Fire Detection System Design

SYSTEM DESIGN

In order to undertake the process of designing a fire system for a building it is necessary to have a sound und the relevant design standards, the legal framework surrounding building safety legislation and a sound workin product application theory. The importance of consultation with all relevant parties cannot be overstressed, ne importance of specialist advice in relevant areas. The following system design process is intended to give a re overview of all the areas of knowledge required for the successful design of a fire alarm system.

It is envisaged that the user will refer to the information contained within the design section to determine the a further detailed advice will be required and to give guidance as to where such advice may be contained.

Due to the complex nature of legislation and design standards relating to fire alarm system design, this desigr intended to be a comprehensive guide to all aspects of fire alarm design but rather a very useful source of bac information to which further application specific detailed information can be added from other sources as requ

The standards referred to in this section relate to the UK and Europe. Although the principles are broadly univ recommended for readers in other countries that they familiarise themselves with specific local requirements f standards, only using the British or European standards where these have been accepted by local fire authori relating to equipment facilities and performance apply to Cooper Lighting and Security equipment and may no apply to other manufacturers equipment. The reader should carefully check whether such comments relate to other manufacturers before considering alternative equipment.

OVERVIEW OF THE DESIGN PROCESS

The following describes a typical fire alarm system design process, after each item a section number is provid relates to the area within the design guide where further information can be found.

• Understand the reasons for installing the fire alarm system in the specific property (section 1)
• Conduct a risk assessment to help determine requirements (section 2)
• Consult with all interested parties (section 3)
• Decide on the relevant design standard (section 4)
• Establish if third party approval is required - for equipment and/or installation.
• Decide on the type of alarm technology to be used
• Decide on the appropriate protection category and extent of coverage where relevant (section 5)
• Discuss and agree the fire strategy (section 6)
• Plan the zoning of the building (section 6)
• Select and position relevant system components (section 7)
- Select the appropriate detectors for each area
- Position the detectors
- Select suitable callpoints and position at appropriate locations
- Agree on the means of summoning the fire authority
- Plan the alarm signalling arrangements (sounders, beacons, pagers etc)
• Select a suitable panel (suitably sized and rated with adequate standby autonomy)
- Review the design such as to - minimise the potential for false alarms (section 8)
- Select Contractor
- Ensure suitable wiring of the system (section 9)
- Make suitable arrangements for commissioning (section 10)
- Appoint/Establish responsible person (section 11)
- Make suitable arrangements for ongoing maintenance and monitoring of system performance (section 11)

BACKGROUND LEGISLATION

The following section contains details of European legislation which relates mainly to legal requirements place manufacturer or importer of equipment. The description is included here to give the user/specifier an understa subject.

EMC

The EMC directive requires that all electrical and electronic equipment is able to co-exist without interference. basic levels, which relate to the type of environment, industrial and commercial/light industrial. The industrial l equipment to emit more electrical noise taking into account the problem of containing electrical noise in large machines.

EMC standards are continually evolving as communication equipment becomes more sophisticated and meas techniques improve.

In principle Fire Alarm equipment must emit low levels of noise but be able to withstand high levels, so that it all applications. To that end a product family standard, EN50130-4 has been published to cover alarm equipm susceptibility and the commercial/light industrial generic standard is used for emissions.

LVD
The Low Voltage Directive requires that all electrical equipment connected to low voltage supplies (up to 100 safe. Various standards are published relating to different types of equipment but the general standard EN609 fire detection and alarm equipment.

Most items in commercial fire detection systems are designed to work at Extra Low Voltage (24V) and so the apply, the exceptions being fire alarm panels, mains rated relays or interfaces and other items of equipment c mains supply such as door closers, smoke vents etc.

CPD
The Construction Products Directive relates to building materials and equipment fixed to the structure of the b section of the directive relates to Safety In Case Of Fire and mandate 109 requires that all fire detection and a is third party certified to the relevant Harmonised European standard. In most cases this will be a part of the E standards, e.g. EN54-2 for control equipment or EN54-5 for heat detectors. Many of these standards are publi the process of harmonisation. Once harmonised there will be a transition period before compliance becomes Therefore at present third party approval is voluntary but over the next few years it is expected to become ma Third party testing to an EN54 standard is very expensive, this may therefore restrict the level of customisatio offered by manufacturers in the future.

CE MARKING
Currently CE marking is used to indicate that the equipment meets the EMC and LV directives. It will also app compliance once mandated standards are in place for the items of equipment in question. CE marking is not r and generally it will be clear as to what directive the marking relates to. The mandated standards will be parts alarm and fire detection systems.

RoHS
The Restriction of Hazardous Substances directive currently does not apply to fire detection and alarm equipn is likely that once alternative materials become available and reliable (particularly in the case of lead solder,) t of the directive will be enlarged to cover current exceptions and to incorporate more materials. The objective c to require manufacturers to stop using substances that potentially provide some health risk, in electrical and e equipment.

1.0 WHY HAVE A FIRE ALARM SYSTEM?

The answer to this question depends on the premises in question and the legal requirements. In large high-ris such systems are essential to warn all occupants that a fire or emergency situation exists and the system is u evacuation in an orderly way. Large sites with a retained fire brigade may require the system to call the brigad them to the area of risk. The property may have considerable intrinsic value and the insurers either require a f system or may incentivise its use.
The building may be unoccupied for periods where equipment is still powered and the owner wishes to ensure goes wrong fire fighters are called to the scene in a timely manner.
Fire alarm systems are often used for other purposes as well as fire detection and alarm, such as bomb alert monitoring systems for high risk equipment or places, emergency call systems and even class change system

Sometimes fire detection and alarm systems are used to compensate for structural fire protection shortcoming special cover for items of high value. Whatever the reason, an automatic fire detection and alarm system gene network of manual callpoints, fire sensors and alarm warning devices over the area covered. It is, in effect, the mouth of the building to constantly monitor the building and warn if a fire breaks out, or is suspected. In the sa if we see flames or smell burning.

