

## **Fire Alarm System Design Overview.**

### **Introduction.**

Firstly, please do NOT take this offering as anything other than it is intended, which is a broad outline of the British Standard, and generally accepted, procedures for design of a Fire Detection and Alarm System. The complexity of fire regulations, Standards, and other affecting legislation makes it impossible to impart anything other than the broadest of guides.

It is important to note several points, before I go any further.

Please, never, ever lose sight of the fact that a fire alarm system (strictly, Fire Detection and Alarm, but referred to as Fire Alarm for brevity has one intended purpose in operation – and that is the earliest possible detection of the outbreak of fire, and subsequent notification of that outbreak.

In the growing majority of cases, a fire alarm system is installed for the protection of LIFE, rather than simply the protection of property, though the requirement may be for property rather than life.

It is sound advice, whichever category of system is specified, to treat the system as though the purpose of it was to protect life, as it will, in any manned premises, carry out that function at least some of the time.

Fire alarm systems, unlike electrical installations, have NO means of safety from risk built in. A typical fire alarm system cannot under any circumstances prevent the risk it is designed to warn against, whereas in an electrical installation that job is carried out by fuses, breakers, RCDs, and so on.

That said, all BS 5839 compliant systems will have a high degree of fault monitoring – early warning – of faults and potentials faults, and will, if properly designed, and installed, remain both fault tolerant, and fault resilient, to the maximum possible extent.

The final piece of advice I give is this (and I generally give this in all cases in all work we each undertake): If in ANY doubt whatsoever, seek expert advice. Never be afraid to admit you don't know. That holds especially true in fire system engineering – an “I didn't know” doesn't bring back a life lost.

## Initial Considerations.

Contrary to all expectation, fire alarm system design does not start with selection of panel, protocol, detection device, or the amount of noise it should make.

Any good design will start with consultation – with all relevant parties (this may include building regulations Officers, architects, fire authorities, the building owner, insurers, and other fire specialists), Risk Assessment, an understanding of the limitations of fire alarm systems, and a thorough knowledge of the building design, plan, and use.

You cannot hope to design an effective system without knowing exactly what the reasons for installation of a fire alarm are.

From all of this, it is possible to come to a conclusion as to what is expected of the fire alarm system, and how it can best meet the needs of the building, and its occupiers. This information gathering should have revealed:

The Standard to which the fire alarm system is required to comply – for commercial, or non-residential premises, and for larger residential premises and HMOs, this will almost certainly be either of:

- British Standard 5839-1:2002+A2:2008
- EN54 – the European Norms suite for Fire Alarm systems.

\*\* It is still exceedingly rare in the UK that a system will be designed or specified to comply with EN54 as in most regions of the UK, CFA policy across the board is that parts of the EN54 suite will not meet the minimum required technical or operating characteristics allowed for in BS 5839.\*\*

For Residential Premises, and most small HMOs:

- British Standard 5839-6:2004

In addition, the consultation and assessment phase of the design should also have established:

- ***Total area to be protected.***
- ***Specific obstacles to provision of detection.***
- ***Particular risks which the fire alarm must consider and react to.***
- ***The scope of operation of the system.***
- ***Specific requirements for installation.***
- ***Use of the building.***
- ***Building floor plans.***

Each of these areas has a part to play in defining the design of the system. A brief explanation of these considerations follows:

### **Total Area.**

Total area, in square metres, is important to design, because there is a maximum permissible area for each zone within a fire alarm system of 2000sq m, subject to certain exclusions – a zone should only ever cover a single floor, unless the overall area of the building is less than 300 sq m, in which case the building in its entirety can be considered as a single zone, or in the case of open warehousing, again, subject to certain criteria, a zone may extend on a single floor to an area of 10,000 sq m.

Zones are less important, but still good practice, on analogue addressable systems, where it is possible for a fire brigade to identify the precise location of the fire at the control equipment.

### **Specific Obstacles to provision of Detection, and Particular Risks.**

This point considers building design – specifically something called compartmentalisation. This refers to areas within a building which are essentially enclosed by fire resisting barriers of one type or another. Whilst the building design may limit the spread of fire through the use of compartmentalisation, it also has the downside that fire can take significant hold, and cause danger long before anyone is aware of it.

The other aspect of this point is areas which can further the spread of fire, by acting as conduits, or fuel sources (because they propagate the supply of air (oxygen) to the fire. These areas include voids, lift shafts, service risers, HVAC systems, many types of plant and equipment, and large openings to the exterior of the building.

