Fire alarm system 2-2020

ENGFREELANCER
Work in a different way

INTRODUCTION:

The aim of the system is to make an early warning indicating that the building has a fire and to allow people to be able to vacate the building in a timely manner and give a signal to the firefighting system to start working.

THE SYSTEM COMPONENT:

1) Detectors
2) Manual call point
3) Bell / alarm devices
4) Fire alarm control panel
5) Other items.

1- DETECTORS:

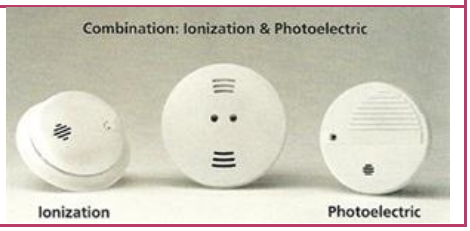
The function of the sensors is to detect the presence of fire and thus is the main component of the system.

DETECTORS TYPE:

The function of the sensors is to detect the presence of fire and thus is the main component of the system. Detector types include:

Smoke detectors:

The smoke detector is responding to smoke particles in the air. And it is the most used type.

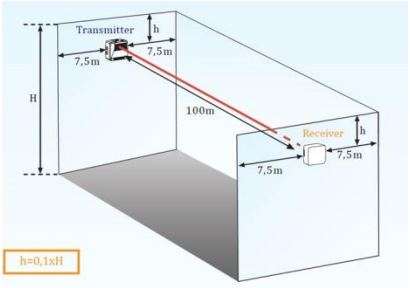
Type A: Ionization Smoke detector: It responds to very small smoke particles. It is most sensitive to hot fast burning fires. Don't locate them near cooking areas, or in locations subject to high air velocity.	
Type B: photo-optical smoke detector It is measure the scattered light from smoke particles. Don't locate in area's subject to steam	
Type C: combination smoke detector In addition to individual ionization and photoelectric detectors, combination detectors that include both technologies in a single device are available. It used in important rooms for more protection.	

Heat detectors:

Heat detectors respond to the temperature.

Type A: Fixed temperature: he most common fixed temperature point for electrically connected heat detectors is 58°C (136.4°F).	
Type B: Rate-of-Rise Rate-of-Rise (ROR) heat detectors operate on a rapid rise in element temperature of 6.7° to 8.3°C (12° to 15°F) increase per minute, irrespective of the starting temperature.	
Type C: Fixed temperature & Rate-of-Rise Combination detectors that include both technologies in a single device are available. It used in important rooms for more protection.	

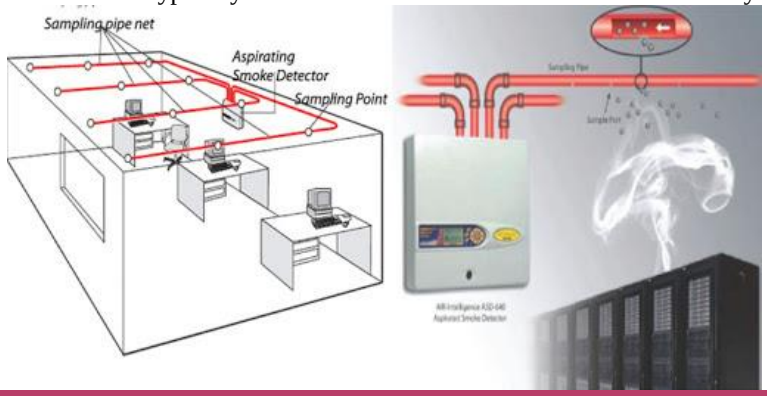
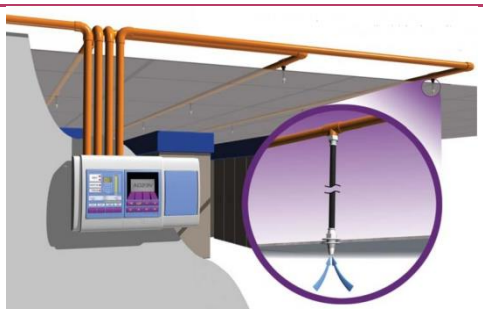
Beam smoke detectors

- For high-ceiling buildings - The linear smoke detector works according to the reflection principle: It sends infrared light to a reflector, which sends it back immediately. - The linear smoke detector provides a flexible monitoring distance of 5 – 100 m. 	

Flame detectors:

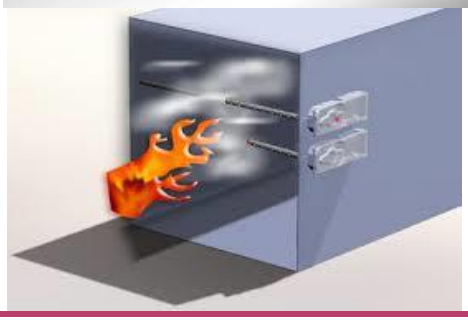
Optical flame detectors: A flame detector is a sensor designed to detect and respond to the presence of a flame or fire, allowing flame detection. Types: - Ultraviolet detector - Near IR array - Infrared - Infrared thermal Cameras - UV/IR - IR/IR flame detection - IR3 flame detection - 3IR+UV flame detection - Visible sensors - Video	 
Ionization current flame detection: Such detectors can be used in large industrial process gas heaters and are connected to the flame control system. They usually act as both flame quality monitors and for flame failure detection. They are also common in a variety of household gas furnaces and boilers.	
Thermocouple flame detection: Thermocouples are used extensively for monitoring flame presence in combustion heating systems and gas cookers. A common use in these installations is to cut off the supply of fuel if the flame fails, in order to prevent unburned fuel from accumulating. These sensors measure heat and therefore are commonly used to determine the absence of a flame. This can be used to verify the presence of a Pilot flame.	