1.1 Insurance Requirements

Insurance requirements normally relate to the protection of property - rather than life. The objective is therefor as early as possible and instigate measures to put the fire out with the minimum amount of damage.

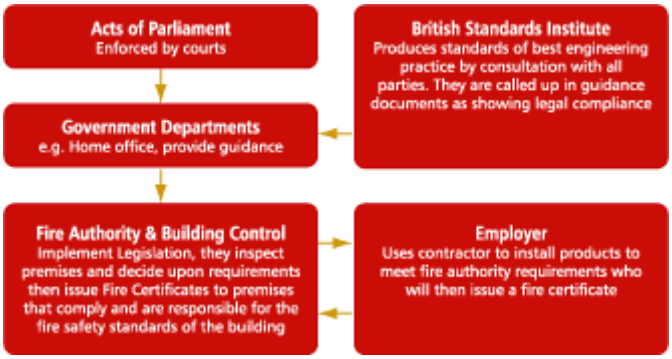
Generally a system designed for property protection will also give protection of life as well but the essential dif the requirements for property protection are driven from the insurance company's desires rather than law. BS

both life and property protection, so is equally useful in both cases.

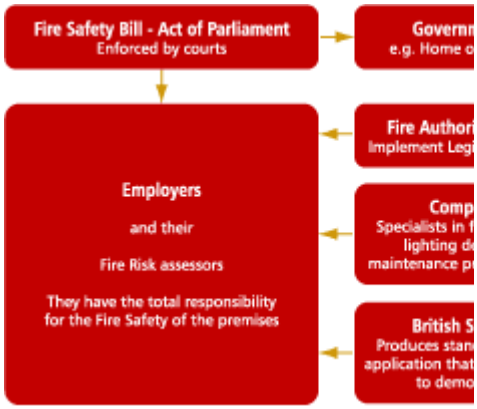
1.2 Legal Framework
Generally the legal requirement for a fire alarm system relates to the protection of life. Either of those in the bu in adjacent buildings. The primary objective of life protection is to warn occupants of the risk of fire and get the safety as quickly as possible.

The UK has traditionally had a number of regulations relating to different types of building and has used the fi as a local enforcement agency either issuing or withholding fire certificates depending on their view of the leve provided. This is now changing and the government is devolving the responsibility onto the building owners - v exceptions. This means that it will become the building owner (or occupier) who is responsible to ensure that t safe for those in and around it. The recommended tool to establish the requirement is 'risk assessment'. The c framework as it currently is and is expected to become are detailed in the charts below.

FIRE SAFETY LEGISLATION - Current Situation



Flowchart of Fire Safety as expected premises after Spring 2005



If a fire detection or alarm system is required then it is necessary to establish the specification for the system. BS5839-1:2002 is normally the appropriate standard for commercial and industrial premises. BS5839-6 relate premises and other standards such as HTM 82 for hospitals relate to specific building types.

2.0 RISK ASSESSMENT

The first step in the design process is the risk assessment. It underpins the whole system strategy and therefo argued as being the most important stage. Risk assessment is the process of considering each part of a build point of view of what fire hazards exist within an area and what would happen in the event of fire or if explosio This would normally be done when considering the building from the point of view of general safety. Clearly ve premises only require a first level of fire protection, such as safe construction, clear escape routes and a fire e Equally obviously, large hotels will require a fully automatic fire detection and alarm system, multiple sets fire equipment and adequate emergency lighting and escape signage. The Risk Assessment process is to help bu buildings between these two extremes make adequate and appropriate provision.

Building owners or operators will often want to employ the services of a professional risk assessor to ensure t is considered impartially and in adequate detail. However there are checklists and technical advice available s can be done 'in-house'. The web site of the office of the deputy Prime Minister provides useful guidance on th (www.odpm.gov.uk). Additional information and guidance on the risk assessment process is available from th Safety executive (www.hse.gov.uk). It is recommended that risk assessors should be fully familiar with the rec BS5839:1 2002 and if in doubt consult a suitably qualified specialist.

3.0 CONSULT WITH ALL INTERESTED PARTIES

BS5839 stresses the need to consult with all interested parties before embarking on a detailed design. As a m following need to consult to ensure that the fire detection and alarm system meets the requirements of all con

- The authority responsible for enforcing health and safety legislation
- The property insurer
- The building user
- The proposed installer

- Fire engineering specialists (where appropriate)

4.0 RELEVANT STANDARDS

Standards are produced for equipment and the application of equipment, they are generally produced or endo
They represent recognised best practice either for the design, manufacture or application of a particular produ
range.

Often these standards are called up within guidance documents for pieces of legislation and since they repres
practice, can be generally be used by employers to demonstrate that equipment they have installed is adequa
appropriate. The following standards relate to the UK and Europe. There are other standards that relate to spe
applications (such as hospitals or data processing installations) and other countries will have their own standa
same area as those listed.

4.1 BS5839

The BS5839 suite of standards relate to specific areas of application for fire detection and alarm equipment. S
1 relates to public premises and part 6 relates to residential premises. BS5839-1 is a comprehensive code of
detection and alarm systems, the requirements relate to both life and property protection and the standard inc
advice and comment with is very useful in informing the building owner or system specifier of the background
requirements. The standard has been developed through input from the whole fire detection industry over a pe
years and is the distillation of expert opinion and practical advice. The application notes that follow relate to th
of BS5839:1 2002.

4.2 BS5588

The parts of BS5588 form the technical element of the building regulations for England and Wales, they shoul
to establish the detailed requirements for the building in question. BS5588 is mainly concerned with the struct
of the building but also contains some requirements for fire detection and alarm systems. The requirements of
incorporated within the building regulations giving it mandatory legal status.

