a guide to

Fire Alarm Systems Design

BS5839 Part1:2013

apollo

WORLD CLASS FIRE SOLUTIONS

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

Legally you must comply!

What is the FSO?

Fire authorities no longer issue fire certificates and those previously in force now have no legal status. The Regulatory Reform (Fire Safety) Order (FSO) replaced most fire safety legislation with one new Order. It means that any person who has some level of control in premises (normally the employer) 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 an assessment of the risk**
- **All Fire Risk Assessments should be carried out by a competent person**
- **Fire Risk assessments must be reviewed regularly**

What constitutes a Fire Risk Assessment and its outcome?

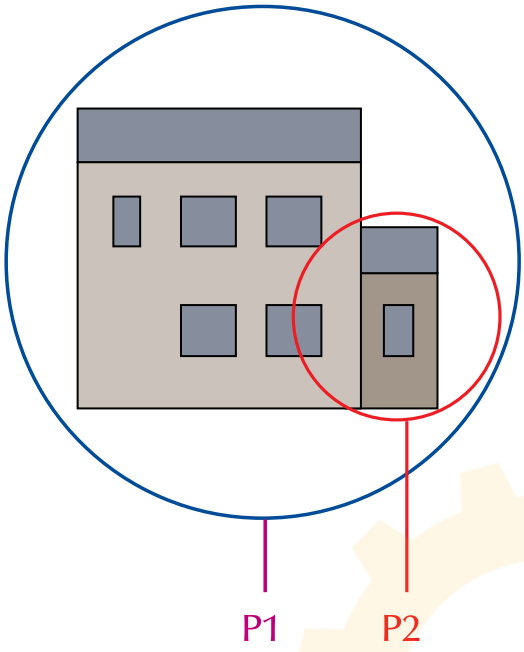
- Identifying fire hazards such as sources of ignition, fuel or oxygen
- Identifying all people at risk in and around the premises
- Evaluating the risk of a fire starting and the risk to people from a fire
- Removing or reducing fire hazards or risks to people from a fire
- Protecting people by providing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

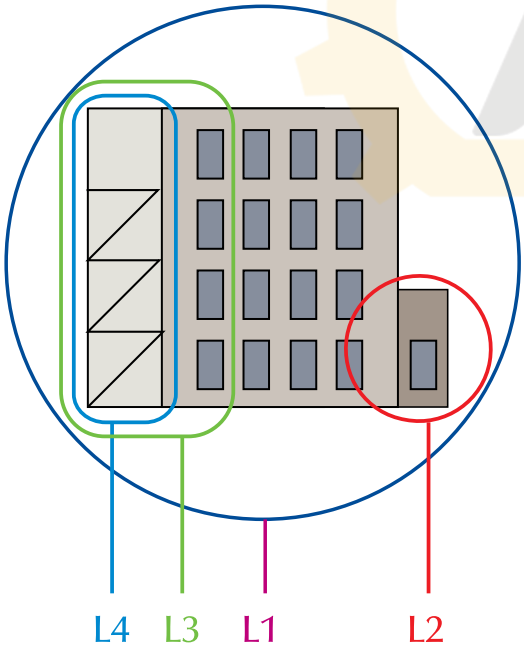
Where does the Order apply?

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

If you would like to find out more about how Apollo products can help you comply with the FSO please contact us on 023 9249 2412 or visit our website on **www.apollo-fire.co.uk**

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.





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

Property Protection Fire Systems

P AFD designed primarily to protect property

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 or areas opening onto these routes

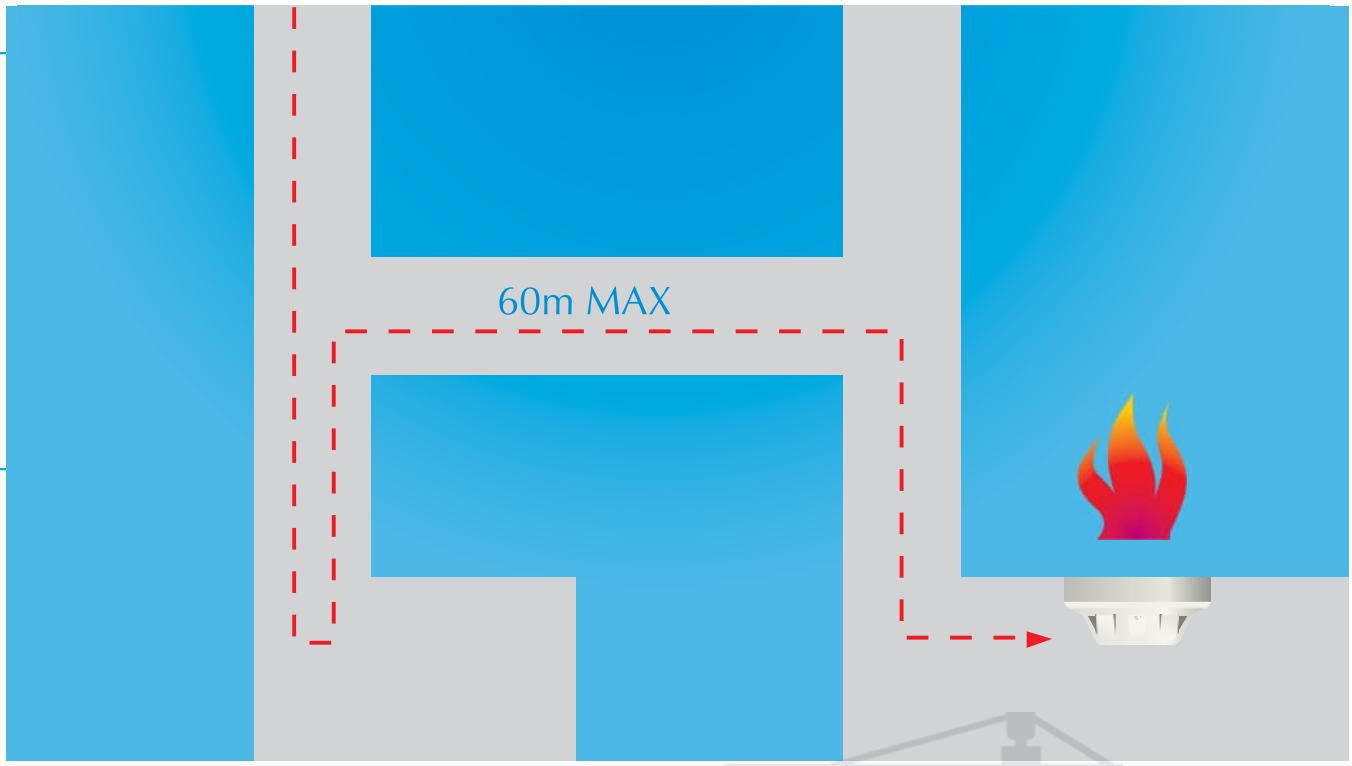
L4 AFD installed in escape routes comprising circulation areas and spaces such as corridors and stairways

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)