Very Early Smoke Detection Apparatus (VESDA) /Aspirated smoke detectors (ASD)

- consisting of a central detection unit which draws air through a network of pipes to detect smoke - It provides the earliest possible warning of an impending fire hazard. - ASDs can typically detect smoke before it is visible to the naked eye. 	

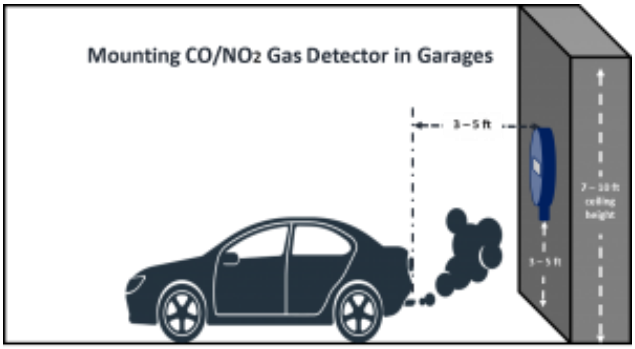
Duct detectors:

- Duct smoke detectors, when installed in HVAC systems, automatically stop their respective fans upon the detection of smoke.
- For HVAC systems with airflows exceeding 2,000 cfm, duct smoke detectors are required.



Gas detectors:

- This type of equipment is used to detect a gas leak or other emissions and can interface with a control system so a process can be automatically shut down.
- CO gas detector at garage
- O2 gas detector at hospital " At Oxygen cylinder storage"
- And other



There are many shapes and models for each type, depending on the manufacturer

DETECTOR TYPE SELECTION:

According to area application

Recommended fire detectors for different applications

Location	Ionisation smoke	Photoelectric smoke	Linear beam smoke	Aspirated smoke	Carbon monoxide (CO)	Fixed temperature Thermal	Rate of rise thermal	Flame	Specific fire engineering
Bedrooms/sleeping areas	✓	✓	ok	ok	✓	ok	ok	ok	ok
Offices, shops	✓	✓	ok	ok	✓	✓	ok	ok	ok
Auditoriums/clubs (theatrical smoke)	x	x	x	x	✓	✓	ok	ok	✓
Autoclave/sterilizer areas	x	x	x	x	✓	✓	x	ok	ok
Bathrooms/laundries	x	x	x	x	ok	✓	x	ok	ok
Boiler/furnace rooms	x	x	x	x	x	✓	x	x	ok
Car parking [1]	x	x	ok	x	xx	✓	✓	ok	ok
Ceiling or roof voids with access	ok	ok	ok	ok	ok	✓	ok	ok	ok
Ceiling or roof voids difficult access	x	x	ok	ok	x	✓	ok	ok	✓
Cleaners'/understair cupboards	x	x	x	x	x	✓	✓	ok	ok
Cool rooms/freezers[2]	x	x	x	ok	x	ok	✓	ok	✓
Electrical risers	✓	✓✓	x	ok	x	✓	ok	ok	ok
Electrical switchrooms/cupboards	✓	✓✓	ok	ok	x	✓	ok	ok	ok
Flammable liquid hazard areas[3]	✓✓	✓	ok	ok	x	✓	ok	✓	ok
Forced air flow/draughts	x	✓	ok	ok	ok	✓	ok	ok	✓
Fume cupboards[3]	x	x	x	x	x	✓	✓	ok	✓

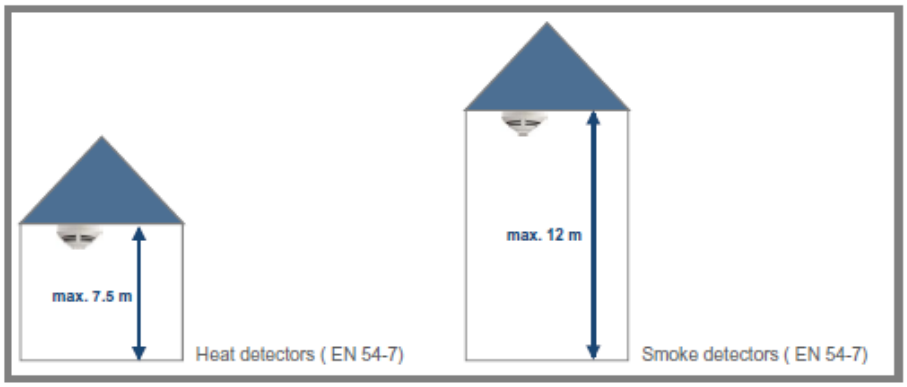
Location	Ionisation smoke	Photoelectric smoke	Linear beam smoke	Aspirated smoke	Carbon monoxide (CO)	Fixed temperature Thermal	Rate of rise thermal	Flame	Specific fire engineering
High/difficult access ceilings	ok	ok	✓✓	✓	✓	ok	ok	ok	✓
HVAC duct sampling	ok	✓	ok	ok	x	x	x	x	✓
Ice rinks[1]	ok	x	ok	ok	ok	✓	✓	ok	ok
Kitchens	x	x	x	x	ok	✓	x	x	ok
Kitchen extract ducts [1]	xx	xx	xx	xx	x	✓	x	x	ok
Paint spray booths(s)[3]	x	x	x	x	x	✓	ok	ok	ok
Service shafts	✓	✓	✓	ok	✓	ok	ok	ok	ok
Stables[1]	x	x	ok	x	✓	✓	ok	ok	ok
Warehouse with vehicles and / or non-electric forklift	xx	✓	ok	ok	xx	✓	ok	ok	ok
<1.8m from rooms containing bath, shower, or steam source	x	x	x	ok	✓	✓	x	ok	✓

