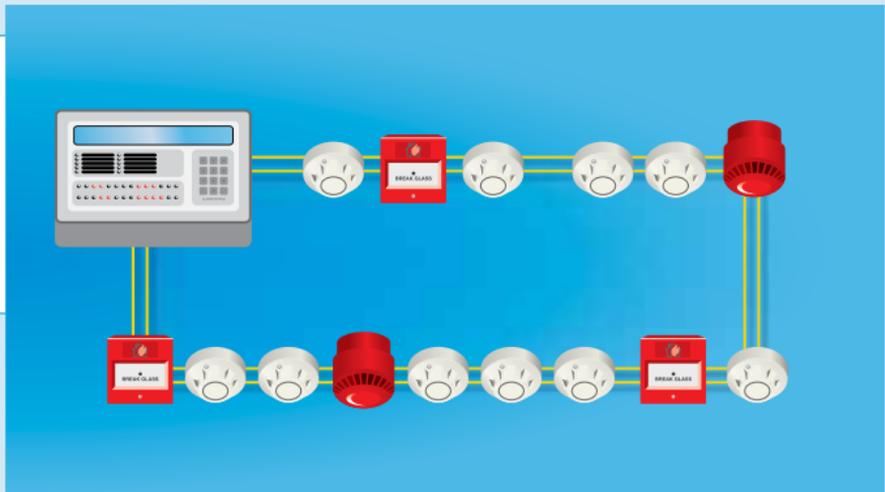
Visual alarms such as beacons should always be mounted at a minimum height of 2.1m from floor level.



Unless MICC cable is used, all cabling should be mechanically protected from floor level up to a height of 2m. In relatively benign areas, such as shops, offices and similar, cabling can be clipped to robust walls etc.



Fire resistant cabling is now required within the whole fire alarm system including the mains supply cables. The use of non-fire resisting cables whether mechanically protected by fire-resisting construction or not, will no longer comply with BS5839 Part 1.



Short circuit isolators limit the effect of one fault to 2000m<sup>2</sup>. '2 simultaneous faults on a circuit should not disable protection within an area greater than 10,000m<sup>2</sup>'.

## Installation Considerations and Key Points

- All mains supply isolators must be double pole and suitably marked. (25.2c&f)
- All cables to be fire resisting with a minimum cross-sectional area of 1mm<sup>2</sup>. (26.2j)
- All joints to be fire resisting, junction boxes to be labelled 'FIRE ALARM'. (26.2)
- Enhanced cable to be used where more than 4 zones of phased evacuation required, or in multi storey systems. (un-sprinklered over 30m) or risk assessment requires enhanced cable. (26.2)
- Cable using trunking as a means of containment must be clipped using fire resistant supports WITHIN THE TRUNKING. (26.2)
- Fire Alarm control panel(s) are installed at a location appropriate for staff and fire-fighters. (23.2)
- Call points are required at all exits to the open air - whether or not the exits are specifically designed to be fire exits. (20.2c)
- CO fire detectors should be spaced as per smoke detectors, but cannot be used without smoke detectors on escape routes. (28.1.8)
- Multi sensors, if used as combined type/space as smoke detectors, if used as individual types ie heat in the day & smoke at night then space as per heat detectors. (26.1.6)
- Linear heat detection cable space as heat detectors. (22.3)
- Unusual ceilings: Cellular ceiling, perforated ceilings or ceilings with closely spaced beams have special spacing & installation requirements, refer to section. (22.3 & tables 1 & 2)
- Bells & Electronic sounders cannot be mixed (16.2.1c)
- Sound levels can be reduced to 60dB(A) in stairs, small cellular offices or enclosures of no more than APPROXIMATELY 60 sq m Bedhead levels remains 75dB(A). (16.2.1)
- If the ambient background noise level is over 90dB visual alarms (beacons) are required. (17.2a)
- Disabled toilets should be fitted with sounders and beacons. (18.1)
- A minimum of one sounder is required in each fire compartment. (16.2.1i)
- Full documentation required, test results as fitted drawings etc. (Section 40)
- An installation certificate will be required. (41.2)

## ✓ Installation and Handover Checklist

<input type="checkbox"/>	1	The system complies with the original specification / design
<input type="checkbox"/>	2	Any changes to original specification/design have been referred to the system designer for approval
<input type="checkbox"/>	3	System has been installed to meet requirements of category L1, L2, L3, L4, L5, P1, P2, M, other
<input type="checkbox"/>	4	Variations to the defined category have been identified and the schedule of variations agreed with the client
<input type="checkbox"/>	5	Cables meet requirements for standard/enhanced/mixed
<input type="checkbox"/>	6	Cables are segregated as required and suitably supported (no plastic clips, cable ties or trunking used as sole means of support)
<input type="checkbox"/>	7	Cables are mechanically protected as required.
<input type="checkbox"/>	8	Junction boxes are correctly labelled and identified on drawings. Connector blocks are fire resistant.
<input type="checkbox"/>	9	All cable insulation and continuity resistance measurements are logged
<input type="checkbox"/>	10	All cable penetrations are sleeved and fire stopped
<input type="checkbox"/>	11	Mains supply is dedicated, non-switched, correctly fused and labelled
<input type="checkbox"/>	12	Mains supply is correctly identified at all distribution boards
<input type="checkbox"/>	13	Standby battery verification has been carried out for all power supplies
<input type="checkbox"/>	14	All batteries are clearly marked and labelled with date of installation
<input type="checkbox"/>	15	Field wiring is labelled and correctly terminated in all control and ancillary equipment
<input type="checkbox"/>	16	Isolators are fitted as appropriate, operate correctly and are marked on drawings
<input type="checkbox"/>	17	There are a minimum of two sounder circuits installed
<input type="checkbox"/>	18	Sound pressure levels have been checked and recorded and meet the minimum requirements.
<input type="checkbox"/>	19	Detector type and spacing is appropriate to the system category
<input type="checkbox"/>	20	MCPs are located correctly and travel distance is appropriate to the system category
<input type="checkbox"/>	21	Remote signalling has been checked for correct operation to Alarm Receiving Centre
<input type="checkbox"/>	22	Zone charts have been fitted in all appropriate locations (adjacent to control equipment and repeaters)
<input type="checkbox"/>	23	As fitted drawings are complete and have been updated where required, including cable size and routing
<input type="checkbox"/>	24	Log book and operating instructions have been issued to the responsible person
<input type="checkbox"/>	25	The responsible person has been adequately trained in the use of the fire alarm system



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By Appointment to  
Her Majesty The Queen  
Manufacturers of Fire Detection  
& Alarm Products  
Apollo Fire Detectors Limited  
Hampshire

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The logo features the word 'apollo' in a bold, red, lowercase sans-serif font. Above the 'o' is a stylized sunburst icon with a red circle at its center and several white lines radiating outwards. Below the word 'apollo' is the tagline 'WORLD CLASS FIRE SOLUTIONS' in a smaller, black, uppercase sans-serif font.