Guidance on the Preparation of a Generic Fire Design Guide

June 2014 Edition

Sponsored by

CHECKMATE FIRE

Living
Learning
Working

USHA

The Universities Safety and Health Association
www.usha.org.uk

Background

The USHA Fire Group identified that fire aspects of building design in the Higher Education sector frequently fail to fully meet the needs of our institutions and that resolution is often a difficult process resulting in less than ideal compromise and unnecessary demands on resources. In our view, use of institution specific Generic Building Fire Design Guides are the most cost effective method of facilitating the best design.

This document is an example to assist institutions in the development of their own. Even if not adopted as the basis for an institution's guide, content will be useful in devising solutions for specific issues. This is not intended to be a 'sector directional document' or used for benchmarking purposes.

It is unlikely that the solutions presented will be suitable for any one institution. Content should be carefully considered for inclusion, adaptation or substitution in completed guides then adapted to local circumstances and practices. Although considerable care has been taken in the preparation of this guidance no liability can be accepted for the content.

Fire Safety Advisors should adapt the examples to suit their institutions then progress development of their own Guide with their Estates Departments. Final approval should be sought from the principle Responsible Person for the institution.

Acknowledgements

The following are thanked for the production of this guide:
USHA Fire Group: Adrian Brown, Paul Brown, John Crust, Rod Harrison, Chris Hewitt. Checkmate Fire Solutions: Alan Oliver.

With valued contributions from UCL, UoE, Durham, Brunel, Loughborough & Bournemouth Universities.

The following external organisations were consulted in the preparation of this document and their input is gratefully acknowledged: Association of Specialist Fire Protection (ASFP), Aviva Insurance, BRE Global, British Woodworking Federation (BWF) & Fire Protection Association (FPA)

Explanation of some terms used

For the purposes of this document these terms have the following meanings:

Institution
Any establishment in the Higher Education sector

Building Regulations
Guidance issued in the respect of:
The Building Regulations, ADB
The Building Standards (Scotland) Regulations, TS
The Building Regulations (Northern Ireland), TBE

Fire Safety Advisor
The 'Competent Person' for the institution

Fire Safety Legislation
Regulatory Reform (Fire Safety) Order
Fire Safety (Scotland) Regulations
Fire Safety Regulations (Northern Ireland)

how to use this guide

Highlighted sections explain the reasons for inclusions of content. They may prove useful in completed guides or be considered unnecessary; largely dependent on the level of knowledge of those it may be issued to. Non-highlighted sections contain examples of successfully applied solutions used in various institutions and approved by their enforcing authorities. Paragraphs are numbered in sequence for ease of reference.

EXAmPlE gEnErIc dESIgn guIdE

A. IntroductIon

Scope
This guide is to be used in the design process for all new builds, changes of use and major refurbishments including property to be leased by the Institution. Content may also be used to advise design in minor works.

Aims

- To align the requirements of the Building Regulations, the Fire Safety Legislation and the Institution. There is potential conflict between these as the Building Regulations are generic and often prescriptive whilst the Fire Safety Legislation encourages creative solutions specific to actual use and management.
- To facilitate high standards, best value and sustainability of fire related issues in building design.
- To provide an indication of non-prescriptive preferred solutions and appropriate standards. The content is not a statement of requirements or intended to replace existing British or European technical standards or national guidance; reference to these will still be necessary.

Consultation

Building Regulations require a suitable and sufficient fire strategy but are generic and quite prescriptive. Fire Safety Legislation encourages creative solutions relative to the actual use and management of the building and surrounding estate.

Without a clear understanding of the buildings actual use and the institution's fire safety management practices, selection of appropriate precautions will often be problematic.

There is the potential to fail to meet the requirements of the Fire Safety legislation resulting in unacceptable risk to employees, students and visitors or unacceptable on-going cost and managerial responsibility.

Addressing issues at a late stage is likely to cause conflict, delay, additional expense or management burden and have a negative impact on fire safety. Effective consultation should ensure that potential negative effects are mitigated and improvements can be considered for inclusion. Consultation should not cause any delay and is likely to reduce cost.

Early and comprehensive consultation with the Fire Safety Advisor is key to achieving good cost effective fire safety standards compliant with all relevant legislation. The Fire Safety Advisor shall be consulted on all fire related aspects from concept to completion and at each RIBA Report stage. The Fire Authority, Building Control Officer or Approved Inspector, Principal Contractor and other relevant persons shall be consulted on a regular basis throughout, in an open and transparent manner.