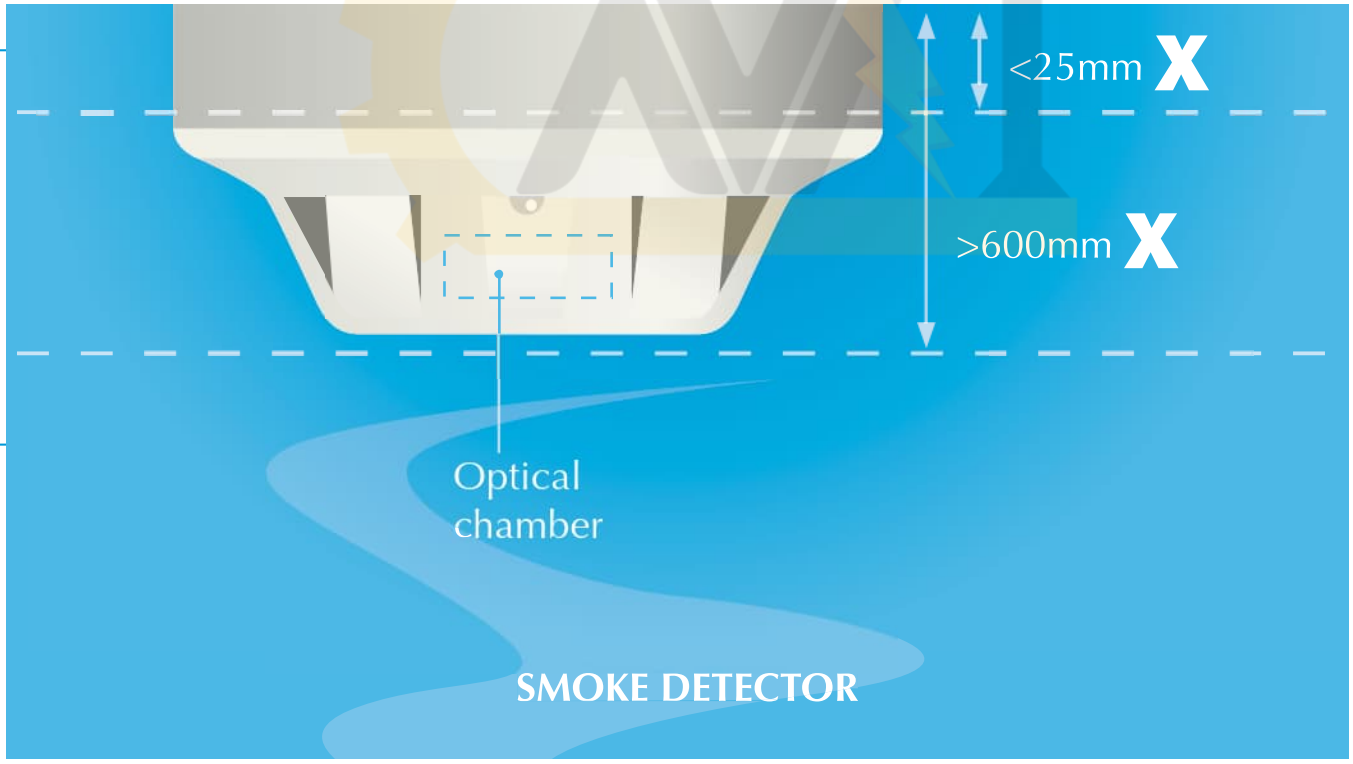
*AFD Automatic Fire Detection

Section 2 Clause 13.2.3

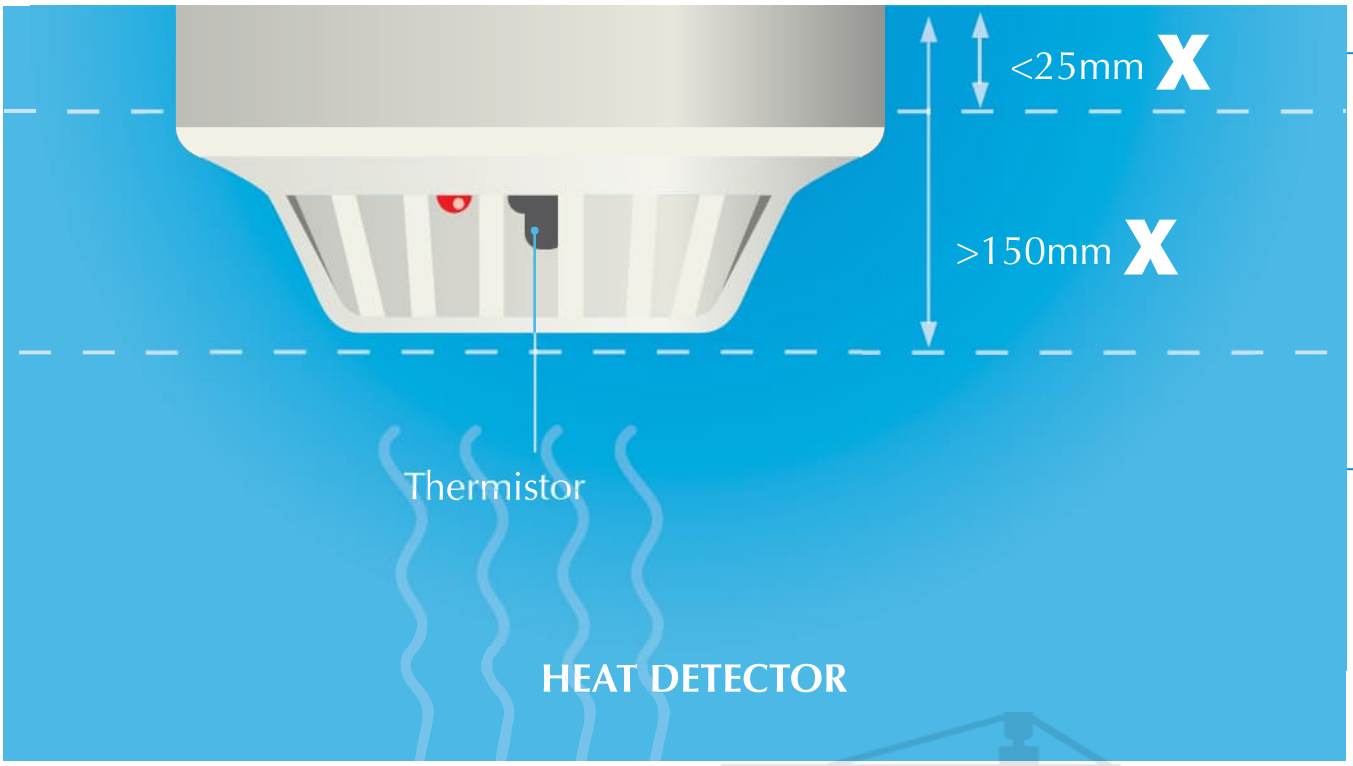


A person searching a zone for a fire in a non-addressable fire system should not have to travel more than 60m to identify the source of a fire.

Section 2 Clause 22.3

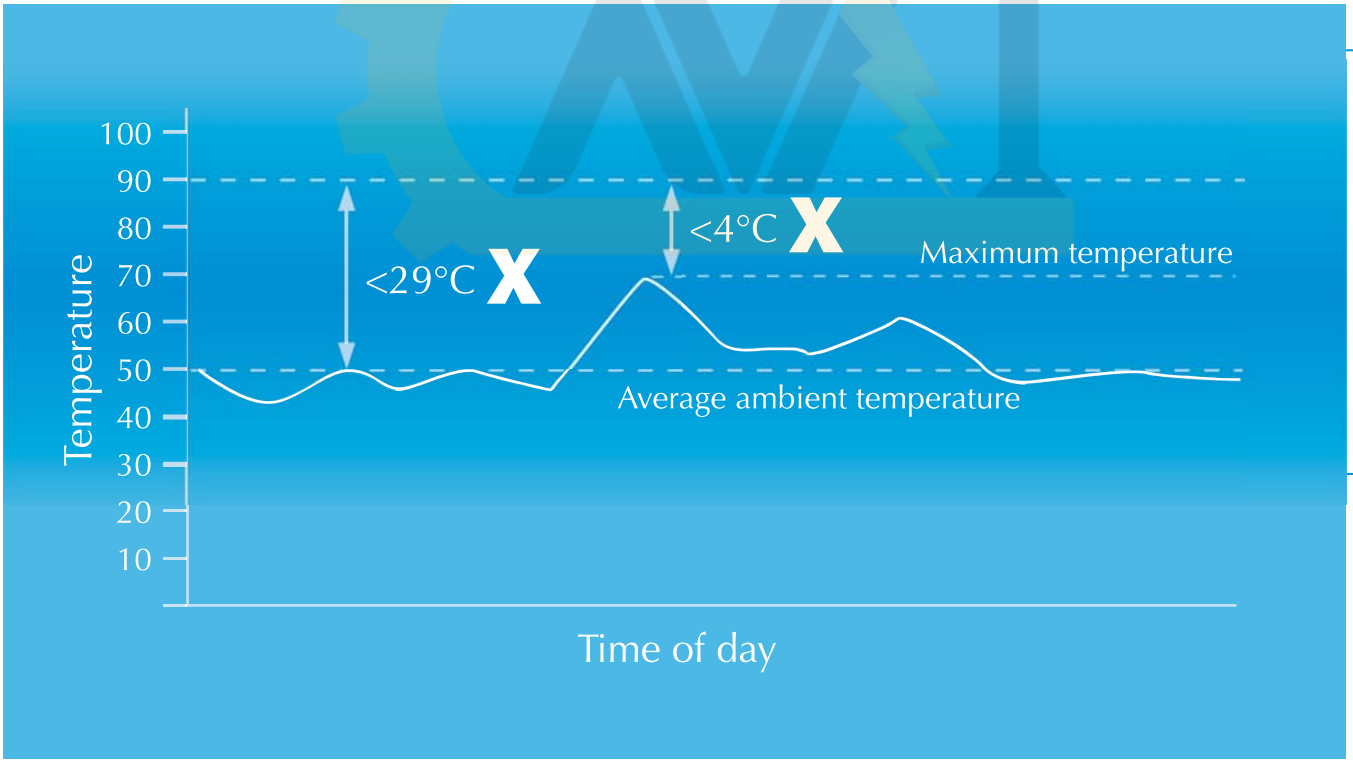


The sensing element of a smoke detection device (optical smoke or ionisation chamber) should not be less than 25mm below ceiling, and not greater than 600mm below ceiling.



Section 2 Clause 22.3

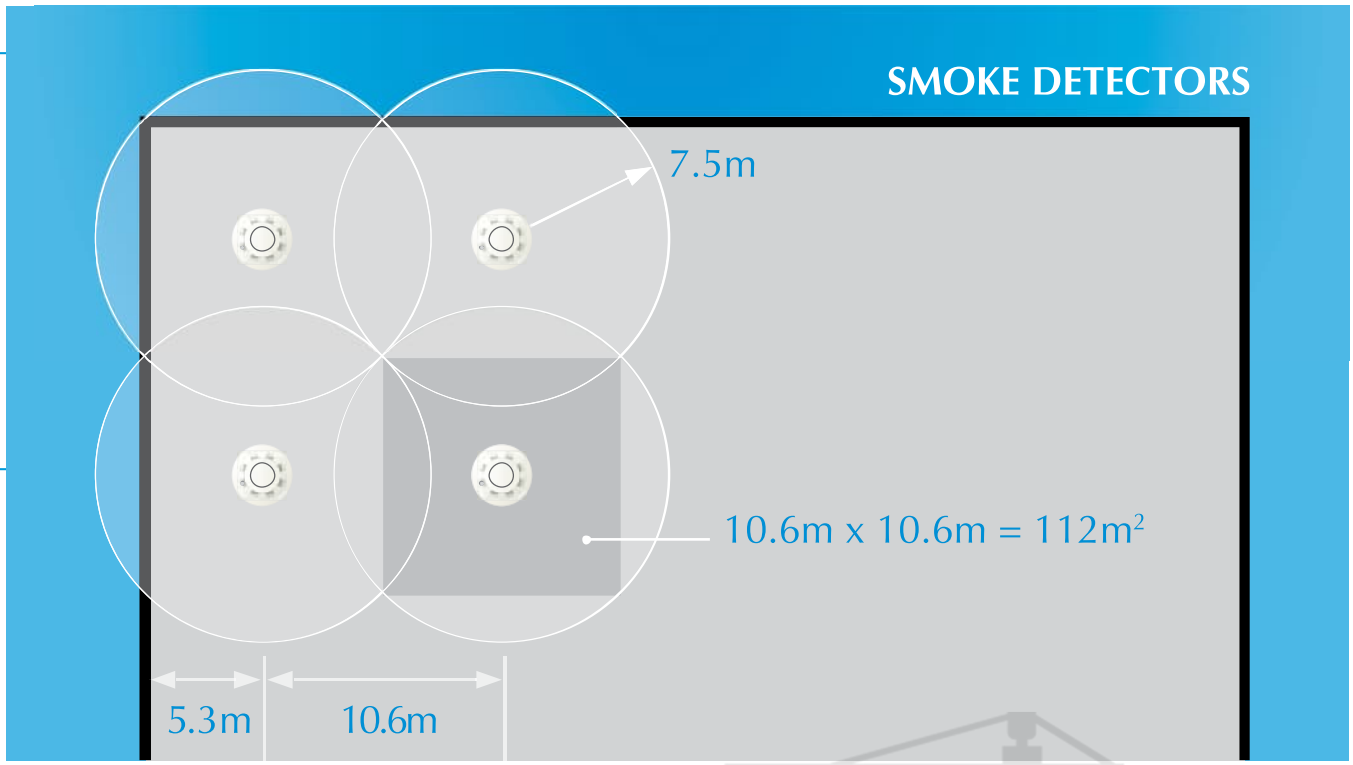
The sensing element of a heat detection device should not be less than 25mm below ceiling, and not greater than 150mm below ceiling.