4.3 BS7273, BS EN 60079-14, BS EN 50281-1-2

The parts of BS7273 are codes of practice for different types of fire protection systems. Generally this is consi
separately to fire alarm systems but there may be occasions where a trade off can be made between the two
where the two systems interact and must be interfaced.

BS EN 60079-14 and 50281-1-2 cover areas where there may be risk of explosive gas/vapour or dust respect
to them may be required in certain buildings or where there is a change of use.

4.4 EN54

The EN54 suite of standards relates to the design and performance of items of equipment that make up a fire
alarm system. Each part relates to a different piece of equipment, for example part 3 relates to alarm devices,
points, part 4 to power supplies etc.

Some parts of the standards have options with requirements. These relate to specific features that are require
applications but not all. For example all control and indicating equipment must be able to detect fire (with the h
appropriate input devices), must monitor certain functions (such as cables for open and short circuit faults) an
disablement facility so that functions or areas of cover can be switched off for maintenance or similar activities
optional to have a test facility or delays to outputs, but if such features are either provided or required in the ap
to allow a local search for fire prior to calling the brigade) then those facilities must meet specified criteria.

It is therefore necessary when specifying compliance to EN54 that the relevant part is identified and that the a
standard (such as BS5839-1) is consulted to identify specific options. For example, the UK fire brigade almost
require zonal light emitting indicators to be incorporated in control equipment to show the extent of the fire eve
this is an option in EN54-2 and many countries in Europe do not require such displays.

4.5 BS7671

BS7671 was previously known as the IEE wiring regulations.
The standard is called up in BS5839-1 and covers the installation of the system.

5.0 SELECTION OF COVER

BS5839-1 lists eight categories of cover, depending on what is required. The category system is a simple sho
of informing all parties of the objective of the system.

5.1 Life Safety

M	Category M systems are manual systems and rely on the occupants of the building discovering the fire and acting to warn others by operating the system. Such systems form the basic requirement for places of employment with no sleeping risk. **Manual cover should be included in all Life Safety systems except L5 systems where it may or may not be provided.** In addition to manual means of triggering an alarm, L category systems will also normally have an element of coverage using automatic fire detection such as smoke or heat detectors. The precise classification depends on the nature of the area(s) provided with automatic protection
L5	Category 5 systems are the 'custom' category and relate to some special requirement that cannot be covered by any other category. Where such systems are specified careful reference much be made to the objective of the cover.
L4	Category 4 systems cover escape routes and circulation areas only. Detectors might be sited in other areas of the building, but the objective is to protect the escape route.
L3	Category 3 systems provide more extensive cover than category 4. The objective is to warn the occupants of the building early enough to ensure that all are able to exit the building before escape routes become impassable.
L2	Category 2 systems relate to automatic fire protection in defined areas of the building as well as satisfying the requirements of category 3. The wider cover would relate to parts of the building considered to have a high level of risk.
L1	With category 1 systems, the whole of a building is covered apart from minor exceptions.

5.2 Property Protection

P2	Category 2 systems provide fire detection in specified parts of the building where there is either high risk or where business disruption must be minimised.
P1	The system is installed throughout the building - the objective being to call the fire brigade as early as possible to ensure that any damage caused by fire is minimised. Small low risk areas can be excepted, such as toilets and cupboards less than 1m².

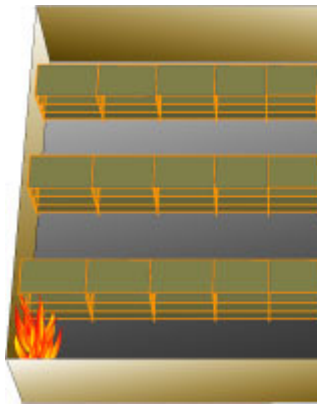
6.0 REVIEW OF THE BUILDING

Before looking at the details of the alarm system it is necessary to understand some of the concepts that are u the system designer. Buildings are divided up into sections in three ways as far as fire safety engineering is c compartments, detection zones and alarm zones.

6.1 Fire Compartments

A fire compartment is a part of a building that is separated from the rest of the building by a fire resistant struc limit the spread of fire within the building. The requirements for designing a building and hence its fire compar defined in building regulations and is outside the scope of this document. It is necessary, however, for the des detection and alarm system to be familiar with the design of the building, in particular the position and extent c compartments.

6.2 Detection Zones



Fire detection zones are essentially a convenient way of dividing up a building to assist in quickly locating the position of a fire. The zone boundaries are not physical features of the building, although it is normal to make the zone boundary coincide with walls, floors and specifically fire compartments. The size and position of the detection zones will therefore tend to be dependant on the shape of the buildings, but will also depend on what the building is used for and to some extent the number of people the building is expected to contain at any one time. BS 5839-1 has some specific recommendations with respect to detection zones:

- Zones should be restricted to single floors, except where the total floor area of a building is less than 300m²
- Voids above or below the floor area of a room may be included in the same zone as the room so long as they are both in the same fire compartment

- Zones should not be larger than 2000m² except for manual systems in single storey open plan buildings, such as a warehouse, where up to 10000m² is allowed
- Fire detectors in an enclosed stairwell, lift shaft or the like should be considered as a separate zone
- The search distance within a zone should be less than 60m (all possible entrance points must be considered). This can be relaxed when using addressable systems if the information provided at the control and indicating equipment would allow fire fighters, unfamiliar with the building, to proceed directly to the location of the fire. The search distance only relates to the distance from entering a zone to being able to determine the location of the fire, it is not necessary to travel to the fire
- Zones should not cross fire compartments, a fire compartment can contain several zones but a zone should not contain more than one fire compartment