Design strategy

The fire safety design emphasis shall be on early detection, suppression and evacuation for the protection of life. The protection of property of national or historic importance, property of high importance to the institution, business continuity and the environment shall also be considered.

Compliance with Building Regulations is expected where practical however BS 9999 & Fire Engineering may be used where beneficial. Any variation from simple compliance with Building Regulations will require full explanation in the Fire Strategy or Fire Safety Manual including any implications for future changes in design or use.

The category of use for academic buildings will normally be either 'Education Premises' or 'Large Place of Assembly'; sleeping accommodation will normally be 'Student Accommodation' or 'Hotel' (compliance with the regulatory fire safety order will be problematic if designed as a dwelling).

The design shall address all of the fire related challenges present:

- Multi use buildings often with content of national or historic importance
- Common changes of use of space. IT, electrical equipment, telephone lines etc. frequently added to or changed, breaching fire compartmentation.
- Inflated and unpredictable occupancy due to open public access and difficulty in controlling entry.
- Extensive range of users including most disabilities, ages, cultures and religions, some with little or no English or appreciation of fire safety, commonly unfamiliar with the buildings.

- Limited resources in terms of fire safety management: maintenance, tests and checks.
- Difficulty in provision of persons with responsibilities in respect of fire (fire wardens and disabled evacuation assistants etc.)
- Considerable numbers of peripatetic, part time or temporary staff. Use of contractors for facilities management, security, building works etc.

- Poor evacuation performance including increasing use of headphones, even when sleeping, resulting in not hearing fire alarm sounders.
- Frequent door wedging and use of corridors and common areas for displays etc. with no clear understanding of fire loading restrictions.
- Large student bodies often working unsupervised. Some anti social behaviour including abuse of fire safety equipment, although not as prevalent as often imagined.

B. rEActIon In thE EvEnt oF A FIrE

Compartmentation

Provision

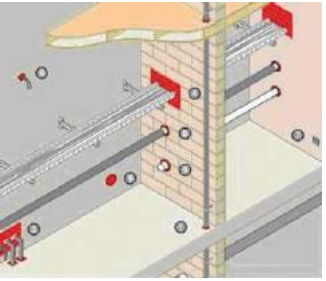

Image courtesy of Hilti

Whilst compartmentation is a requirement of the Building Regulations in certain places, it has further benefits:

- It helps to prevent rapid fire spread within the building;
- It reduces the chances of a fire becoming large, on the basis that large fires are more dangerous to occupants, fire and rescue personnel and other relevant persons.
- It helps to reduce the risk of total loss of a floor or building thus reducing the impact on business continuity.
- Provides the capacity for staged or progressive evacuation and refuge 'spaces'.

The following features should always be compartmented:

- Escape routes: protected or fire-fighting staircases; protected corridors for dead-end situations; where persons may be required to utilise some form of airlock or sterilisation system to make their escape.
- Vertically rising shafts that penetrate through horizontal compartmentation (lift shafts, risers etc).
- Walls common to two or more buildings or separate domains (tenants etc.).
- Areas where intended activity or content involves a high risk of fire: plant rooms, workshops, laboratories, catering kitchens, sleeping risk etc.
- Voids above non-fire related ceilings when these bridge compartment partitions, doors etc.

60 minutes fire resisting compartmentation may be required where there are business critical facilities, areas containing high value equipment or irreplaceable information etc.

Sub-compartmentation

Sub-compartmentation of a floor may well not be expensive or affect the design of the building. In buildings where alternative staircases are provided there is a requirement to separate the stairs and most building materials used to divide areas of floor space tend to provide a minimum of thirty minutes fire resistance. Placing fire doors where two of these walls are opposite each other on the corridor can divide the space in half without causing too much extra cost. For more complex layouts this may take a little more design effort but the theory can be repeated.

Most University floor space could be classed in the purpose group for *'Assembly and recreation, Shop and commercial'* [(1)] where Building Regulations may allow a compartment size of 2000m^2. This is a substantial allowance such that a fire could effectively take out a large area. Sub-compartmentation of areas over 1000m^2 utilising the internal walls and corridors is to be considered.

doorways

Corridors that lead to alternative means of escape do not need to be protected corridors and thus the doors on these corridors (except cross-corridor and other specifically identified doors) do not need to be self closing fire doors. In all other areas the risk of breaches due to fire doors being wedged open is considerable and will result in the additional cost of provision of required approved hold open devices.

Compartmentation should avoid crossing doorways wherever possible so as to reduce the number of doors required as fire doors.