Section 3 Clause 35.2.3

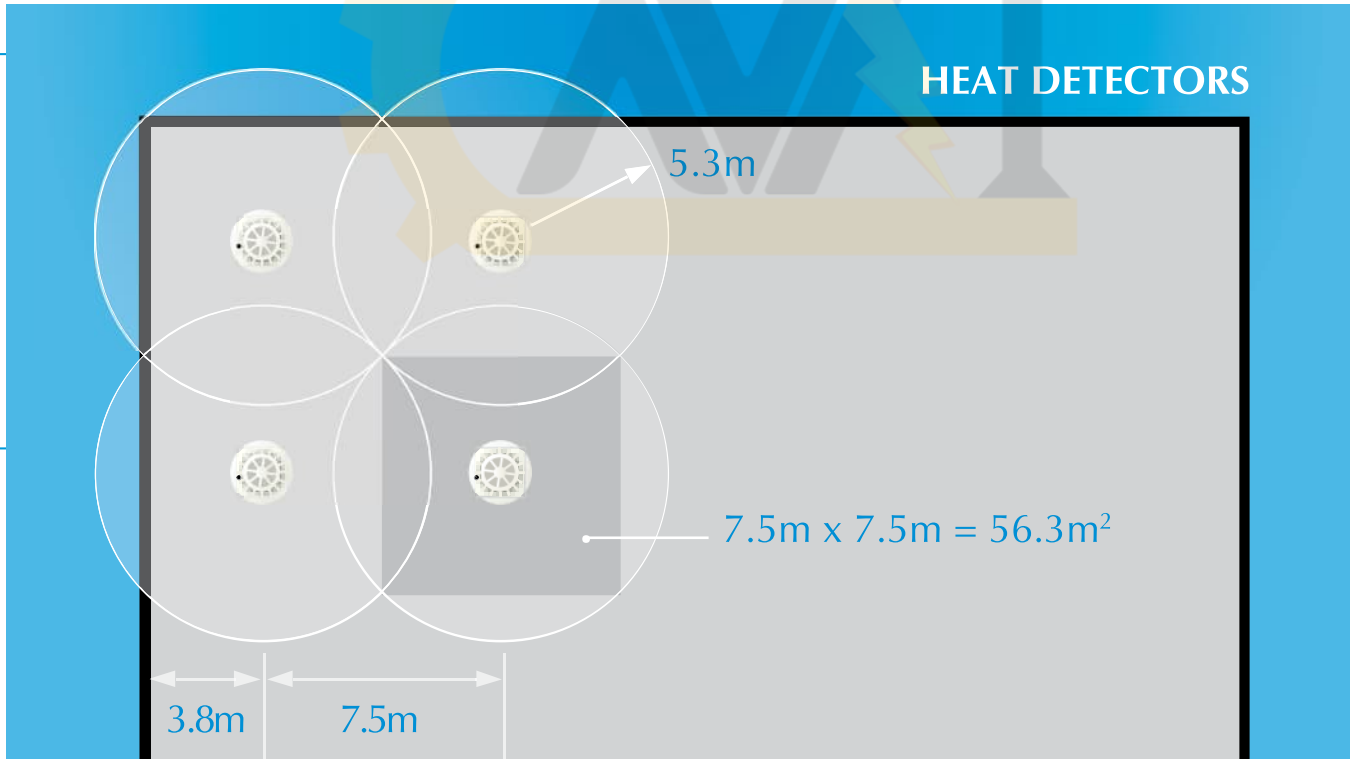
The minimum static response to heat devices should not be less than 29°C above the average ambient temperature, or less than 4°C above the highest temperature the device can expect to experience.

Section 2 Clause 22.3

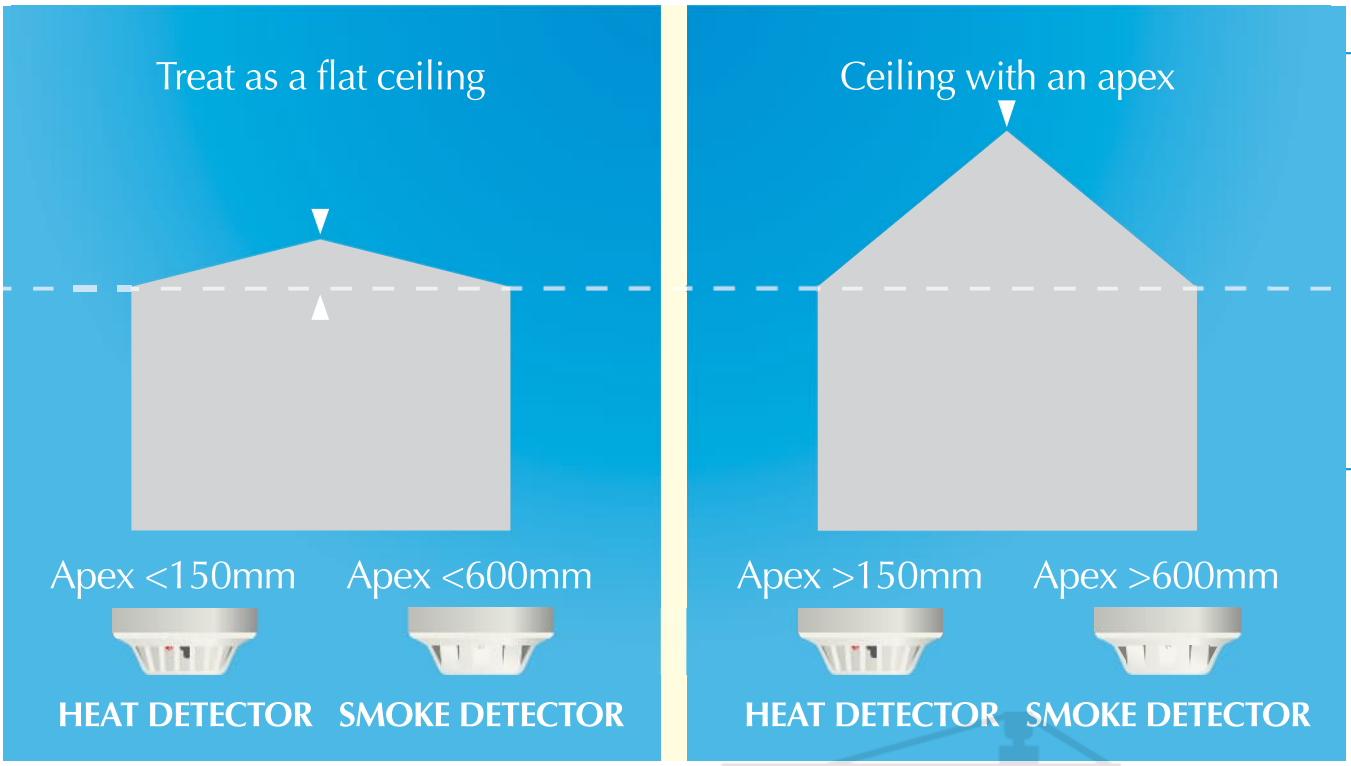


When mounted on a flat ceiling, smoke detection devices have an individual coverage of 7.5m radius. However these radii must overlap to ensure there are no 'blind spots'. Therefore individual coverage can be represented by a square measuring 10.6x10.6m giving an actual area coverage of 112m² per device.

Section 2 Clause 22.3



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 56.3m² per device.

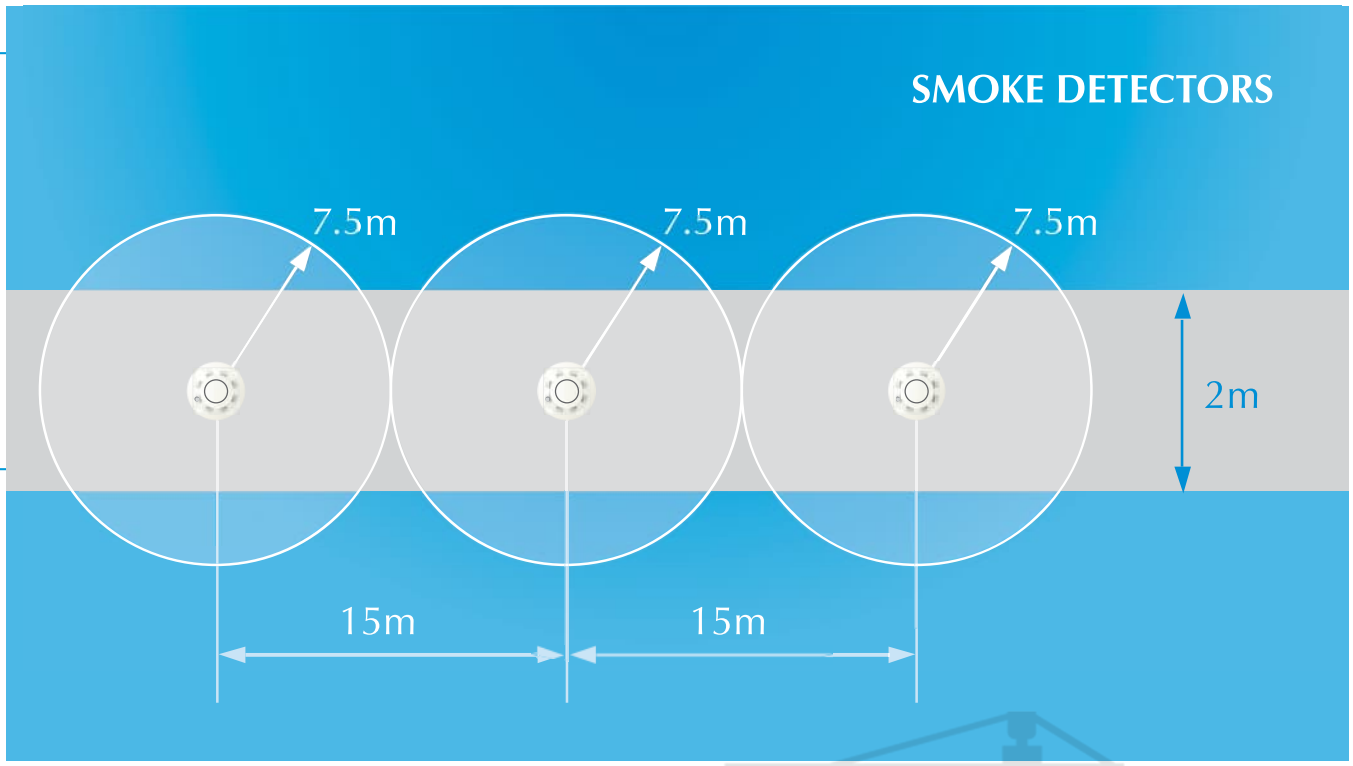


For ceilings that feature an apex: as long as the height of the apex from the rest of the ceiling is less than 150mm for heat detectors or less than 600mm for smoke detectors, then these can be treated the same as flat ceilings. For higher apexes, a device should be installed at the highest point. The distance to adjacent devices can be increased by 1% per degree of angle of the roof up to a maximum of 25%.