6.3 Alarm Zones
Alarm zones are only needed in buildings where operation of the alarms needs to be different in certain parts If the only requirement is to activate all the alarm sounders to provide a single common evacuate signal once detected, then alarm zones are not needed, the whole building is one alarm zone.
For more complex buildings where it is necessary to operate alarm devices differently in parts of the building, building should be divided into alarm zones such that all of the alarm devices in one alarm zone operate in the BS5839-1 contains some recommendations for alarm zones:
- The boundaries of all alarm zones should comprise fire-resisting construction
- Signal overlap between alarm zones should not cause confusion
- The same alarm and alert signals should be used throughout a building
- A detection zone must not contain multiple alarm zones, alarm and detection zone boundaries should coinci zone may contain multiple detection zones

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7.0 SELECTION OF EQUIPMENT

7.1 Component Compatibility
Because most conventional systems operate in a similar manner, there can be a temptation to mix and match panels and sounders from different suppliers. Cooper Lighting and Security strongly recommend that all comp sourced from a single supplier to ensure that they are fully compatible with each other. Minor incompatibilities components may not be immediately obvious but could cause system malfunction under particular conditions.

Section 11.1 of BS5839 part 1:2002 makes specific mention of the need to confirm that all system component compatible with each other.

Note also that section 12.2.2 of BS5839 part 1:2002 requires that removal of any or all detectors from a circuit affect the operation of any manual callpoint. With Cooper Lighting and Security conventional systems, this fun inherently provided by the design of the detector base, however with other systems this requirement may requ purchase of additional components or place limitations on the wiring order of detectors and callpoints. Other c require that this requirement is met by the use of separate zones (e.g. France).

7.2 Repeater Panels
Repeater panels are available for most systems and are required where the fire brigade may enter a building one entrance, where security staff are located away from the main panel or where operational staff need the s information in more than one location, for example in hospital wards.

All control panels including most repeaters, require two power supplies. The back up supply is built into the pa provided by sealed lead acid batteries, but a secure mains supply is required for the primary power source. Fu switches should be clearly marked to ensure that the fire alarm system is not inadvertently powered down.

7.3 Selection of Suitable Equipment Autonomy
Standby time for life safety systems is normally 24 hrs. For property protection this may need to be increased where the building is unoccupied over weekends.

Conventional panels and most repeater panels generally have batteries, which are sized to provide a defined

autonomy based on a fully loaded system. For analogue systems, batteries are typically custom sized to suit t configuration, because the amount and type of connected equipment can vary considerably.

7.4 Selection of Appropriate Automatic Detectors
Cooper Lighting and Security provide a range of automatic fire detectors to suit most general risks. Smoke de earliest warning of fire, typically responding to a fire 1/10th of the size as that required to operate a heat detec

Optical smoke detectors are suitable for most applications giving the fastest response to slow burning fires - th common start to fire events. Ionisation detectors were the first type of detector to be commercially developed popular choice.
They have superior response to fast burning fires but an inferior response to slow smouldering fires, which are modern construction materials. Ionisation detectors are also less acceptable from an environmental point of vi radioactive material that they contain. There is increasing restriction on the transportation and disposal of ionis so it is recommended that alternative types are used where possible.

BS5839 section 21.1.8 (d) recommends the use of optical detectors to provide coverage for escape routes du superior ability to detect optically dense smoke that would easily obstruct the use of escape routes.

Opto-heat detectors have been developed to mimic the response of ionisation detectors to fast burning clean maintain the advantage of photoelectric detectors when detecting smouldering fires and allow a higher alarm t the EN54-7 specification under normal conditions thus providing a greater rejection of false alarms.

Heat detectors should be used in environments where the ambient conditions might cause false alarms if smo were to be used, for example where there is a high level of dust, fumes, steam or smoke under normal conditi

There are three available types of conventional heat detector, a fixed high temperature heat detector which ha trigger temperature of 92°C, a medium fixed temperature heat detector with a nominal trigger threshold of 77° rise heat detector which responds to the rate of change in temperature rather than at a specific temperature. F detectors also have a fixed temperature backstop to ensure that even very slow increases in temperature will an alarm if the increase continues for a sufficiently long period.

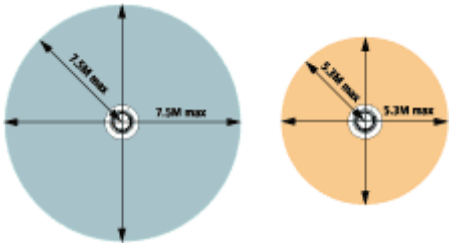
The rate of rise type is the most sensitive type of heat detector, particularly when used in areas where the aml temperature can reach low levels and therefore create a large difference between the ambient temperature ar temperature of a fixed temperature detector.

In order to avoid false alarms rate of rise detectors should not be used in areas subject to frequent temperatu as in kitchens, boiler rooms and warehouses with large doors to open air. BS5839-1 recommends that the sta temperature of a heat detector should be a minimum of 29°C above the maximum ambient temperature likely experienced for long periods of time and 4°C above the maximum temperature likely to be experienced for sh time.

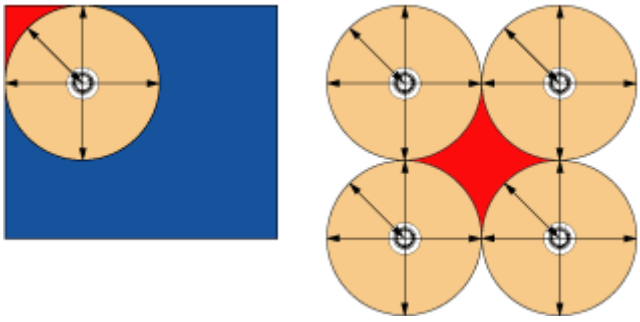
Each type of conventional heat detector is manufactured to have specific characteristics, which cannot be alte analogue systems are more sophisticated, only a single analogue heat detector is produced, the characteristic programmable to suit the relevant application requirements at the time of commissioning and can be altered la

Heat detectors must be mounted closer together than smoke detectors, so whilst the mounting bases are com types, care should be taken to ensure that the spacing between detectors is appropriate for the detector type analogue systems it is possible for the photo thermal detector to act as a thermally enhanced smoke detector times and as a pure heat detector at other times. If this mode of operation is envisaged then spacings must be appropriate for heat detectors.