Image courtesy of Hilti

Penetrations

It must be accepted that as a building moves forward in its life span there will be times where, for various reasons, someone will wish to put a breach through a fire wall. Whilst it is impossible to anticipate every possible reason for this being done there is one common reason which accounts for a vast amount of these breaches and that is the running of cabling or wiring. It is therefore important to consider what passive fire protection can be included into fire compartmentation walls to pre-empt the need for future penetrations. The inclusion of devices such as fire sleeves to allow for the running of cables when installing fire compartment walls will provide the end user and future contractors with a quick and safe way of running cable through compartment walls.

Image courtesy of Checkmate Fire

Intumescent protection sleeves with internal smoke barriers shall be installed where cables pass through fire compartment walls. The size of the sleeve should be of suitable size to allow for future extra cabling.

vertical service shafts etc
60 minutes fire resisting compartmentation is required at all access points and where services leave shafts rather than at floor levels. Detection will normally be required at the top of shafts.

ducts and dampers;
Where air handling ducts pass through fire separating elements the integrity of those elements is to be maintained by using one of three basic methods:

- Method 1: Protection using fire dampers;
  Automatic fire dampers provided where the duct passes through fire resisting elements. There may be a requirement under Building Regulations for these to be operated on activation of the fire alarm. Access for regular maintenance must be provided.

- Method 2: Protection using fire resistant enclosures;
  The air handling equipment enclosed in fire resisting construction. Access is sometimes required and this is afforded by fire doors which are kept locked at all times. See also vertical service shafts above.

- Method 3: Protection using fire-resisting ductwork
  Fire resisting ductwork with a minimum performance to match the penetrated element.

Means ofEscape

Image courtesy ofJalite

People who may have difficulty evacuating:
It is normal to make minimal allowance for the 'evacuation of disabled persons' however, there is also an ever growing percentage of the population who have impairments. In addition, our policy is to include all users who may have difficulty evacuating. Ease of escape for such persons must be considered in the initial stages of the design process.

All escape routes should be designed to enable self evacuation of people with mobility impairments wherever practical: Steps should be avoided; slopes of no more than 1:20 are acceptable. Any requirement for evacuation assistance or equipment should be avoided where practical; where necessary our preference of evacuation chair is *name or model*.

Horizontal disabled escape routes into separate compartments are preferable to vertical escape where reasonably practical. Where vertical escape is necessary, evacuation standard lifts are required.

When estimating the holding capacity of a protected refuge area, a figure of one person per square metre is considered a reasonable maximum occupant density to include standing and wheelchair users. There should also be space for escape equipment, an electric point and sufficient room for powered wheelchairs to manoeuvre.

Evacuation strategies

Simultaneous evacuation
The simplest escape strategy is to ensure that, as soon as a fire has been confirmed, all of the occupants leave the building simultaneously. The actuation of a call point or detector gives an instantaneous warning from all fire alarm sounders for an immediate evacuation.

Simultaneous evacuation is preferred in smaller buildings however, some situations require variations, for example:

- Apartment buildings where a defend-in-place strategy is adopted by providing a high degree of fire protection, such as fire-resisting separation between individual dwellings.
- Tall buildings where phased evacuation is adopted and only the fire floor (and sometimes the one above) is evacuated in the first instance.

- Facilities where the immediate interruption of some function could cause major problems (e.g. hazardous process areas) and the evacuation of key personnel must be delayed.

Staged evacuation
The operation of a call point or detector gives an evacuation signal on the storey or zone affected; an 'alert' warning signal may be given in other parts of the premises. The decision to evacuate the remainder of the occupants then rests with the management and/or The Fire and Rescue Service.

In large or complex buildings, a staged evacuation procedure by floor level will generally be required in order to provide manageable sized alarm zones and reduced disruption. This will require the alignment of fire compartmentation. It is essential that adequate means of communication between storeys or zones is provided; a public address system or voice alarm, instead of sounders, is the most suitable way to control the evacuation process.

Phased evacuation
Different parts of the building are evacuated in a controlled sequence of phases, first the original fire affected storey or zone, then the remainder of the building in various phases.

Phased evacuation may be considered in complex buildings: buildings over ten floors where escape down stairs can be prolonged and tiring and protected refuge levels are provided where people can wait in safety before being evacuated using the lifts or stairs and hospitals where progressive horizontal evacuation from the fire-affected area into adjoining fire compartments is required.

A two-stage alarm system to give 'alert' or 'evacuate' signals will normally be required. The escape stairs in the building will be designed specifically and evacuation will normally be coordinated from a fire control centre, having directive public address announcements, aided, where appropriate, by colour CCTV.

occupant capacity
Occupancy figures are often the deciding factor in regards to the width of escape routes, staircases and doorways. Although client specifications will be met there is often some spare exit width or occupancy capacity in completed designs which is not supplied. This information is crucial when considering changes of use, items to be placed in corridors etc.