Response	All categories of system	
Max Height		
Detector Type	**General Area**	**10% of Area**
Heat RoR	9m	10.5m
Heat Fixed	7.5m	10.5m
Smoke/CO point	10.5m	12.5m
Optical Beam Normal Sensitivity	25m	28m
Optical Beam enhanced Sensitivity	40m*	43m*
ASD normal	10.5m	12.5m
ASD Class C with 5 holes	15m	18m
ASD Class C with 15 holes	25m	28m
ASD Class B with 15 holes	40m	43m

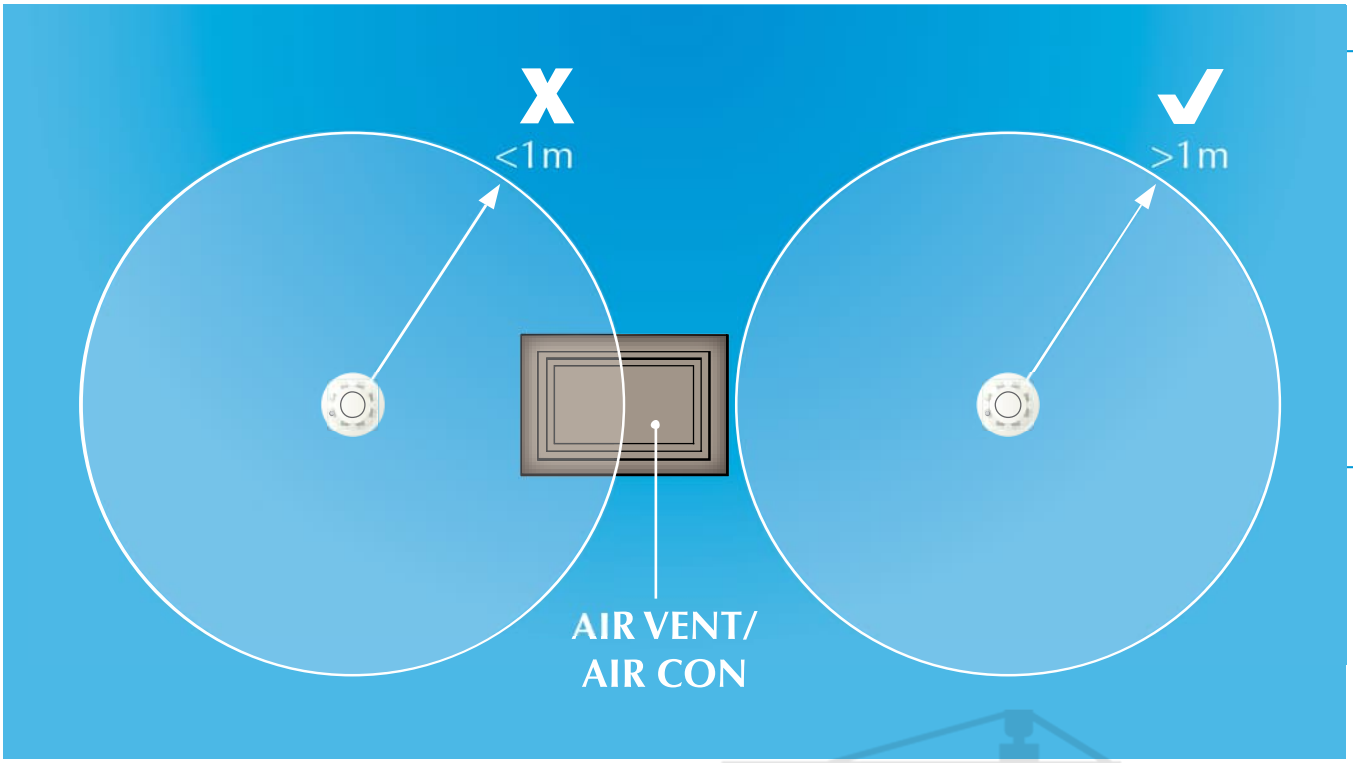
*Supplemented detection recommended unless risk of stratification is minimal.

Section 2 Clause 22.3



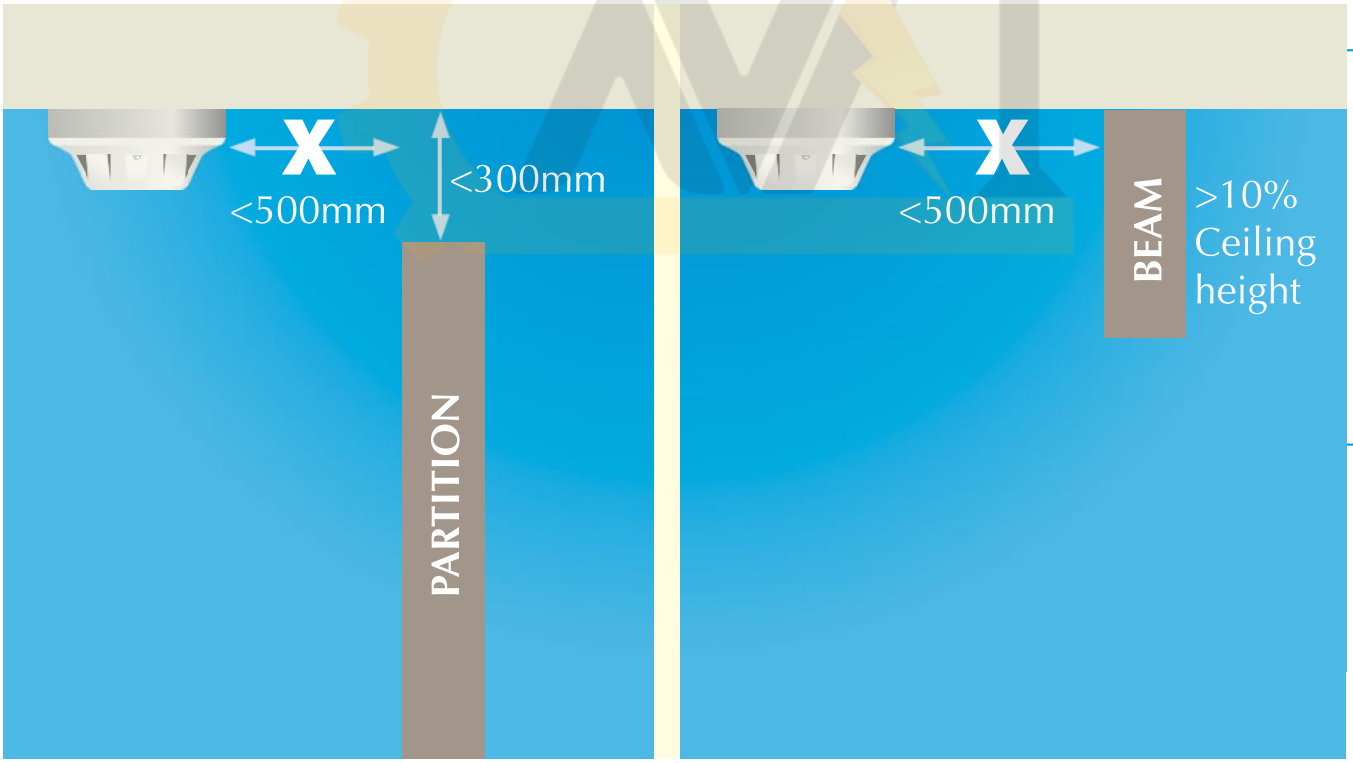
In corridors less than 2m wide the horizontal spacing of detectors may be increased, the areas of coverage need not overlap as in the case of a room. Any corridor over 2m wide is deemed a room and device spacing should follow the standard for rooms (see page 6).

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



Section 2 clause 22.3

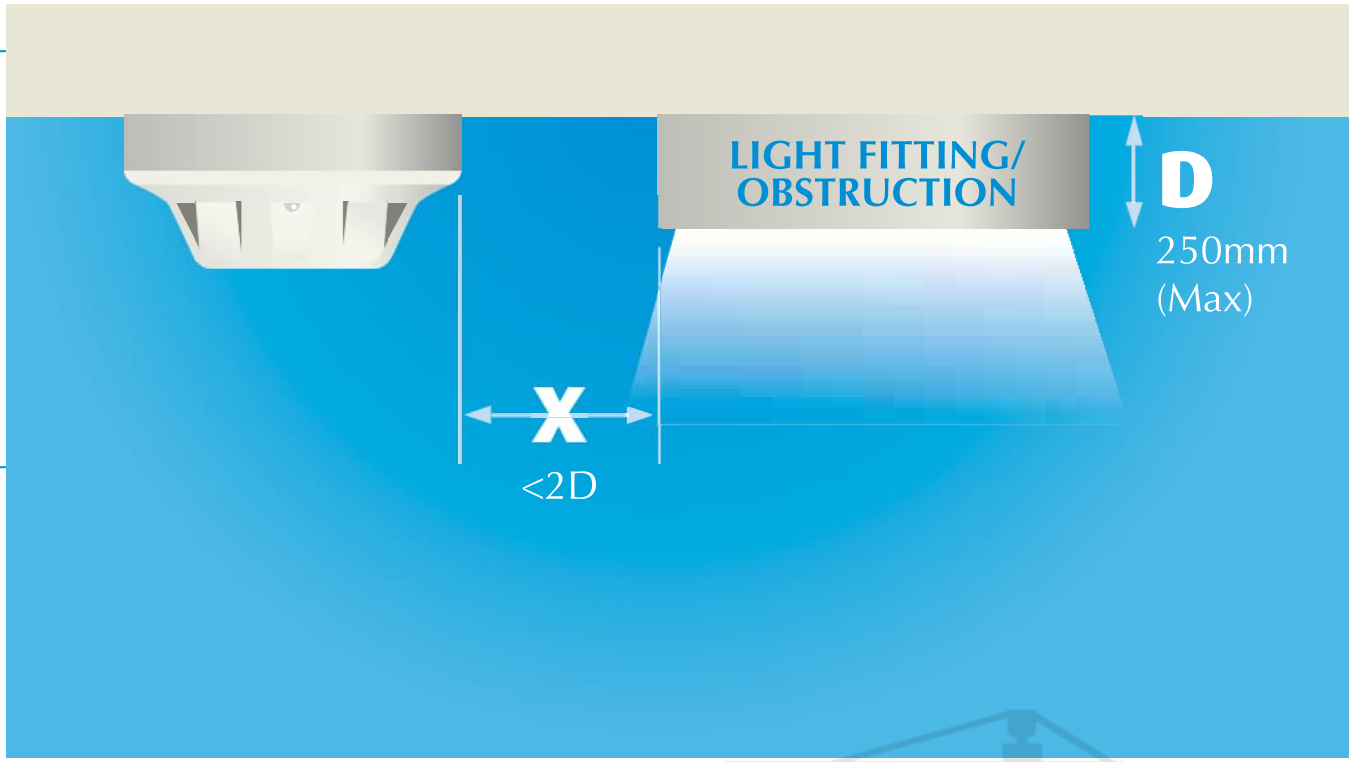
Do not site detectors less than 1m from air supply points or air circulating units.