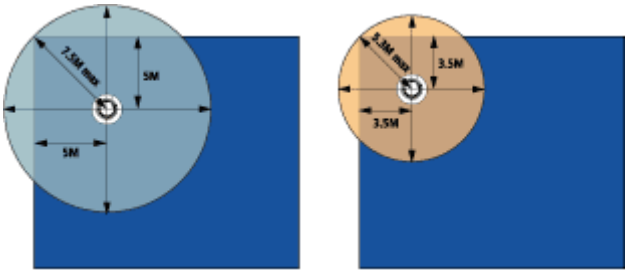
7.5 Positioning of Smoke and Heat Detectors
All smoke detectors have similar spacing requirements, heat detectors also all have similar spacing requirements although these are different to smoke detectors. According to BS5839 for general areas the spacing between any point in a protected area and the detector nearest to that point should not exceed 7.5m for a smoke detector and 5.3m for a heat detector.



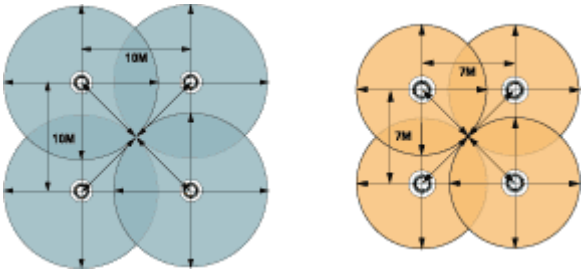
The above are the maximum areas that can be covered by an individual detector. In order to ensure that coverage is provided into the corners of rooms and to ensure that there is no gap at the junction point of multiple detectors, spacings have to be reduced.



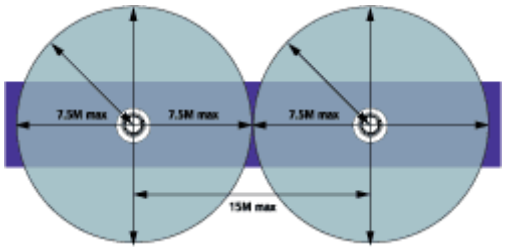
To ensure complete coverage for square layouts, spacings between detectors and walls should be reduced to 5m for a smoke detector and 3.5m for a heat detector.



To ensure complete coverage, spacings between detectors should be reduced to 10.0m between smoke detectors and 7.0m between heat detectors.



For corridors less than 2m wide only the centre line need be considered therefore it is not necessary to reduce detector spacings in order to provide complete coverage. Therefore for smoke detectors spacing becomes 7.5m from a wall and 15.0m between detectors. For heat detectors the spacing becomes 5.3m to a wall and 10.6m between detectors.

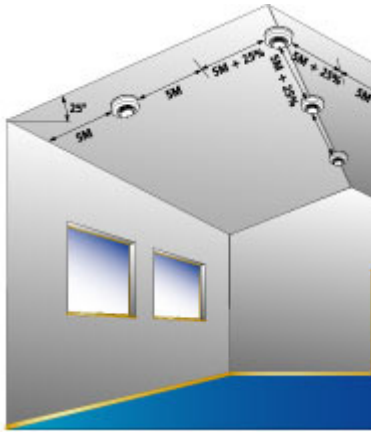


The above data is based on flat level ceilings; for pitched ceilings or ceilings with a non-flat surface, spacings will alter. For pitched ceilings use the data below, for other ceiling types refer to BS5839 for comprehensive guidance. Where detectors must be mounted onto a pitched ceiling, a detector should be mounted near to the apex but spacing can be increased by 1% for each 1° of slope up to 25%. 'Near' is defined as within 600mm for smoke detectors and within 150mm for heat detectors.

7.6 Mounting Heights of Detectors
Under all normal circumstances point type fire detectors should be mounted on the ceiling - this ensures that the height restrictions are met together with the following table.

	Ceiling Heights (m)	
	General Limits	**Rapid Attendance***
Heat detectors - class A1	9	13.5
Heat detectors - other classes	7.5	12
Point type smoke detectors	10.5	15
Optical beam smoke detectors	25	40

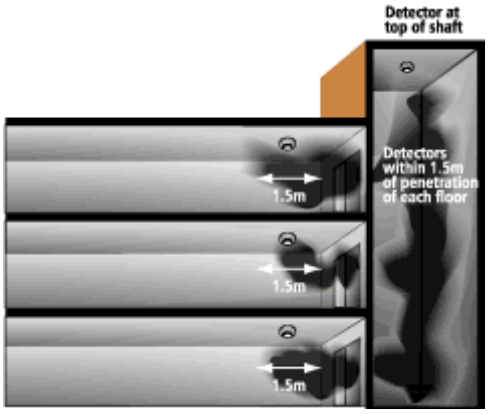
* Rapid attendance values can be used in type P systems providing fire brigade response time is less than 5 minutes



7.7 Beams and Other Similar Ceiling Obstructions
Fire detectors should be mounted at least 500mm away from walls or ceiling obstructions greater than 250mm deep and at least twice the depth of obstructions less than 250mm deep. They should also be mounted at least 1m away from any forced air inlet. Where the obstruction is greater than 10% of the height of an area it should be considered as a wall. Similarly a floor mounted obstruction (such as racking) should be considered a wall if it comes to within 300mm of the height of the detector.

For obstructions of less than 250mm Y s
least 2 x Z

7.8 Lift Shafts
Where detection is required in vertical shafts, such as stairwells, a detector should be mounted at the top of the shaft and within 1.5m at each level.