KEY - ✓✓ strongly recommended ✓ recommended ok may be used
X not advised xx do not use

NOTE –
(1) Environmental protection may also be required.
(2) Cold rooms and freezers can be difficult to reliably protect and will usually need special engineering including heaters to prevent ice build-up on detectors, manual call points and alerting devices.
(3) Hazardous area.

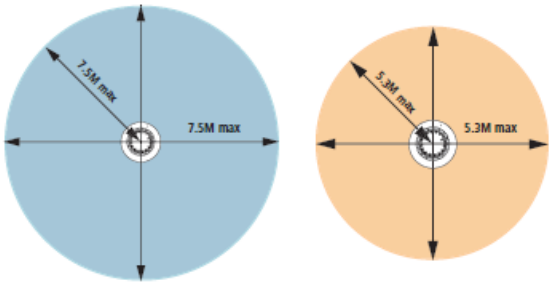
According to building height

Room height	Soke detectors DIN EN 54-7	Heat detectors DIN EN 54-5:1989-09			Flame detectors DIN EN 54-10
		Class 1	Class 2	Class 3	
		Heat detectors DIN EN 54-5:2001-03			
		Class A1	Class A2, B, C, D, E, F and G	-------	
Up to 45 m	Not suited	Not suited	Not suited	Not suited	suited
Up to 16 m	Not suited	Not suited	Not suited	Not suited	suited
Up to 12 m	suited	Not suited	Not suited	Not suited	suited
Up to 7,5 m	suited	suited	Not suited	Not suited	suited
Up to 6 m	suited	suited	suited	Not suited	suited
Up to 4,5 m	suited	suited	suited	suited	suited



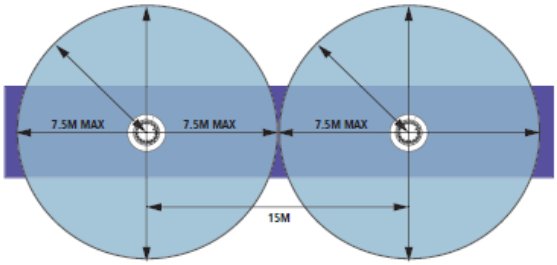
DETECTOR COVERAGE AREA:

The covered area should be reviewed according to the manufacturer

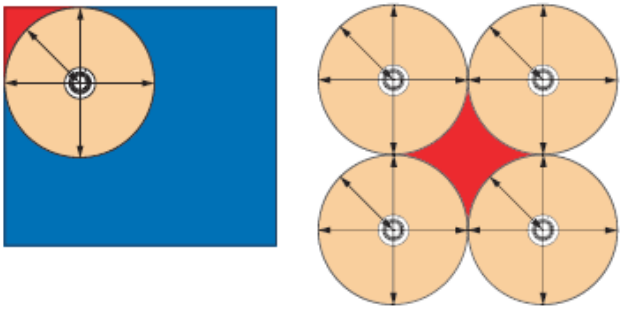


Area of coverage for a smoke detector

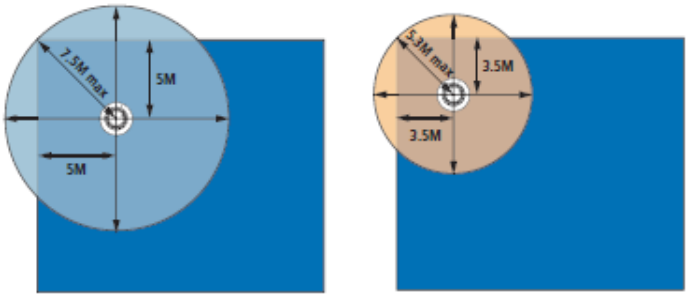
Area of coverage for a heat detector

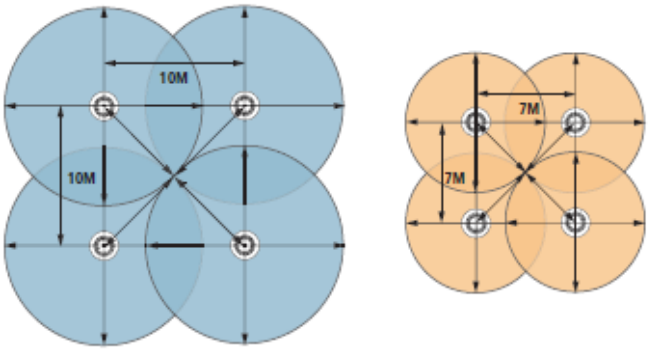


Corridor spacing for smoke detectors



= Missed coverage in the corners of rooms and intersections





Spacings between smoke detectors

Spacings between heat detectors

DETECTOR COVERAGE AREA NOTES:

Heat detector spacing distance effective by the Ceiling height

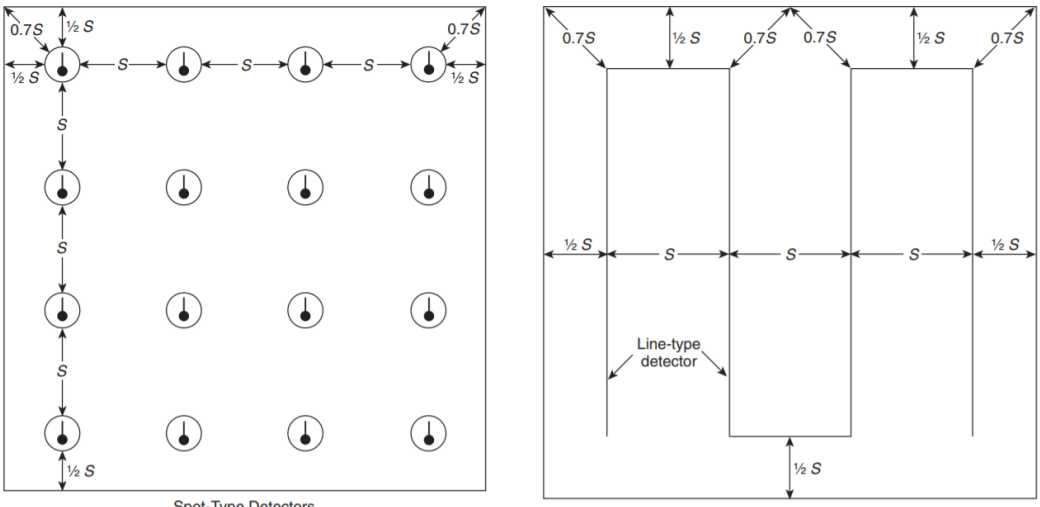
Table 17.6.3.5.1 Heat Detector Spacing Reduction Based on Ceiling Height

Ceiling Height Greater than (>)		Up to and Including		
ft	m	ft	m	Multiply Listed Spacing by
0	0	10	3.0	1.00
10	3.0	12	3.7	0.91
12	3.7	14	4.3	0.84
14	4.3	16	4.9	0.77
16	4.9	18	5.5	0.71
18	5.5	20	6.1	0.64
20	6.1	22	6.7	0.58
22	6.7	24	7.3	0.52
24	7.3	26	7.9	0.46
26	7.9	28	8.5	0.40
28	8.5	30	9.1	0.34

17.6.3.5.2

For line-type electrical conductivity detectors *(see 3.3.70.11)* and pneumatic rate-of-rise tubing heat detectors (*see 3.3.70.15)*, which rely on the integration effect, the derating required by Table 17.6.3.5.1 shall not apply, and the manufacturer's published instructions shall be followed for appropriate alarm point and spacing.

DETECTORS DISTRIBUTION:



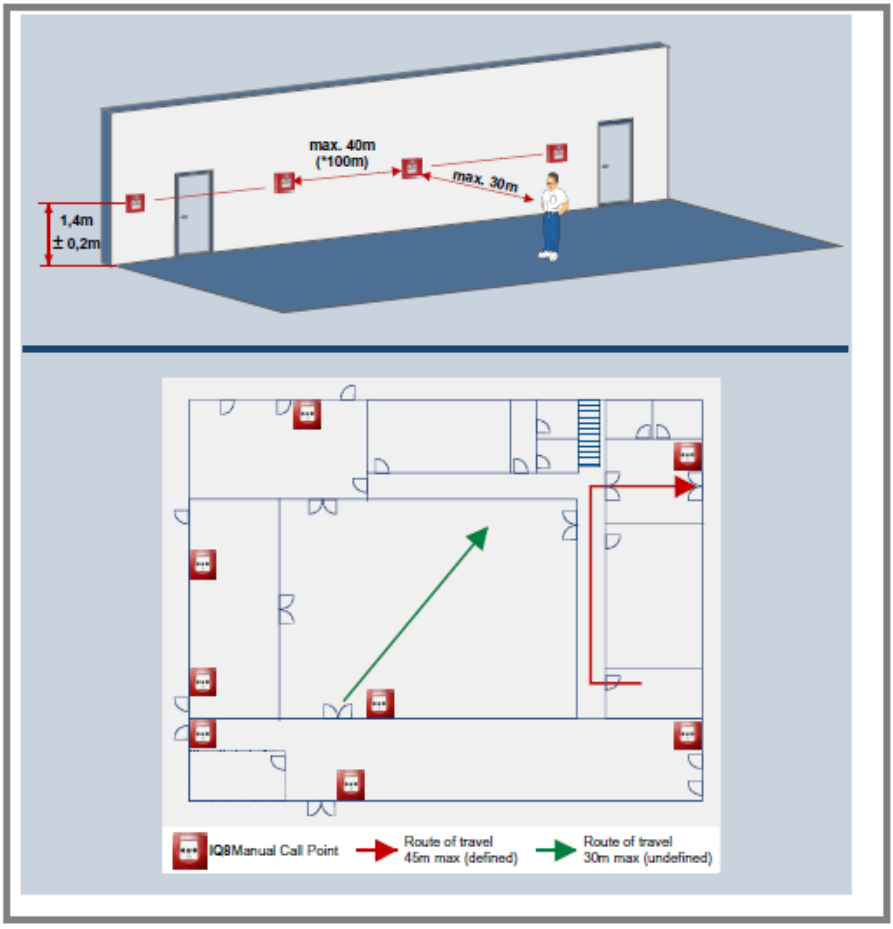
Heat Detectors—Spacing Layouts, Smooth Ceiling