Section 2 Clause 22.3

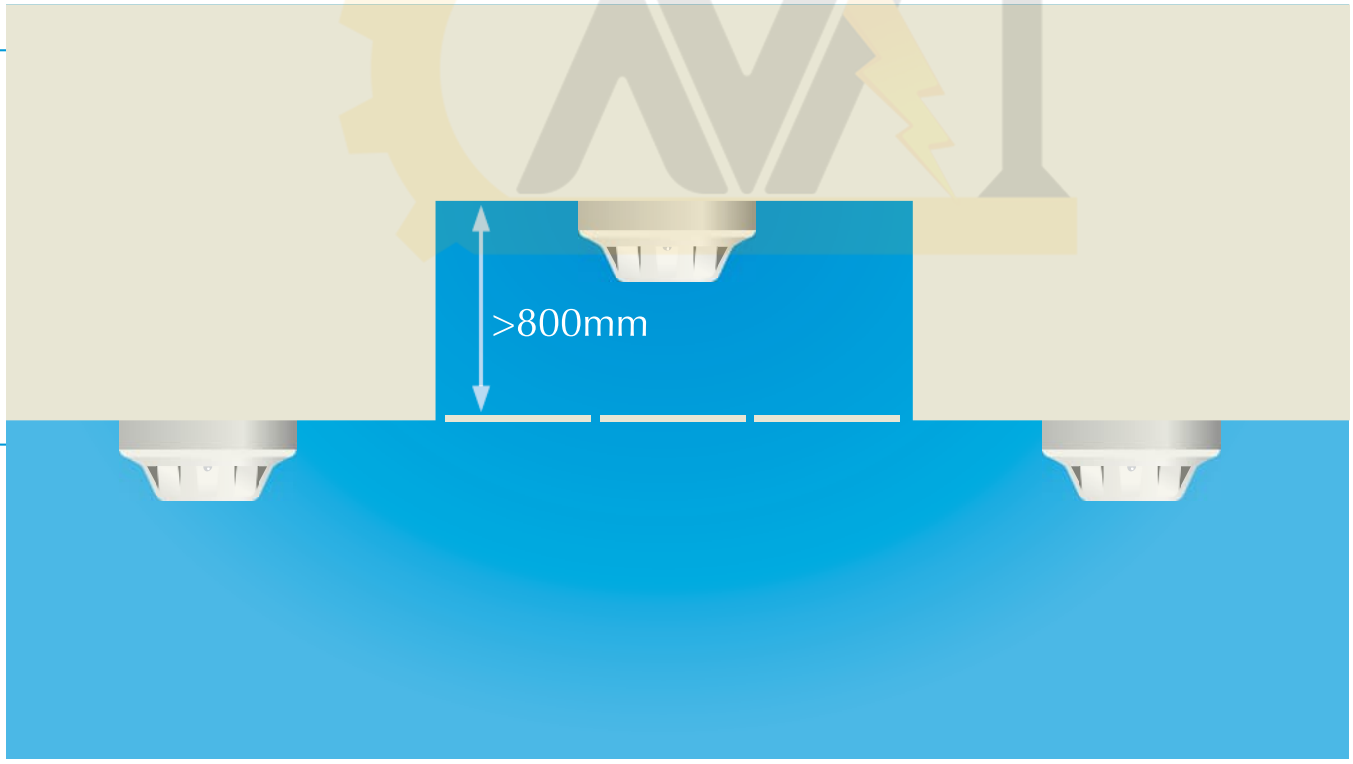
A device should not be mounted within 500mm of any obstruction. If the top of a solid partition is less than 300mm from ceiling then treat it as a wall. Similarly, ceiling obstructions such as beams should be treated as walls if deeper than 10% of the ceiling height

Section 2 Clause 22.3

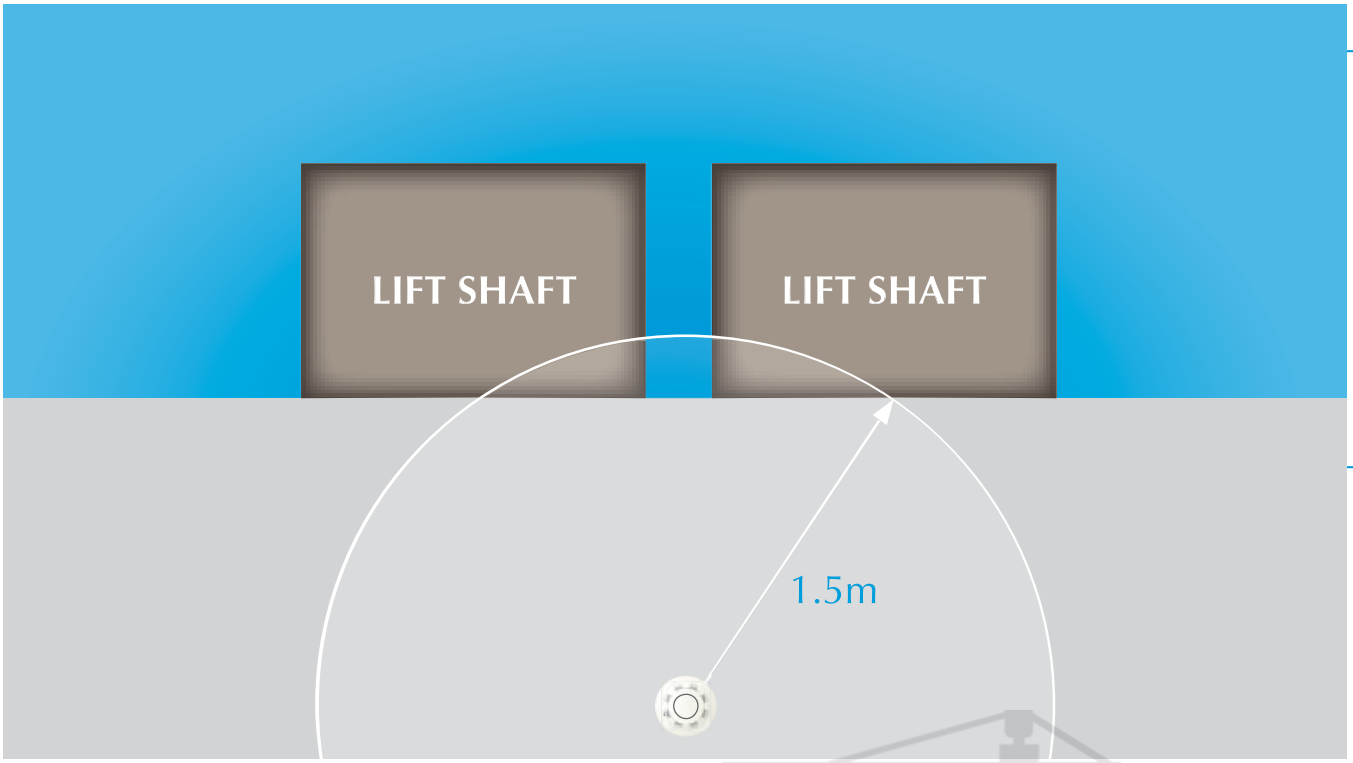


Never mount devices closer than twice the depth of light fittings or other obstructions on the ceiling.

Section Clause 22.2

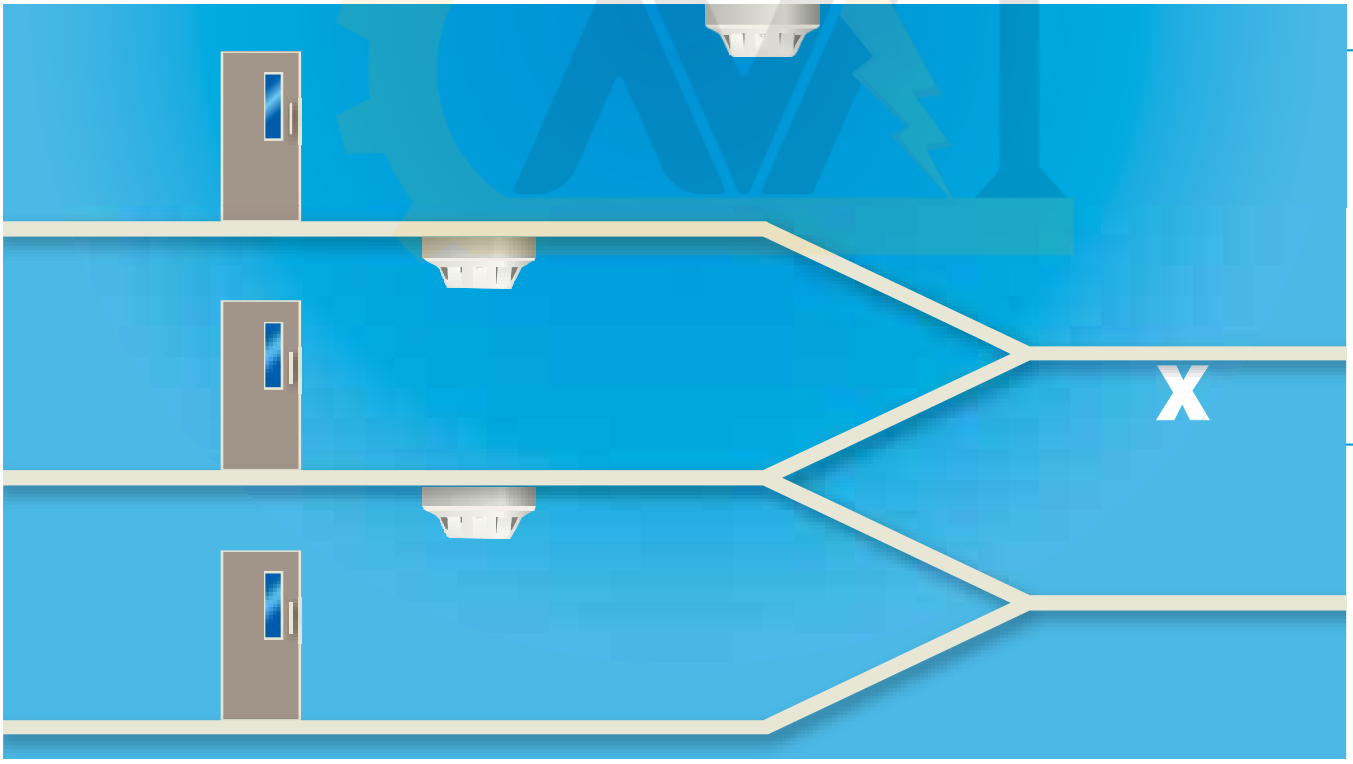


Voids less than 800mm in height need not have independent coverage, unless fire or smoke is able to spread from one area to another through the void or risk assessment shows AFD (Automatic Fire Detection) to be necessary.



Section 2 Clause 22.2

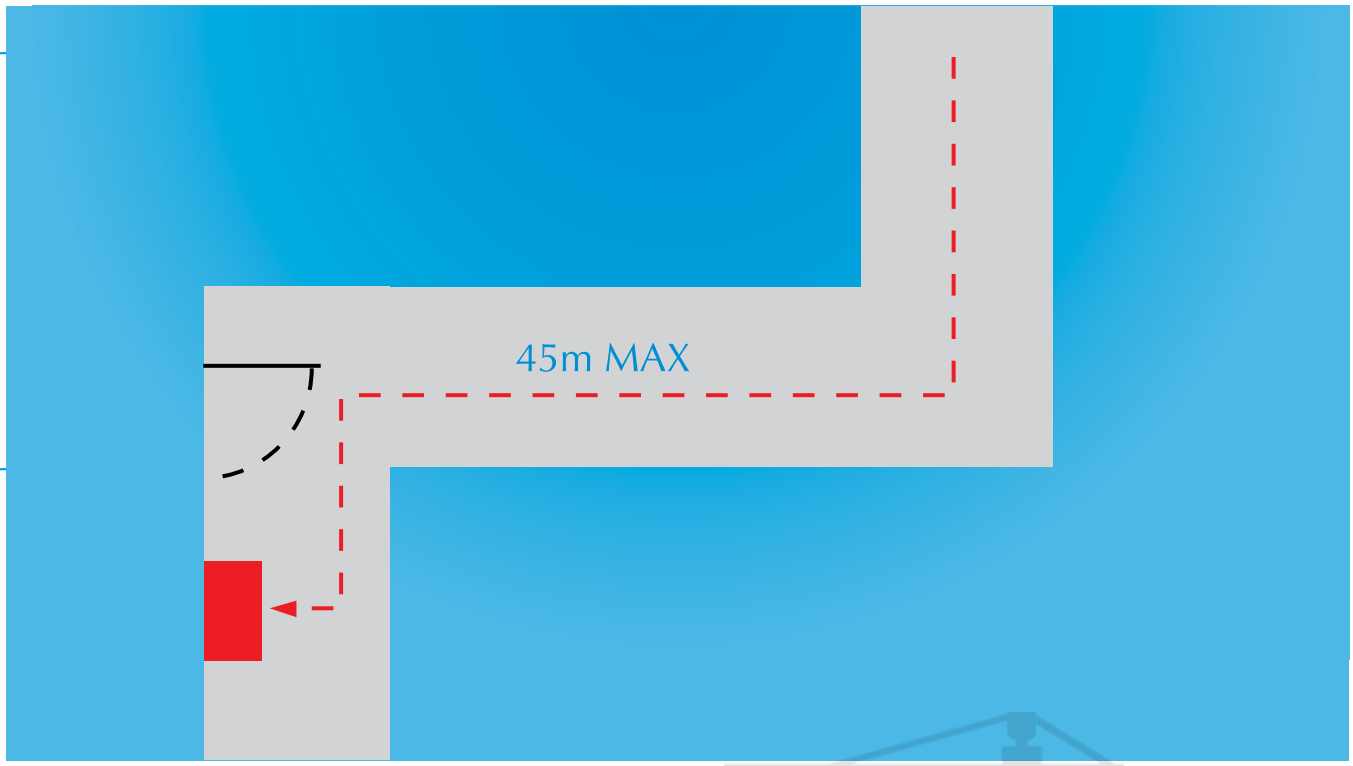
Vertical shafts like lifts and open stairways should have a device mounted within 1.5m of any opening. (This is not necessary for enclosed stairways, because as noted below, there are detectors on every landing within the stairway).