Typical detector positioning for L2 coverage

7.9 Beam Detectors
Beam detectors provide a cost effective method of covering wide open plan areas, however care should be ta activities in the space do not obstruct the beam and that the building structure is such that the beam does not operation may result.

If optical beam detectors are mounted within 600mm of the ceiling level, they should be positioned such that r protected space is more than 7.5m from the nearest part of the optical beam. Should the beam detector be m than 600mm below ceiling level then spacings should be altered to 12.5% of the height of the beam detector a highest likely seat of any fire.

Other than the part of the beam within 500mm of the beam's transmitter or receiver, if any other section of a b closer than 500mm to any wall partition or other obstruction to the flow of hot gasses, that section of the beam discounted from providing protection.

Where optical beam detectors are mounted in the apex of pitched roofs then the same enhanced spacings ca for point smoke detectors (see above)

The area covered by a single optical beam detector should not exceed that of a single detection zone.

7.10 Aspirating Systems
Aspirating systems should be specified where protection is required in areas such as cold stores or areas whe response to fire is needed, and whilst each sense point can be considered a smoke detector, special training design such systems - particularly as they are normally required to cover special risks. Other specialist detect connected to Cooper Lighting and Security systems via interfaces where there is a specific requirement, such detectors or equipment in areas requiring an intrinsically safe installation.

7.11 Selection of Manual Callpoints
The selection of manual call points is somewhat simpler. Surface or flush types are selected depending on the and whether the fire system is being installed into an existing building (where surface call points are generally install). IP65 types should be specified where there is risk of moisture ingress, for example in external locatior points use a frangible glass element which is designed to break under light pressure triggering the call point ir

condition.

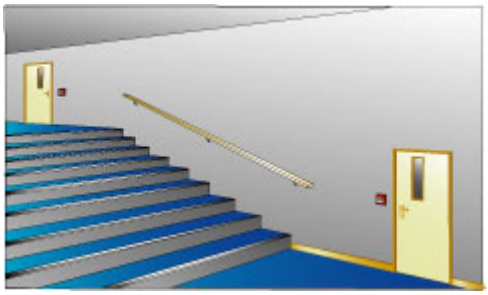
The glass element is covered with a thick plastic film to protect the operator against broken glass, however pla elements and protective flaps can be used where there is the risk of unwanted operation or in food preparatio hinged covers are used these should be recorded as a design variation. Call points can be supplied with LED mounted onto the front face to simplify the location of an operated call point.

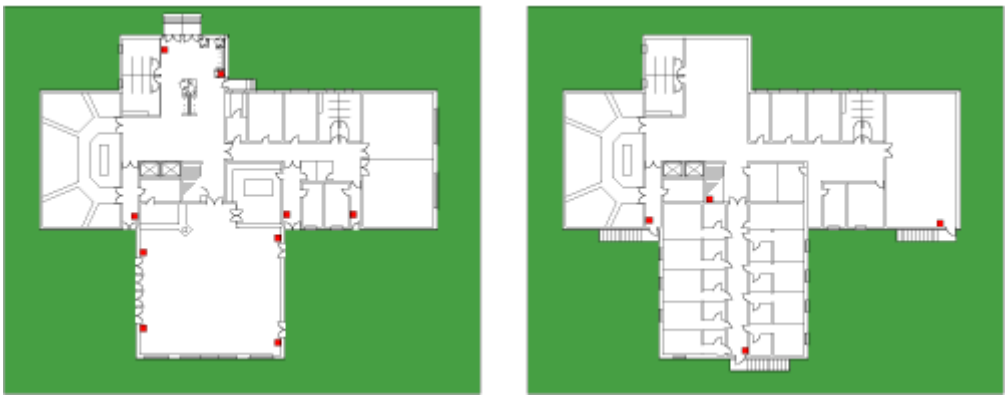
7.12 Positioning of Manual Callpoints
Manual call points should be located on escape routes, at all exits to free air and at all exits from each level of buildings.

For general applications, call points should be located such that nobody need to travel more than 45m to reac call point. This distance is based on measuring the actual route that would be travelled. If at the design stage is unknown then a straight-line distance of 30m should be used as a design guide and the 45m limit verified a complete.

Call points should be located near to specific hazards (e.g. flammable liquid store) and at 1.4m (+/- 0.2m) fron well lit easily accessible positions. Lower mounting heights might be needed to accommodate building users i

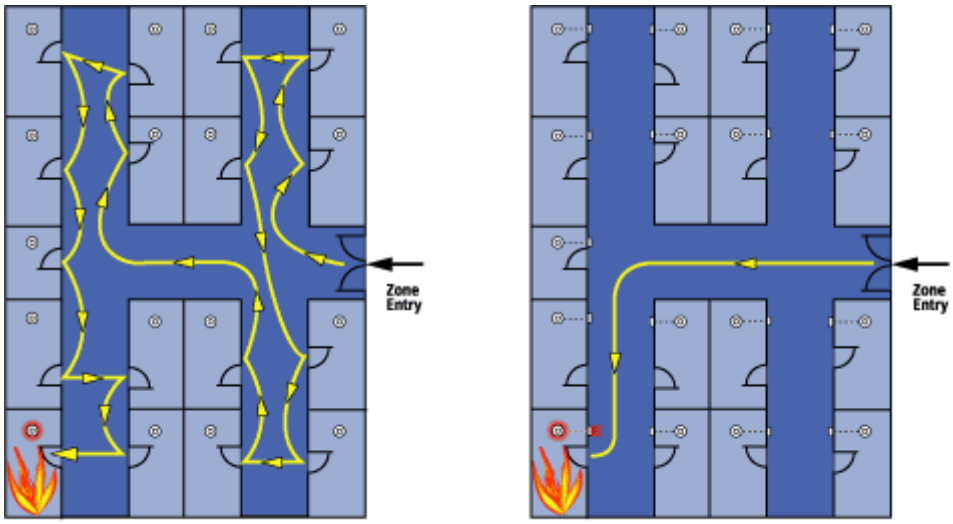
The figures of 45m and 30m above should be reduced to 25m and 16m respectively if either a significant prop building users have limited mobility and it can reasonably be assumed that one of these occupants will be like person to operate the alarm or if the nature of equipment or activity in an area gives a high likelihood of rapid development. The method of operation of call points should be the same throughout the building - all Cooper Security call points meet this requirement, whether IP65 or standard types.