Future flexibility of use and all restrictions on exit capacity must be considered and agreed with the institution. Maximum capacities for each space, permitted by the finished design, shall be included in the Fire Safety Manual.

Where client specification or furniture plans do not indicate the number of people in office accommodation a figure of 10m^2 per person may be used. Guidance recognises that where specific or comparative data are available to demonstrate the actual maximum occupancies, this may be used instead of the standard floor space factors.

Image courtesy of Lloyd Worrall

Exit routes
Single direction escape routes and rooms within rooms should be avoided. Staircases and lifts should normally be installed at the extremities of the buildings.

Travel distances will account for use by people with mobility impairments, 18m is the usual maximum acceptable single direction travel distance unless there are suitable compensatory features.

Display information and items are often required within corridors. Where this is the case, fixed encased display facilities are to be provided.

Where exit routes are through an open plan area, the floor surface should indicate the route and management policies should ensure that this is kept clear of any obstructions.

Exit widths
Allowance may be required for client specified furniture, break-out areas etc.

Allowance must also be made for the width of powered wheelchairs and to take account of disabled persons who may need to go against the flow.

Spare exit width over the client occupancy specification permitted by the finished design shall be included in the Fire Safety Manual.

Image courtesy of Jalite

Way finding
Illuminated escape signage shall be utilised as far as reasonably practicable and shall augment emergency lighting. Non-illuminated signage should be photo-luminescent. All signage should be as large as practical to aid those with impaired vision.

Routes specifically for the use of people with mobility impairments (i.e. alternatives to staircases) should be indicated with the standard wheelchair user symbol in green; those not suitable with the same symbol crossed through added to the standard 'running man' signage.

There should be clear colour contrast of doorways, edge marking of stairs and steps etc. to aid those with impaired vision.

Fire action notices.
These should preferably be in pictogram format to prevent language issues. See USHA Fire website for a free download example.

lifts
All lifts are to be to evacuation standard unless use of an accommodation lift can be justified by risk assessment.

Lifts will be reserved for disabled evacuation on operation of the fire alarm. They must be operable without the need for a key or other specific technical knowledge, at least on operation of a fire alarm. They should not be linked to the fire alarm but remain in normal operation to enable unaided escape by mobility impaired people who will, in the main, have been notified.

Lifts should carry standard 'do not use in a fire' signage supplemented with the disabled exit route sign where suitable.

Emergency lighting
Systems shall include a self test facility unless individual units are identifiable. Consideration must be given to areas where hazards are present in respect of people with impaired vision.

doors:
Final exit doors shall be fitted with single action locks and provide level exit or be ramped to 1:20 max.

All fire doors shall be:

- Fitted with intumescent strips and smoke seals
- Of contrasting colour to the walls or frame
- Provided with disabled friendly handles usable by a closed fist and one-handed operation.
- Operable one handed with a maximum of 30kn force opening force.
- Corridor doors are generally to be provided with magnetic hold open devices interlinked to the alarm system. Room doors shall be fitted with a self closing device only where there is a fire safety or other need (unlikely where there is dual means of escape). Free swing closing devices are preferred on room doors likely to be wedged open.
- All electronic door locks, hold open devices or closers must fail safe in the event of an alarm activation or power failure. Where used at the junction of alarm zones they must release on activation of the alarm system of either zone.
- All doors with manual locks must have a handle or other simple fastening that can be easily operated, without the need for a key or other specific technical knowledge, on the side approached by people evacuating.
- Mains powered tamper proof open door alarms are required on all student kitchen doors (proven extremely effective at reducing false alarms from cooking).
- Access control systems must be programmed such that all escape routes serving areas which may be occupied are available should there be a fire. There should be no requirement to use a card, code etc under these circumstances.

Image courtesy of Lorient

c. ActIvE SyStEmS

Supression Systems

Image courtesy of Tyco

The installation of a suppression system can have many positive benefits:

- Greater flexibility in building design.
- The reduction, through risk assessment, of active and passive fire safety measures.
- Reduced disruption and business continuity risk.
- Reduction of insurance premiums;
- Meeting environmental targets by a reduction in the risk of water pollution from fire fighting, the amount of waste materials damaged in the fire going to landfill and the need for the use of raw materials for rebuilding purposes.