Section 2 Clause 22.2

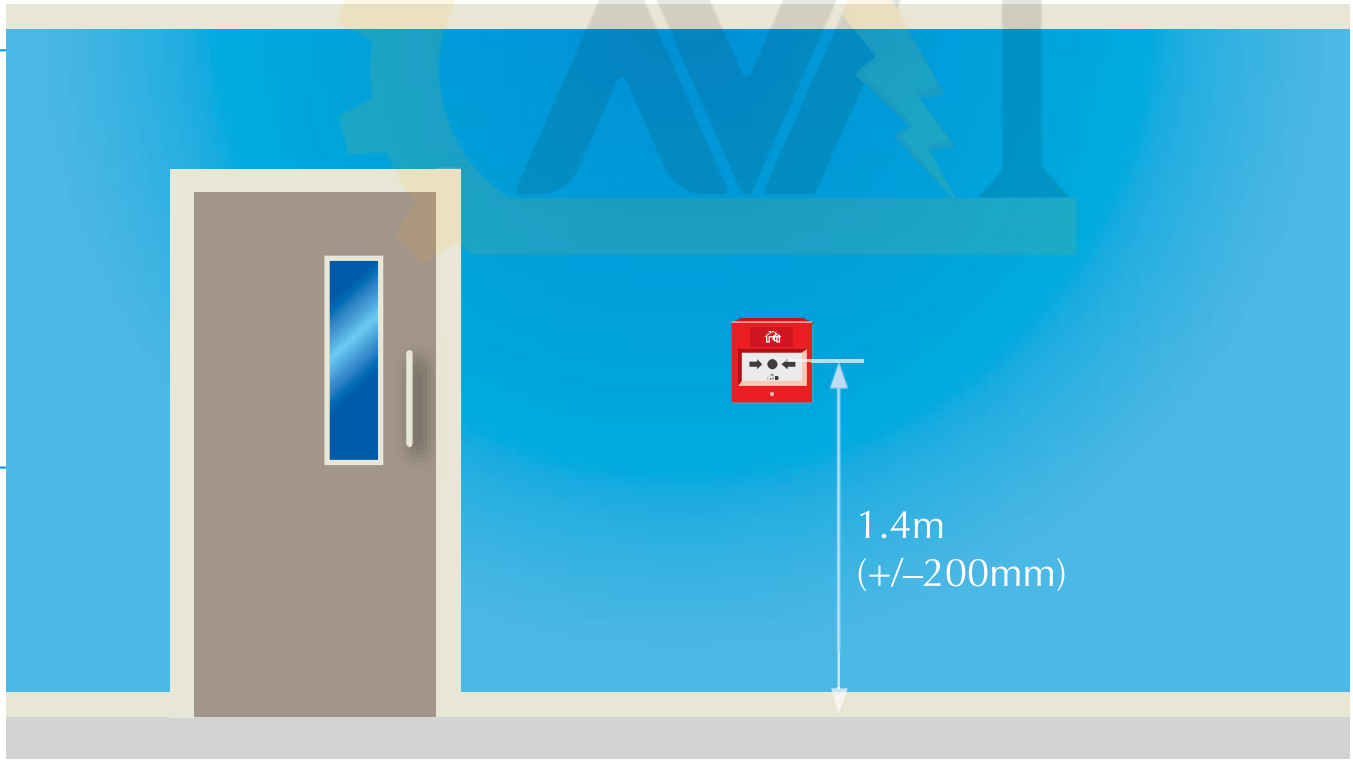
Enclosed stairways should have a detector at the top of the stairway and on each main landing.

Section 2 Clause 20.2



A person should not have to travel more than 45m 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.

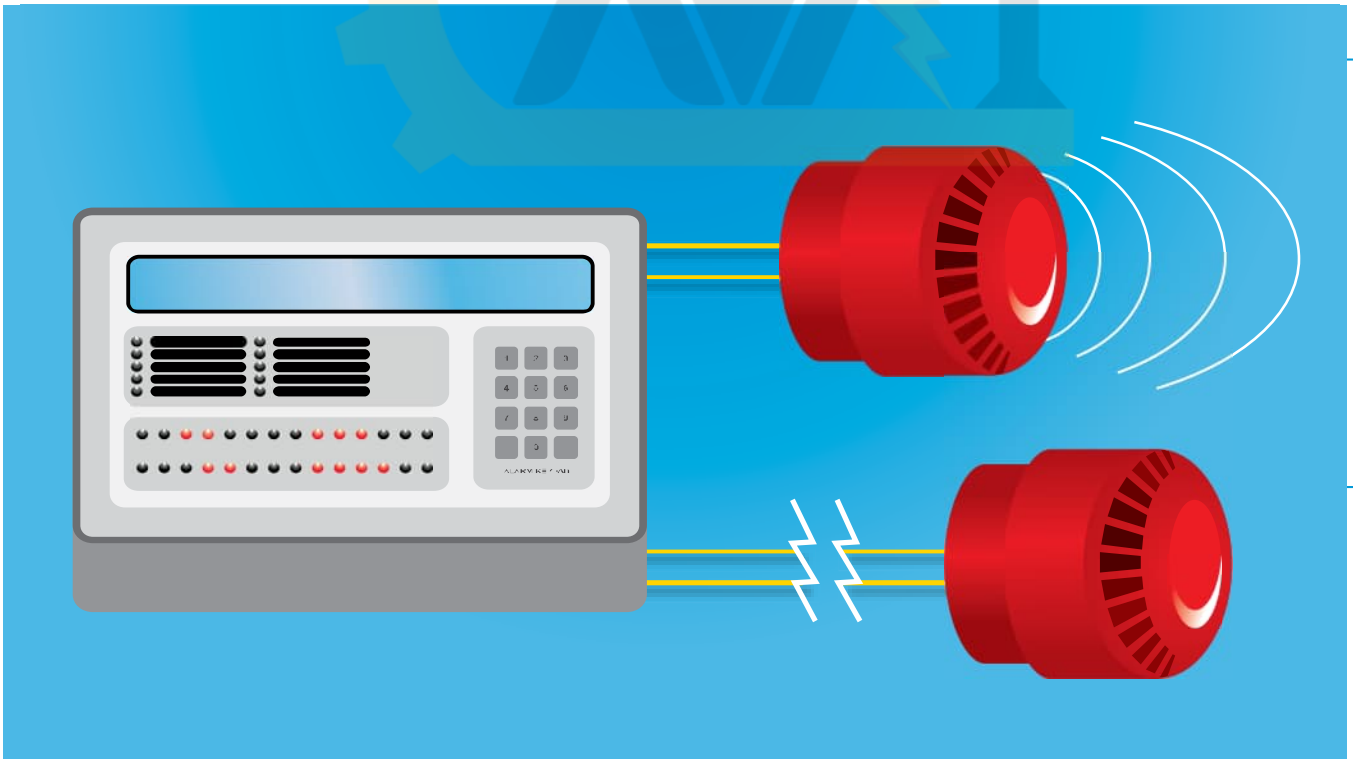
Section 2 Clause 20.2



The centre of the 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).

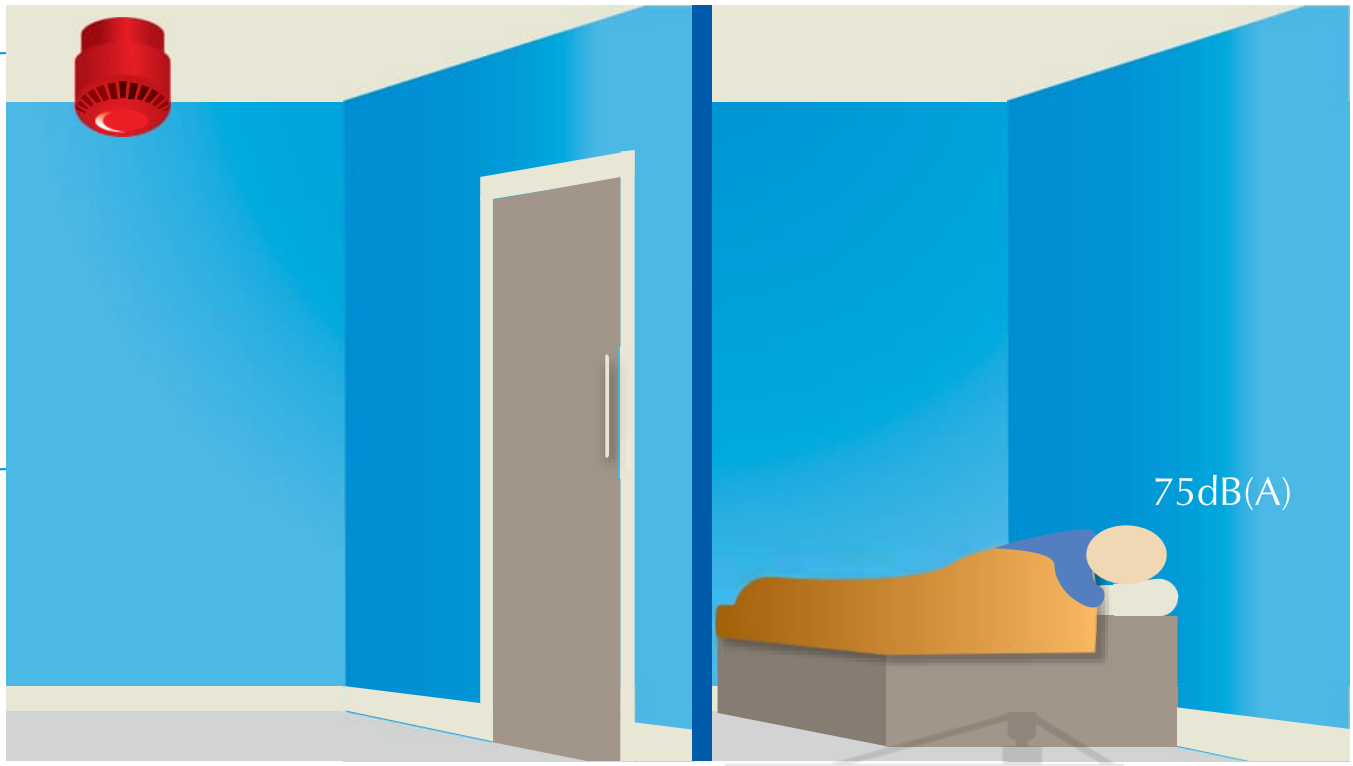
The minimum sound level should be 65dB(A) or 5dB(A) above a background noise which is louder than 60dB(A) (if lasting more than 30 seconds) and at a frequency of between 500Hz and 1000Hz. The maximum sound level should not be greater than 120dB(A) at any normally accessible point. May be reduced to 60dB(A)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