Typical building layout showing positioning of callpoints

7.13 Remote indicators
Remote indicators should be used in areas where the detector mounting position is such that the detector is n viewed, for example in ceiling voids. Remote indicators can also be used to dramatically reduce search distan detectors are mounted inside rooms, such as in hotels, thus simplifying system zoning and reducing the time the source of an alarm.



Without remote indication

With remote indication

7.14 Alarm Devices

Alarm devices fall into two types, audible and visual. The audible types are most common, with a variety of typ
available from bells to all kinds of different electronic sounders including those containing pre-recorded spoke
The choice of device is dependant on local preference, legal requirement and the need to have a tone distinct
building audible alarms.

Speech alarms or links to PA systems overcome some of the complacent responses to warning tones and car
good effect when carrying out regular fire tests in buildings where there are many people unfamiliar with the re
such as hotels. Finally visual alarms are to be used where the hard of hearing may be occupying a building or
ambient noise is such (above 90dBA) that audible warning may not be heard, where hearing protectors are in
the sounder levels would need to be so high that they might impair the hearing of the building occupant.

BS5839-1 requires that Alarm Circuits should be arranged such that in the event of a single fault at least one s
operates within the vicinity of the control equipment; or in the case of certain buildings open to large numbers
public, a single fault only partially reduces the alarm level. This is met by loop-powered devices or by the use
alarm lines for conventional systems, interleaved throughout the relevant area or by use of at least two zones
systems (single zone Bi wire panels have a built-in sounder incorporated within the control panel).

Sound levels should generally be 65dBA or 5dBA above persistent background noise levels. This may be redu
in rooms smaller than 60m2, in stairwells or in specific limited points of the building. Most sounders have adju
levels, which allows a balance between meeting the requirements of the standard and providing a sensible lev
comfort.

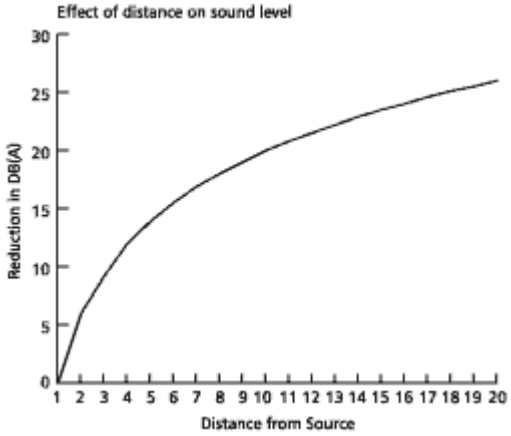
Generally more low output sounders are better than few high output sounders in this respect.

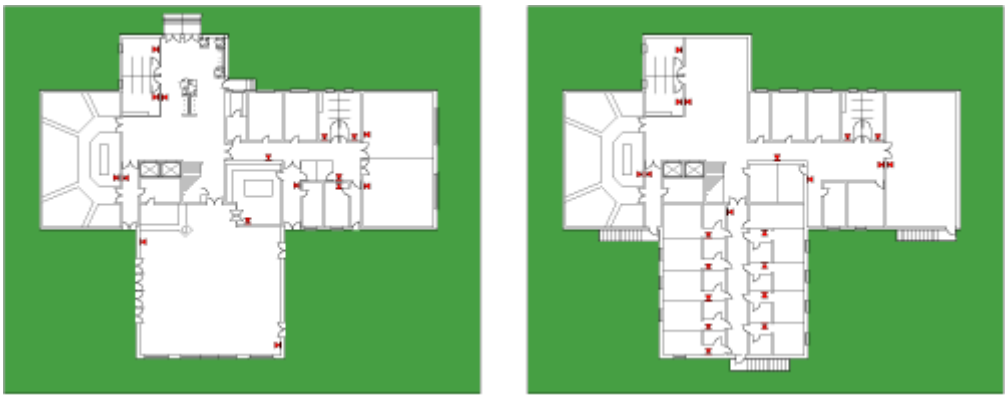
In addition to these general requirements the following specific requirements should also be noted:
- A level of at least 75dBA at the bedhead is required to wake sleeping occupants
- At least one sounder is required per fire compartment
- All of the sounders utilised in a building should emit a similar noise

When considering the number and position of sounders the following should be considered:
- A loss of at least 20 to 30dBA should be allowed for sound going through doors
- Where two identical sounders are in one location the level increases by only 3dBA
- The sound pressure level drops with distance according to the graph below
- It is necessary to consider cable loading requirements when designing sounder circuits. Volt drop should be
than 10% of nominal voltage
- It is recommended to always err on the side of caution when selecting sounders and their locations as it is fa
reduce the volume setting of a sounder where appropriate than to retrofit additional sounders should the initia
inadequate

Sounder output levels are normally quoted in dB(a) at 1m, the graph below can be used to calculate effect on
other distances in free air. In addition allowances have to be made for obstructions such as doors, the absorp
furnishings the directional nature of the sounder, mounting position and location of the sounder etc.