Heat Detectors

S— Space between detectors

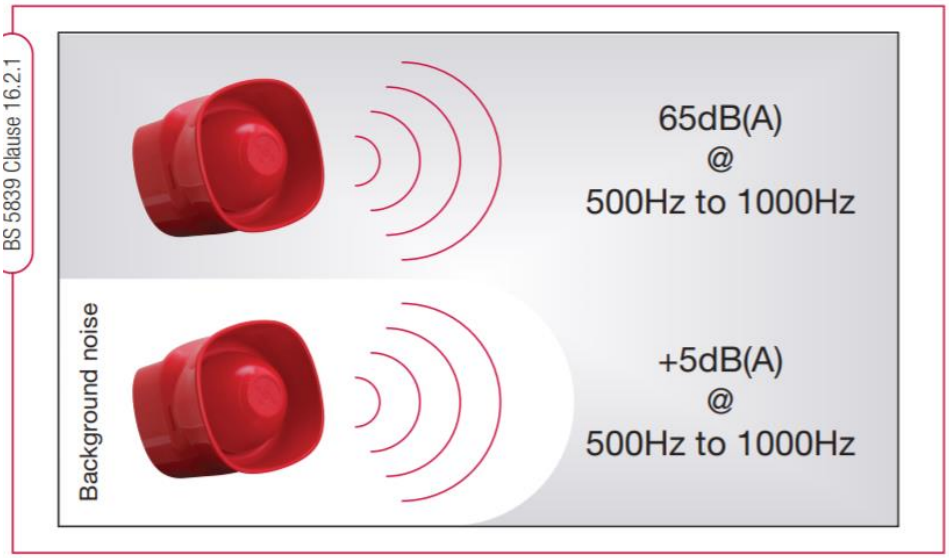
2- BREAK GLASS FOR MANUAL FIRE CALL POINT:

- A manual call point is a device which enables personnel to raise an alarm in the event of a fire incident by pressing a frangible element to activate the alarm system.
- A fire alarm call point should be installed at a height of 1.4m above floor level at easily accessible and conspicuous positions. This includes on exit routes, at the entry floor landing of staircases and at all exits to the open air.
- A fire alarm call point should also be spaced so that one may always be found within a maximum distance of 30m apart.



3- ALARM ITEMS:

The minimum sound level of a sounder device should be 65dB(A) or 5dB(A) above a background noise (if lasting more than 30 seconds) and at a frequency between 500Hz and 1000Hz. The maximum sound level should not exceed 120dB(A).

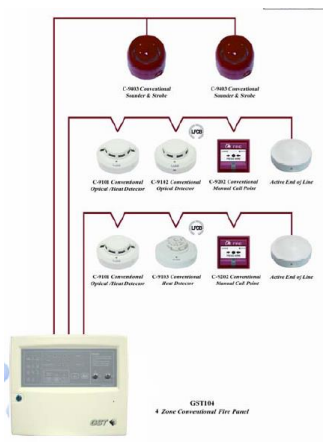


4- **FACP fire alarm control panel:**

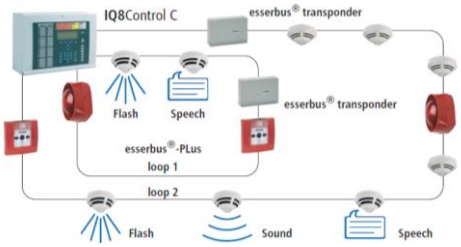
The panel receives information from devices designed to detect and report fires, monitors their operational integrity and provides for automatic control of equipment, and transmission of information necessary to prepare the facility for fire based on a predetermined sequence. The panel may also supply electrical energy to operate any associated initiating device, notification appliance, control, transmitter, or relay. There are four basic types of panels: coded panels, conventional panels, addressable panels, and multiplex systems.

There are different types of panels:

Conventional type:

Conventional fire alarms are ideal for small buildings, such as individual offices or retail shops. They go off individually when they detect smoke or heat and will help everyone escape from your building safely and quickly. Conventional fire alarms can be set up in zones, with each zone hardwired to a control panel or zone expander. Conventional fire alarm systems are much less expensive and require significantly less labor to install.	

Addressable type:

Addressable fire alarms are a necessity for large building complexes or campuses. Since they show exactly which devices are going off, it makes it extremely easy to figure out either where there is a fire or, in the event of a false alarm, which specific device is having a problem. Another benefit of addressable fire alarms is that they require less cabling than conventional fire alarms. All of the devices installed as part of an addressable fire alarm system connect to a single cabling loop that runs through the entire premises, making it easy to add new devices to the existing system.	