Section 2 Clause 16.2.1



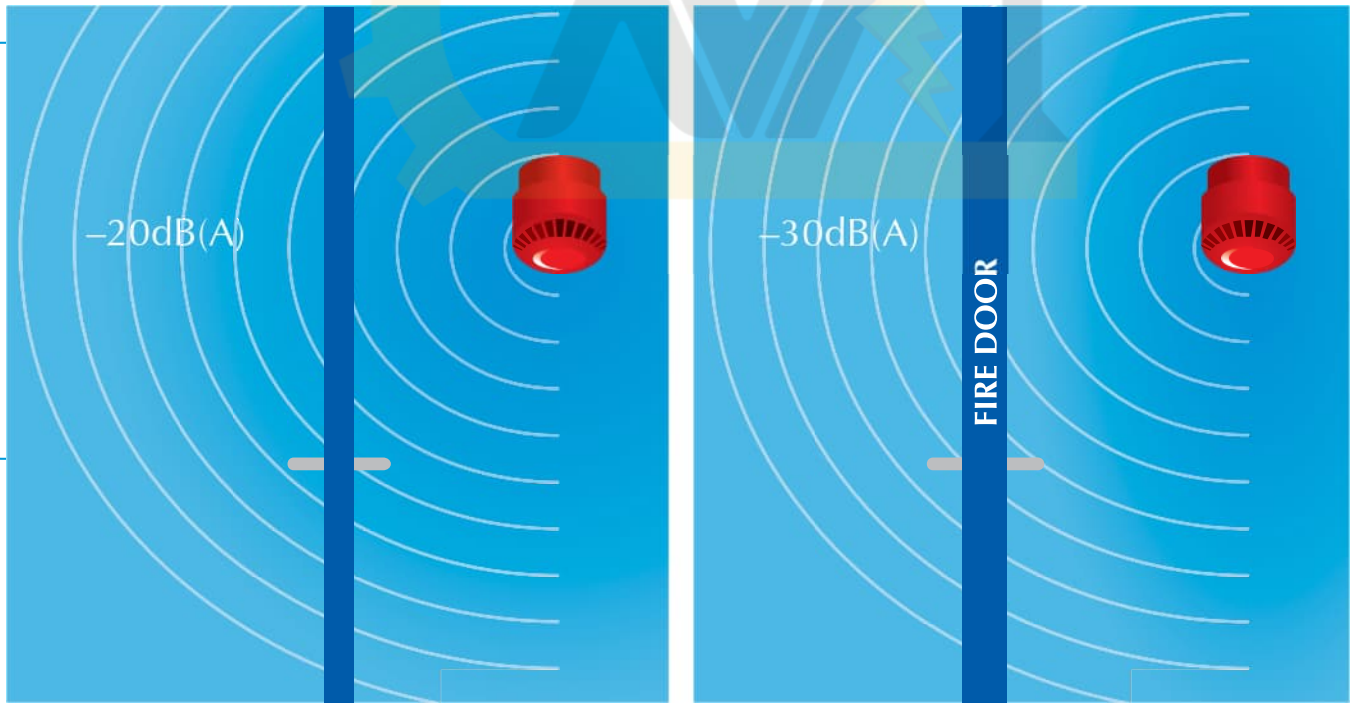
Sounder device cabling should be arranged so that in the event of a fault at least one sounder will remain operational during a fire condition.

Section 2 Clause 16.2.1

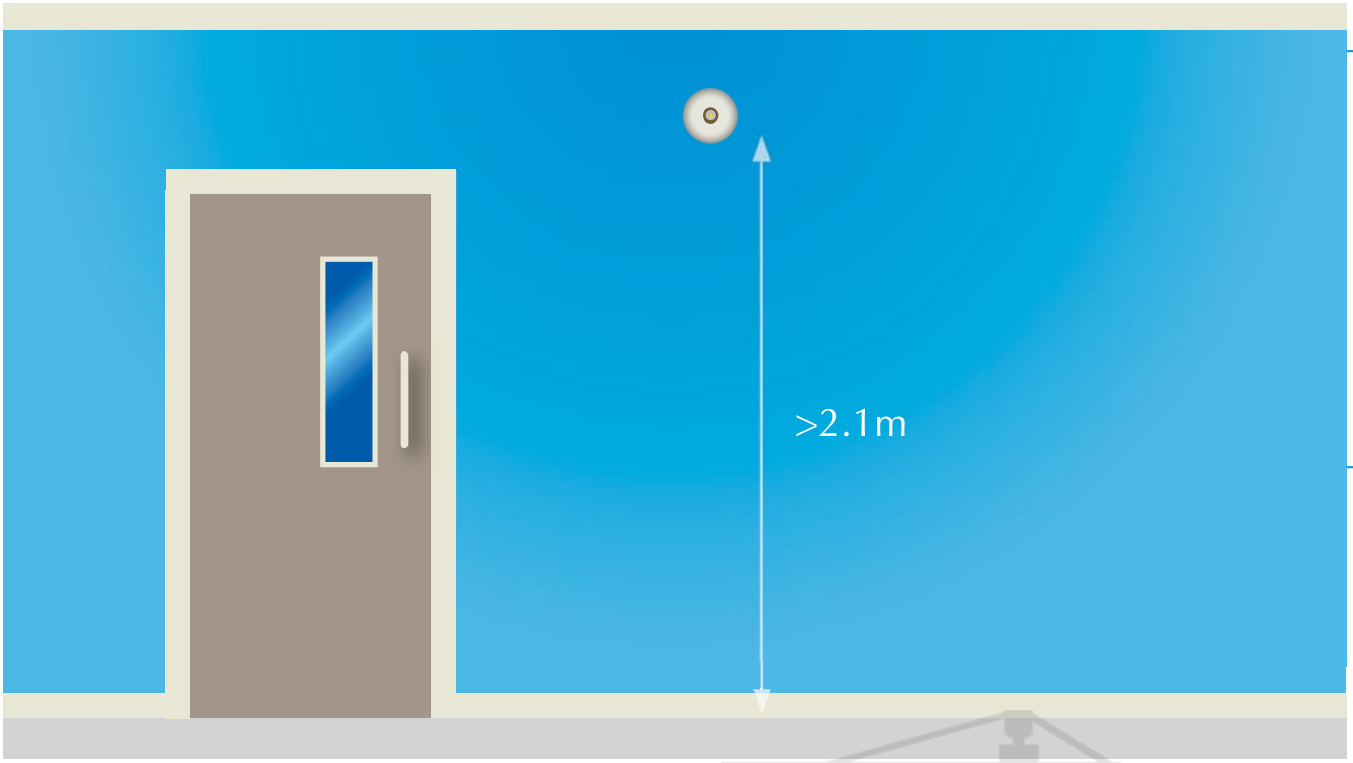


For areas where people are sleeping, sounder devices should produce a minimum 75dB(A) at the bed-head with all doors shut. In buildings providing sleeping accommodation for deaf or hard of hearing people, bedrooms should have both audible and visual alarms. (Note: Visual Alarm Devices are not intended to wake sleeping persons).

Section 2 Clause 16.2.1

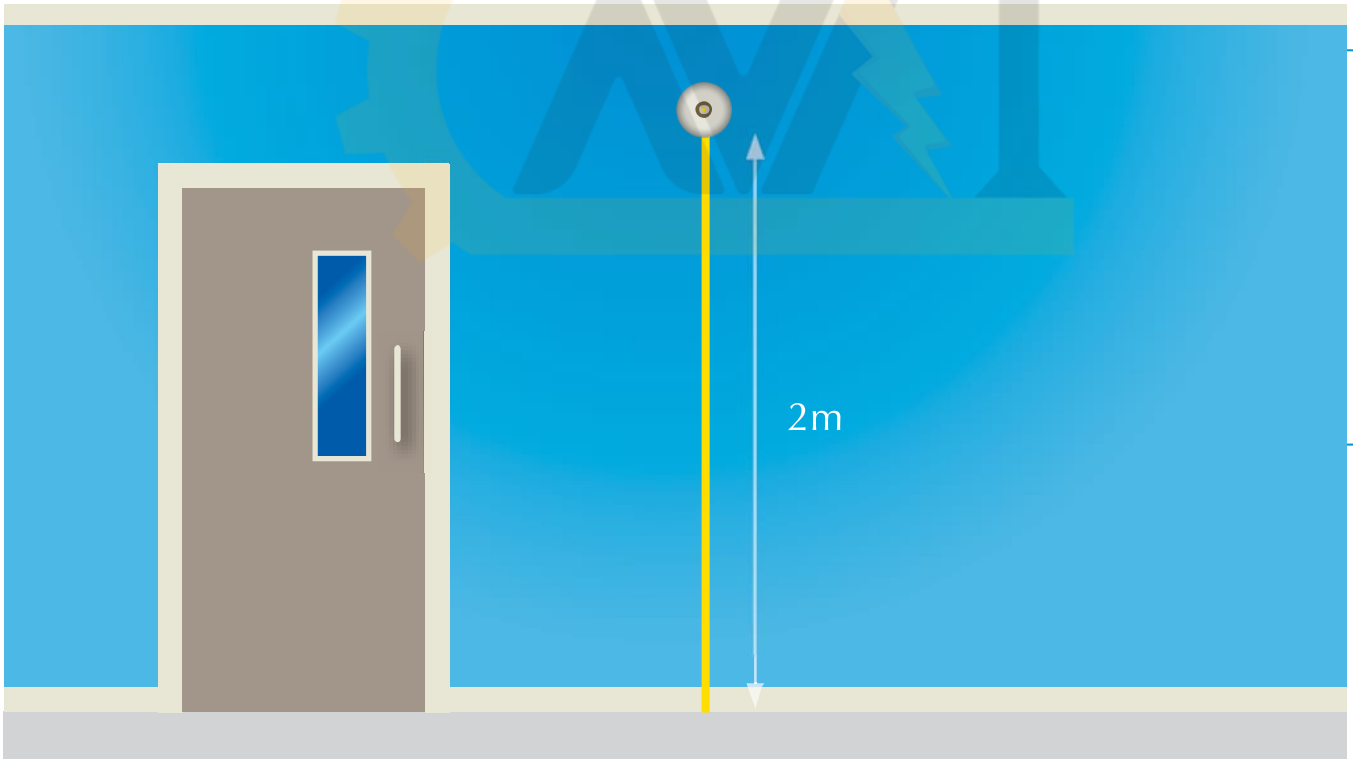


Decibel loss occurs through doors: approximately –20dB(A) through a normal door, and approximately –30dB(A) through a fire door. **Unless a sounder is installed in a bedroom, it is unlikely that 75dB(A) will be achieved.**