Distance from source (m)	Reduction in DB(A)
1	0
2	6
3	9.2
4	12
5	13.9
6	15.5
7	16.9
8	18
9	19
10	20
11	20.8
12	21.5
13	22.2
14	22.9
15	23.5
16	24
17	24.6
18	25.1
19	25.5
20	26





Typical sounder positioning based on sounder with 105dB(a)

7.15 Fire Protection Equipment

Cooper Lighting and Security provide a range of door holders, interfaces and relays that can be used to contr of smoke vents, hatches, ventilation systems, lifts etc. It is recommended that reference is made to the individ pages of this catalogue or to our technical sales department who will be able to advise on the best type for a p application.

7.16 Alarm Routing Equipment

Alarm output relays are available to connect to alarm routing equipment. The selection of types of routing equ

depend on the requirements of the selected alarm receiving centre.

7.17 Interfaces
The product pages of this catalogue list the range of interfaces that are available, most relate to analogue sys designed for specific applications, such as interfacing an analogue panel to a conventional zone of detectors, interface to a shop etc. Conventional systems can interface directly to volt free contacts by using suitable resi monitoring sprinkler flow switches for example) and are provided with relay outputs in the panels to connect tc routing equipment, fire protection equipment etc.

By definition an interface bridges the gap between two pieces of equipment or two systems, consequently it is consider the requirements of both sides of the interface both from a loading point of view and with regard to fu typical fault scenarios.

The main area of caution is to ensure that the voltage rating of the equipment and interface are compatible. F relay contacts should not be used to switch mains voltage, even if they appear to work and it is best to provide between systems (such as protection and alarm systems) so that there is no risk of electrical interference cau alarms.

8.0 DESIGN REVIEW TO MINIMISE FALSE ALARM POTENTIAL

False alarms have the potential to cause substantial disruption to the smooth running of a business and in addition place a tremendous burden on fire service resources.
Regular false alarms can cause building users to disregard alarm signals leading to incorrect actions in the event of a real fire situation. False alarms can broadly be divided into four categories,
- Unwanted alarms
- Equipment false alarms
- Malicious false alarms
- False alarms with good intent

Unwanted alarms are those that are caused by a combination of factors such as environmental conditions, fire like phenomena such as steam, aerosol spray or dust triggering smoke detectors or by inappropriate action by people in the building such as smoking in areas protected by smoke detectors.

The following is designed to assist with selection of equipment to avoid common potential unwanted alarm conditions, BS5839 gives comprehensive guidance on the subject and should be consulted for in depth guidance.

Photo thermal detectors analyse both change in temperature as well as density of smoke or smoke like phenomena. This can considerably reduce the potential for false alarms. In addition with analogue systems it is possible to configure the detector to operate in heat only mode at specific times when smoke or smoke like phenomena is likely to be present and then to revert to combined smoke and heat detection when the presence of smoke is no longer expected.

Area	
Kitchen	Smoke d should r
Areas close to kitchens	Avoid ra detector Avoid sr if possib Do not ir smoke d Conside detector
Rooms in which toasters are used	Avoid sr if possib Do not ir smoke d Conside detector
Rooms in which people smoke	Avoid sr if possib Do not ir smoke d Conside detector
Bathrooms shower rooms and areas where steam occurs	Avoid sr if possib Do not ir smoke d Conside detector
Areas with high dust concentrations	Avoid sr if possib Do not ir smoke d Conside detector
Areas where the sensing element is subject to high air velocity	Do not ir smoke d
Areas in which engine	Avoid sr

exhaust fumes occur	if possib Do not i smoke c Do not i detector Conside detector
Areas close to openable windows	Avoid sr if possib Do not i smoke c

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9.0 CABLES

BS5839-1:2002 introduced more onerous requirements for the types of cables used in fire detection and alarm Fireproof cables should now be used for all parts of the system and enhanced fire resistance cables should be there is a requirement to ensure cable integrity over a longer period of time. For example when connecting to or where the connection between sub-panels provides any part of the alarm signal path.

Fire alarm cables should be segregated from the cables of other systems; they should be clearly marked, pref red and should be routed through parts of the building that provide minimum risk. This latter point is particularl where the use of the building is being changed - for example if a fuel store is being moved.

10.0 MAINTENANCE

Regular testing and inspection of the fire alarm system is essential to ensure that it is operating correctly. Mar functions of the system are monitored but it will still require an inspection of the panel by the responsible pers fault indication and all such events should be entered into the system log together with the implementation of investigate the reason for the fault and a repair/correction program.

The Cooper Lighting and Security service division is able to provide this function. The advantage of making us is that the service department will have ready access to all spares and to information relating to possible desig specification enhancements that invariably happen over time.
BS5839-1 recommends the following minimum regular tests and inspections:
Daily - Check to see if the system is indicating fault and that any corrective actions have taken place.
Weekly - Test the system by operating a manual call point (different one each week).
Periodic Inspection - Subject to risk assessment, should not exceed 6 months between visits. Check the sys ensure that corrective actions have taken place. Visually inspect all items of equipment, to ensure that the sys obstructed or rendered inappropriate by change of use. Check for any false alarms, compare to nationally acc and take appropriate action if unacceptable. Test the system on standby power to ensure that the battery is fu correctly. Check all outputs for correct operation. Check all controls and indicators. Check remote signalling e Additionally any other special checks - for example beam detectors for correct alignment.
Over 12 month period - Carried out over 2 or more visits.
In addition to the periodic inspection: Test all manual call points and fire detectors for correct operation. Inspe detector levels to ensure that they are within correct levels.
Check all alarm devices for correct operation. Visually inspect all accessible cable fixings. Confirm the cause programming is correct and up to date.

11.0 SYSTEM EXTENSIONS

An extension to a fire alarm system should be planned and implemented with the same care and considerati to the original system. There is always a risk that small extensions may affect the integrity of the whole systen is needed if a different manufacturer is chosen for the extension to ensure that there is compatibility between equipment and to ensure that system loading constraints are met.