### **Scope of Operation of the System and Specific Requirements.**

This point identifies the requirements for the category of system within the standard. Typically, this will be either of M (rarely) L, or P. P and L categories will be accompanied by a number, specifying the level of the category, as follows:

An **M** category system will contain only manual call points, satisfying the design criteria of the building. This system contains no automatic detection at all. Use of this category of system is limited.

An **L** category system (the majority of installations) is designed with consideration to the protection of life, and is popularly known as a Life Safety type system – and will include the basic **M** category of protection as follows:

#### **L5**

The lowest (and usually best avoided) category, is for those systems which do not fit into any other category, and is the only category of installation in which manual call points may NOT need to be installed. Most UK designers will struggle to find a suitable use for this category of system. To most of us, it is oxymoronic.

#### **L4**

A category L4 installation is designed to cover escape routes and circulation areas only. The objective in an L4 installation is to protect the escape route.

#### **L3**

Systems designed to meet L3 provide more extensive cover than L4. Whilst the objective again is to protect the escape route, there is a further criteria which is to provide warning to all occupants

of the building early enough that they can escape. It is a vague definition, and of necessity, will probably include areas not directly on the escape route too, in order to achieve the objective.

## L2

AN L2 system, in addition to the criteria for lower category installations will provide protection in areas considered to have a high fire risk, such as kitchens, plant rooms (especially oil or gas fired plant), compartmentalised areas, and void areas.

## L1

This is the highest possible life safety category, and as such the objective is to provide detection and warning throughout the building, with few exceptions (typically very small rooms, under 1sq. m, such as cupboards, and toilets also do not require protection (unless there is risk of fire from equipment installed in such areas).

A P category system is designed for the protection of property, and is often specified where the risk of fire in the building will prejudice other buildings or life in the vicinity.

P category systems likewise are followed by a number, to signify the required level of protection:

## P2

A category P2 installation will provide cover where there is high risk of fire, or where there is a need to minimise disruption to a business.

## P1

This category of installation requires that cover is provided throughout the building, with the exception of very small areas (as L1), and with the objective that the fire brigade is called as early as possible so as to minimise damage caused by fire. By extension, a category P1 installation will probably require some form of automatic summoning of the fire brigade by default.

Over and above the definition of the category of the system, specific requirements may include the need for the system to perform additional functions, such as:

- ***Automatic shut-down of plant, such as generators, boilers, noisy machinery, and any plant or equipment which might pose additional fire risk, or in any way fuel fire.***
- ***Automatic shut-down of ventilation systems, air conditioning systems, and open gas or oil fed flame heating systems.***
- ***Automatic grounding of lifts.***
- ***Automatic release of fire exit doors forming part of an access controlled system.***
- ***Switch over or switch on of emergency lighting systems.***

## **Use of the building/Building plans.**

These are critical pieces of information over and above anything else because the use of the building will enable identification of any particular requirements for the warning aspects of the installation. For example, there may be an expectation of a high ambient noise level, in which case consideration will need to be given to high output warning devices, or flashing beacons.

Additionally, indicated use of the building may reveal a requirement for compliance with the Disability Discrimination Act in some way, and while this is not yet mandatory where no requirement is identified, it is good practice to assume that it will be a requirement at some point.

Further, the building plans will be essential to identifying the requirements for detection devices, location and quantity of manual call points, location of control or indicating equipment, and cable runs.

The “electrical” aspects of the installation must always comply with British Standard 7671, with some additional requirements set out in British Standard 5839. Cable routes are especially important in terms of design, and care should always be taken when selecting routes, to ensure cable remains within protected areas, is properly routed, and is of the correct specification. Attention should also be given to the method of installation and fixing.

### **Review.**

By this stage, you have the basic information required to begin your design proposal. It is important to note here, especially where there is consultation with insurers, the Fire Service, and with other fire specialists that at this stage, it is a design proposal, and not a finalised design.

You’re ready now to start selecting equipment which will form the proposal for the installation. I cover this off in the next part of this guide.

Be prepared at this first design submission to have all or part of the design rejected, for any number of reasons. It is also possible that other stake holders will have input for alteration of, or addition to, the design submitted.

Again, I cannot stress nearly enough that this is the stage at which consultation, and open discourse is essential.

For a successful fire alarm system, design is everything. And that applies in all directions too, from production of a fit for purpose system, to technical consideration of the system, to cost of ownership of the system throughout its life.

Your project file should contain, for reference again and again, all the information discussed here. Ideally, you will, at some point, summarise this information in a System Design Document, which will form a part of any hand over documentation or O&M manual.