Section 2 Clause 17

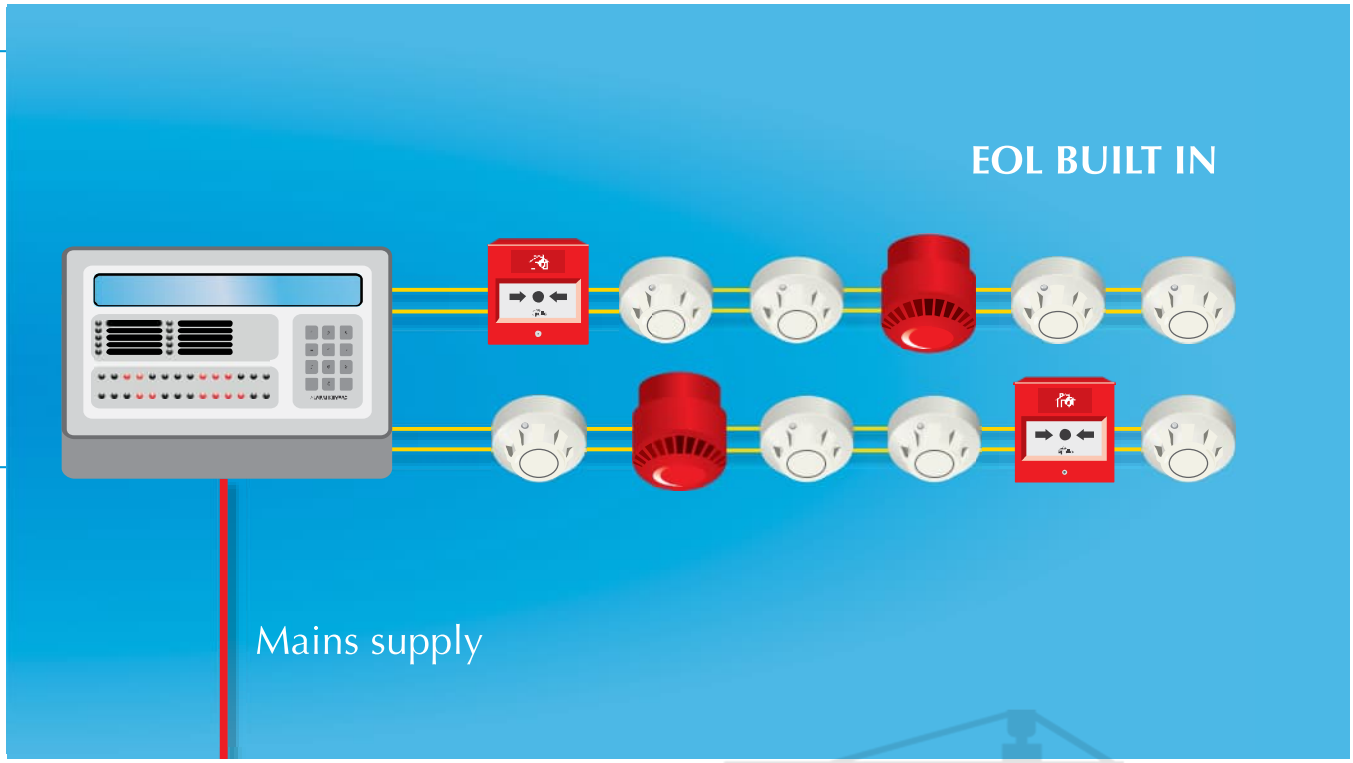
Ceiling or wall mounted Visual Alarms Devices should always be mounted at a minimum height of 2.1m from floor level. Coverage and orientation to be specified by the manufacturer.



Section 2 Clause 26.2

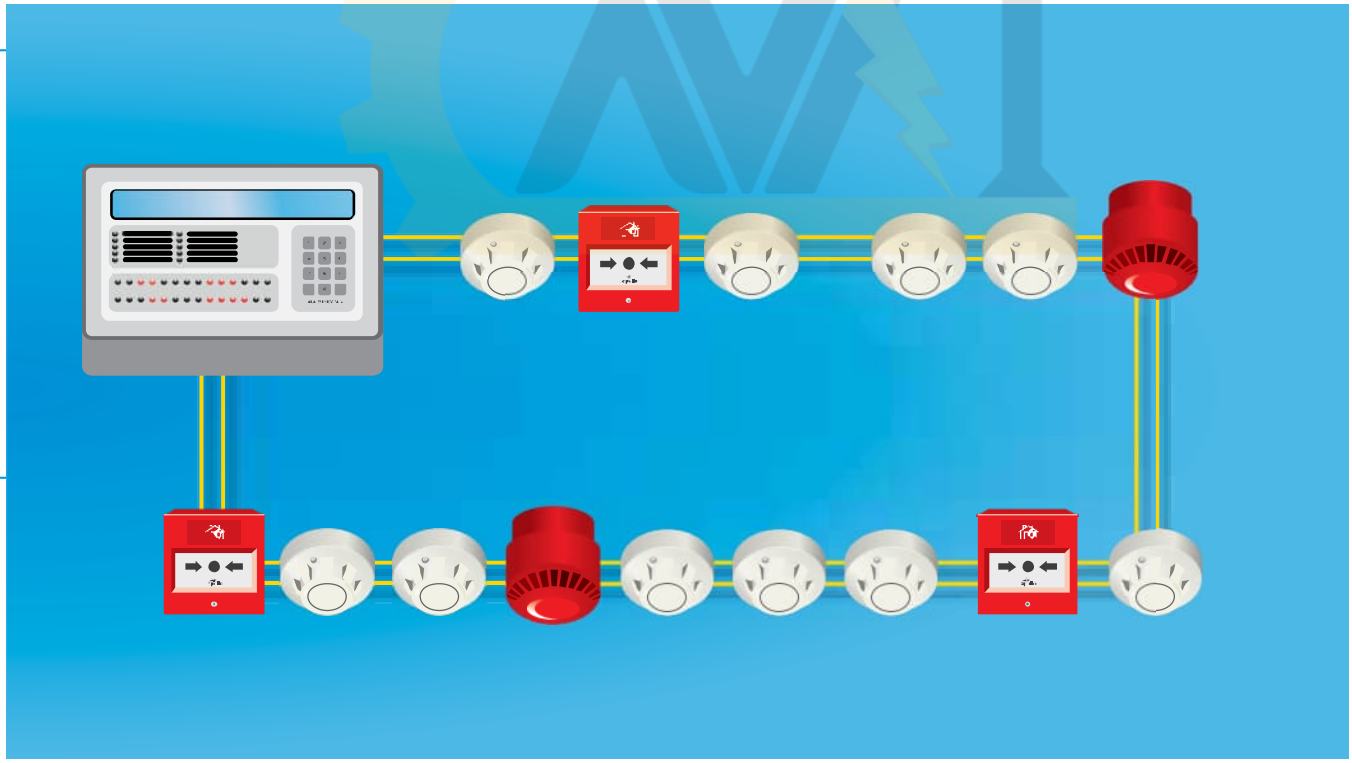
Unless MICC cable is used, all cabling should be mechanically protected from floor level up to a height of 2m. In relatively benign areas, such as shops, offices and similar, cabling can be clipped to robust walls etc. No additional mechanical protection is then necessary.

Section 2 Clause 26



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.

Section 2 Clause 12.2.2



Short circuit isolators limit the effect of one fault to 2000m^2 and to a single storey of the building. '2 simultaneous faults on a circuit should not disable protection within an area greater than 10,000m^2'.

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^2. (26.2g)
- All joints 'other than those within the system components' to be fire resisting. Junction boxes to be labelled 'FIRE ALARM'. (26.2g)
- Enhanced cable to be used where more than 4 zones of phased evacuation required, in multi storey systems, hospitals (un-sprinklered over 30m) or risk assessment requires enhanced cable. (26.2c)
- Cable using trunking as a means of containment must be clipped using fire resistant supports WITHIN THE TRUNKING. (26.2h)
- 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 unless, for example, the exits lead to an enclosed courtyard from which there is no escape. (20.2c)
- CO fire detectors should be spaced as per smoke detectors, but cannot be used without smoke detectors on escape routes. (22.4)
- Multi sensors, incorporating smoke detection should be spaced as smoke detectors, if used as individual types ie heat in the day & smoke at night then space as per heat detectors. (21.1.6)
- 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 rooms or enclosures of no more than APPROXIMATELY 60 sq m. Bedhead levels remains 75dB(A). (16.2.1a)
- 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 5 Clause 40)
- An installation certificate will be required. (41.2)

✓ Installation and Handover Checklist

☐	1	The system complies with the original specification / design
☐	2	Any changes to original specification/design have been referred to the system designer for approval
☐	3	System has been installed to meet recommendations of category L1, L2, L3, L4, L5, P1, P2, M
☐	4	Variations to the defined category have been identified and the schedule of variations agreed with the client
☐	5	Cables meet requirements for standard/enhanced/mixed
☐	6	Cables are segregated as required and suitably supported (no plastic clips, cable ties or trunking used as sole means of support)
☐	7	Cables are mechanically protected as required.
☐	8	Junction boxes are correctly labelled and identified on drawings. Connector blocks are fire resistant.
☐	9	All cable insulation and continuity resistance measurements are logged
☐	10	All cable penetrations are sleeved and fire stopped
☐	11	Mains supply is dedicated, non-switched, correctly fused and labelled
☐	12	Mains supply is correctly identified at all distribution boards
☐	13	Standby battery verification has been carried out for all power supplies
☐	14	All batteries are clearly marked and labelled with date of installation
☐	15	Field wiring is labelled and correctly terminated in all control and ancillary equipment
☐	16	Isolators are fitted as appropriate, operate correctly and are marked on drawings
☐	17	There are a minimum of two sounder circuits installed
☐	18	Sound pressure levels have been checked and recorded and meet the minimum requirements.
☐	19	Detector type and spacing is appropriate to the system category
☐	20	MCPs are located correctly and travel distance is appropriate to the system category
☐	21	Remote signalling has been checked for correct operation to Alarm Receiving Centre
☐	22	Zone plans have been fitted in all appropriate locations (adjacent to control equipment and repeaters) this must be a plan, a list does not suffice.
☐	23	As fitted drawings are complete and have been updated where required, including cable size and routing
☐	24	Log book and operating instructions have been issued to the responsible person
☐	25	The premises management have been adequately trained in the use of the fire alarm system

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Her Majesty The Queen
Manufacturers of Fire Detection
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