5- other items:

Control module		It is a device that responsible for sending a signal from fire alarm panel to other systems such as: - Electrical panel to shut down at fire case - HVAC system to shut down at fire case - Stairs fan to work - Elevator to down to the floor and stop working at fire case - Fire alarm bell - Access control
Monitor module		It is a device that responsible for sending a signal from other systems to fire alarm panel such as: - Firefighting valve zones at each floors - Firefighting pumps If the fire fighting started to work, fire alarm panel will receive a signal from monitor module and starting the alarm

Isolation module		Module to isolate a fault at the fire alarm loop put each 20 device of the loop. There is a detector include isolator module at its base
MIMIC PANEL		A Fire Alarm LED Graphic Annunciator / Mimic Panel is effective method to quickly convey critical information to the people who must respond to alarms. Placed in public places, especially in high-rise building, indicating escape paths
Battery for fire alarm panel		Battery to ensure continued work

Battery calculation:

DESCRIPTION	STANDBY CURRENT PER UNIT (AMP)		QUANTITY		TOTAL STANDBY CURRENT PER ITEM	ALARM CURRENT PER UNIT (AMP)		QUANTITY		TOTAL ALARM CURRNT PER ITEM
FIRE ALARM CONTROL PANEL	0.4	X	1	=	0.4	0.4	X	1	=	0.4
Fire Alarm Bell	0	X	31	=	0	0.225	X	31	=	6.975
Fire Alarm Horn With Strobe Light	0	X	3	=	0	0.225	X	3	=	0.675
MANUAL CALL POINT	0.0004	X	31	=	0.0124	0.0065	X	31	=	0.2015
SMOKE DETECTOR WITH AUDIBLE BASE	0.0004	X	128	=	0.0512	0.0065	X	128	=	0.832
SMOKE DETECTOR	0.0003	X	243	=	0.0729	0.0065	X	243	=	1.5795
HEAT DETECTOR	0.0003	X	14	=	0.0042	0.0065	X	14	=	0.091
Combined Smoke Heat Detector	0.0003	X	28	=	0.0084	0.0065	X	28	=	0.182
MIMIC	0.03	X	14	=	0.42	0.15	X	14	=	2.1
FAULT ISOLATOR	0.0004	X	31	=	0.0124	0.005	X	31	=	0.155
CONTROL MODULE	0.0004	X	12	=	0.0048	0.007	X	12	=	0.084
MONITOR MODULE	0.0004	X	7	=	0.0028	0.007	X	7	=	0.049
	TOTAL SYSTEM STANDBY CURRENT (AMP)				0.9891	TOTAL SYSTEM ALARM CURRENT (AMP)				13.324

STANDBY CURRENT:	24	HOURS	*	1/60 =	0.5	
ALARM CURRENT:	30	MINUTES				

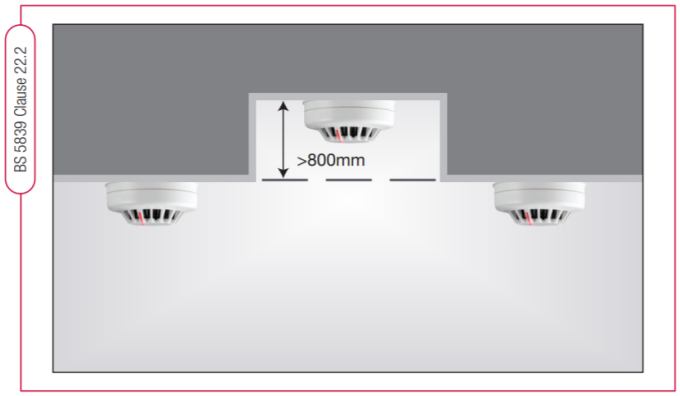
PREPARED FOR:	REQUIRED STANDBY TIME(HRS)		TOTAL SYSTEM STADBY CURRENT (AMP)		REQUIRED STANDBY CAPACITY (AMP-HOURS)	REQUIRED ALARM TIME (HRS)		TOTAL SYSTEM ALARM CURRENT (AMP)		REQUIRED ALARM CAPACITY (AMP-HOURS)
	24	X	0.9891	=	23.7384	0.5	X	13.324	=	6.662

REQUIRED STANDBY CAPACITY (AMP-HOURS)		REQUIRED ALARM CAPACITY (AMP-HOURS)		TOTAL CAPACITY (AMP-HOURS)	TOTAL CAPACITY (AMP-HOURS)		SAFETY FACTOR		ADJSTED BATTERY CAPACITY (AMP-HOURS)
23.7384	+	6.662	=	30.4004	30.4004	X	1.25	=	38.0005

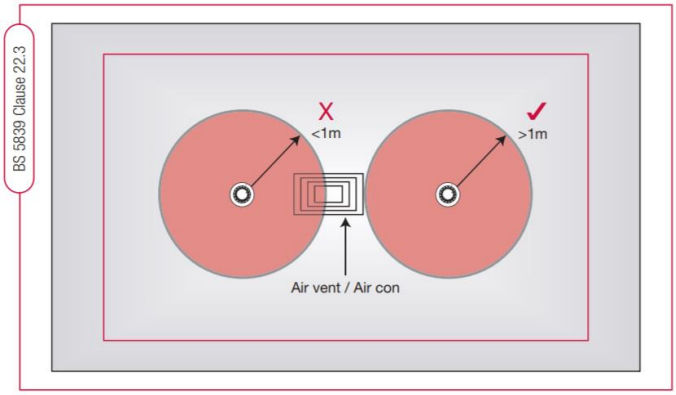
USE: 2X12V, 40 Ah

GENERAL NOTES:

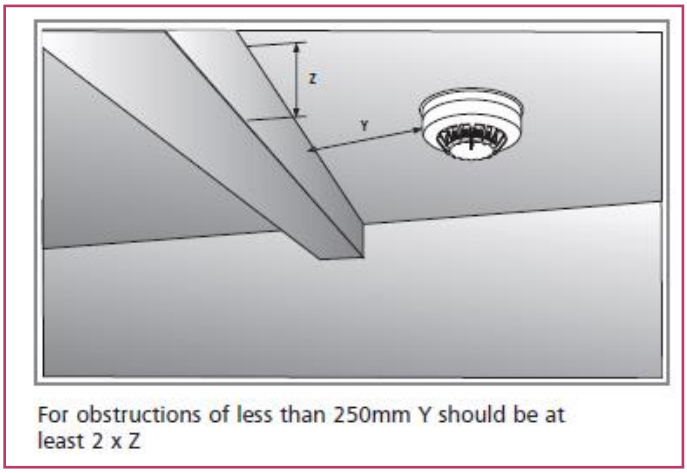
Detectors distribution:



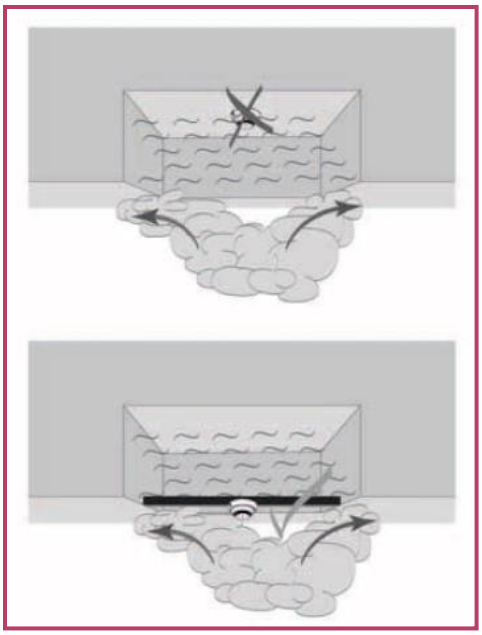
Voids less than 800mm in height are required to have a risk assessment to determine if AFD is required. Voids in excess of 800mm do require independent coverage.

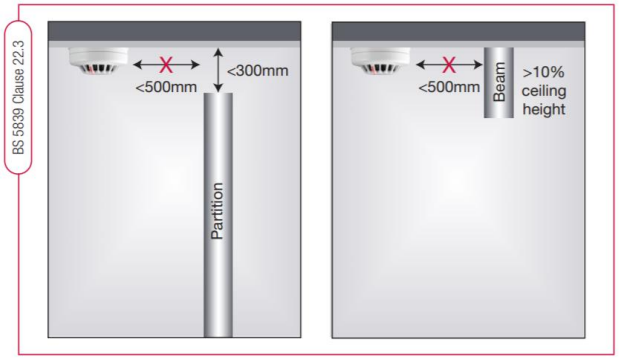


Do not site detectors less than 1m from air inlets or air circulating systems.

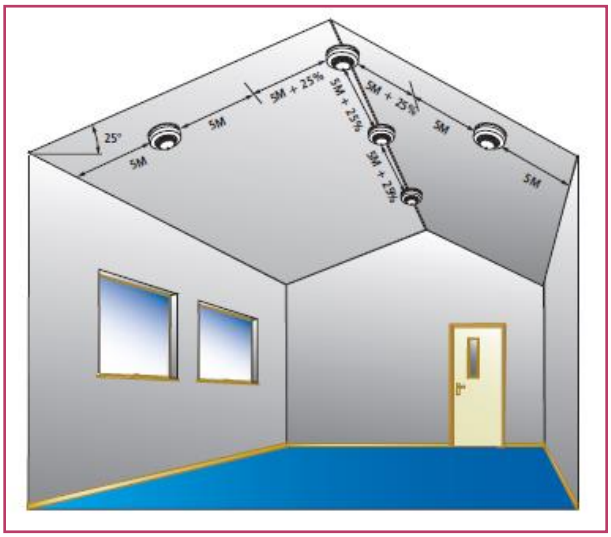


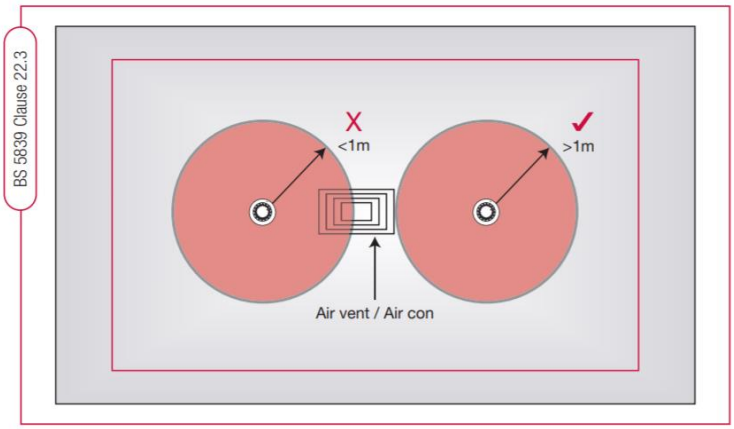
For obstructions of less than 250mm Y should be at least 2 x Z





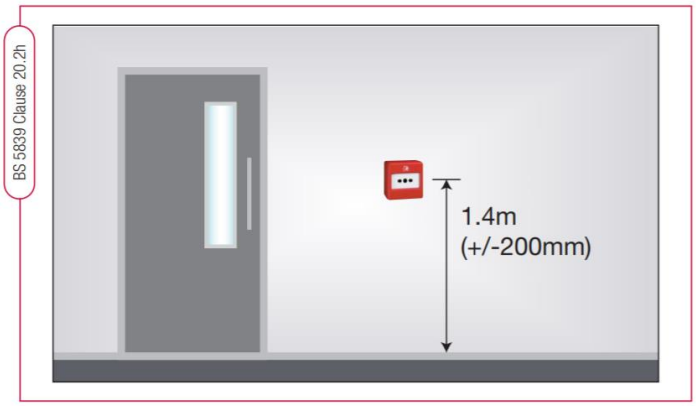
A device should not be mounted within 500mm of any obstruction. If the top of a solid partition is less than 300mm from the ceiling then it should be treated as a wall. Similary, ceiling obstructions such as beams should be treated as walls if deeper than 10% of the ceiling height (particularly important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





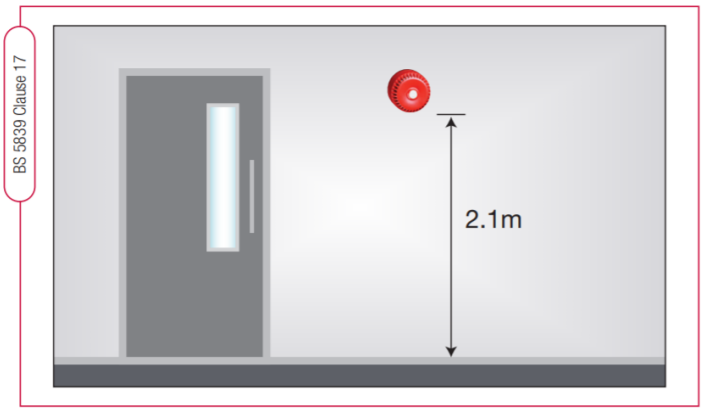
Do not site detectors less than 1m from air inlets or air circulating systems.

Call point:

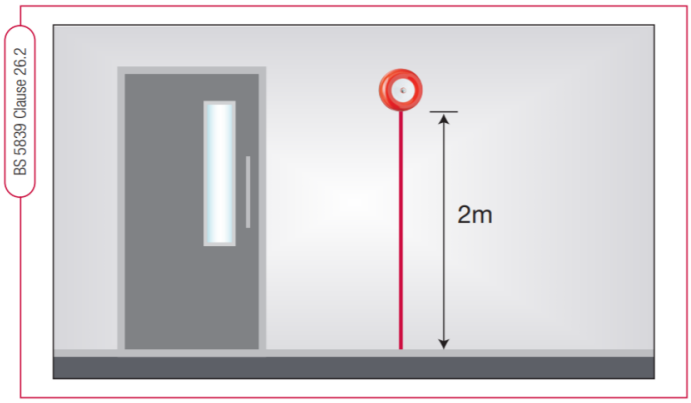


The centre of the element of the manual callpoint should be positioned 1.4m (+/-200mm) from floor level (unless a wheelchair user is likely to be the first person to raise the alarm, when this is applicable it should be noted on any certification).

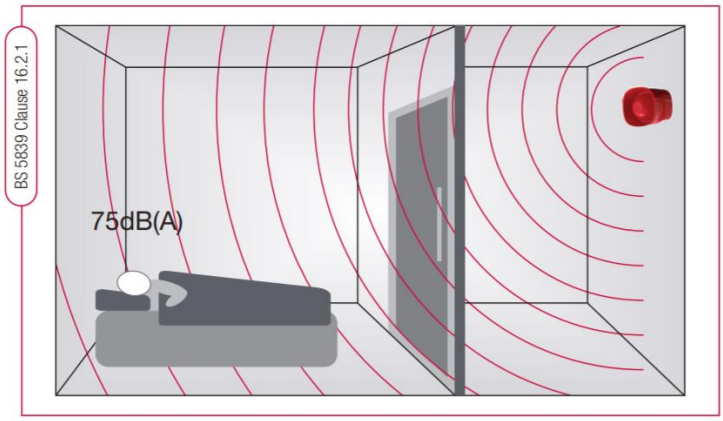
Bell:



Visual alarms such as beacons should always be mounted at a minimum height of 2.1m from floor level, in a position that is likely to attract attention.



Unless MICC or armoured cable to BS7846 standard is used, consideration should be given to the protection against physical damage from floor level to the height of 2m. Except in relatively benign areas, such as shops, offices and similar, where cabling can be clipped to robust walls.



For areas where people are sleeping, sounder devices should produce a minimum 75dB(A) at the bed-head with all doors shut. In buildings likely to provide sleeping accommodation for the hearing impaired, consideration should be given to the incorporation of both audio and visual devices.

At bedrooms especially at hotels, detector with sounder base used

Sources

- NFPA
- Cooper A guide to fire alarm systems design BS 5839 Part 1:2002
- menvier FIRE SYSTEM DESIGN GUIDE
- PDH Course M219
  www.PDHonline.org
  Introduction to Fire Alarm & Detection Systems
  Course Content
- siemens synova tm product catalog
- global system technology fire alarm datasheet
- Novar GmbH a Honeywell Company

By: Eng: Eman Mohamed

Facebook page: Engfreelancer

Blogger: Engfreelancer

2-2020