Water mist systems rather than sprinkler systems greatly reduce the risk of water damage and the spatial need for water storage tanks.

myths

When there is a fire all the sprinkler heads go off at once. Wrong. Each head is independent and only the head(s) adjacent to the fire go off.

Water damage is as bad as the fire damage. Wrong. A typical sprinkler discharges 55 litres per minute. A firefighting hose discharges over 600 litres per minute. You can expect a sprinkler to discharge less than five per cent of the water used by the fire service.

Sprinklers can go off accidentally. Wrong. Records show that the chance of an accidental discharge is in the region of 16 million to one.

Sprinkler Systems are expensive. Wrong. The costs can be recovered over a period of about 10 years through reduced insurance premiums and less disruption to business continuity when a fire occurs. Installed in a new building, a sprinkler system should not cost more than one to two per cent of the total build cost.

Sprinkler or water mist suppression systems are to be seriously considered at initial design stage; where they are not to be provided a detailed explanation and justification will be required.

Suppression systems shall generally be in accordance with the appropriate B.S. but may vary at the discretion of the Fire Safety Advisor.

Image courtesy of Tyco

gas systems

Gas suppression systems should be used to protect valuable materials or equipment where they would not react well to water.

The most common form of gas suppression systems currently in use are: Inergen and Argonite which work by reducing the oxygen content within the space; FM200/NOVEC1230 work by interrupting the chemical reaction and absorbing heat.

These systems will normally have a pre-determined countdown period before activating to allow for persons to egress from the area and if they should still be in the area after activation it will still be possible for them to make good their escape without any adverse effects.

Systems for kitchens

A suppression system which distributes a fine mist spray of a chemical designed to react with burning fat is required over cooking ranges and deep fat fryers. These systems work by the chemical reacting with the oil to form a coating or crust over the oil which has both a cooling effect and also cuts off the oxygen supply thus extinguishing the fire.

Automated Fire Alarm Systems

Although not always required by building regulations, automated fire detection is incorporated into most new buildings as it is beneficial for both life and property protection.

Failure to explore the advantages and disadvantages of the detection equipment and system designs available (based on the nature of the building, the users, their activities and behavioural history) can have a drastic impact in regards to the performance of the system and its effectiveness.

A well designed system, incorporating the best methods of detection for each space, will result in the earliest warning of a fire without excessive amounts of unwanted alarms and result in optimum evacuation performance.

Badly designed systems result in:

- Unnecessary disruption and complacency, potentially increasing evacuation times, to the point where the escape route becomes untenable prior to everyone evacuating. There is also the risk of Fire Authorities charging for attendances or reducing their level of attendance. *See: USHA Fire Docs (False alarms & cooking).*
- Late detection of fires with increased life safety risk and fire damage.

Standard

New systems should be compatible with or match existing effective systems.

The level may vary but in the main we expect L3 enhanced with detection in all rooms where the normal occupancy is over four persons, plant rooms, service ducts, lift shafts, air handling ducts and high risk areas.

The normal standard in sleeping accommodation is L1 with sounder beacons at all bed heads.

Image courtesy of Hochiki

monitoring

All detection and alarm systems shall usually be 24hr monitored at the campus security control point, where zoned evacuation is required remote activation must be facilitated.

Monitoring by call handling centres may be useful for alerting staff not on site however it should be noted that may Fire Services will not attend purely as a result of alarm activation, requiring confirmation of signs of fire from a person.

Zoning

Alarm zones may be required in large buildings and must be based on confirmed fire compartments, usually by floor level. They must include other compartments which provide single means of escape. The extremities of fire alarm zones shall generally be provided a call point inside each exit from the zone.

detection Specification

False alarms and changes of room use are common feature so installations, detection and alarm equipment must be adaptable.

The specification should require addressable, open protocol, detector bases allowing the fitting of ancillary equipment such as sounder and beacon units.

Combined programmable rate of rise heat and optical smoke units are normally preferred.

Heat detection settings are generally slower to react to a fire but will be required in areas where smoke detection is likely to cause frequent false alarms. Where the risk of the false alarms is during defined periods only (i.e. commercial kitchens, some laboratories etc), detection should be programmed to smoke outside of the risk periods. Student kitchens may be used at any time so heat detection only is appropriate.

Bedroom detectors must be positioned such as to reduce the likelihood of triggering by aerosols, shower steam etc.

CCTV technology and the development of Infra-Red cameras can be beneficial in the early detection of a fire. Although IR cameras will not identify developing heat sources the cameras do give better night time vision thus allowing operators to more easily identify smoke and small fires. Most models also have the ability to swap from IR mode to normal mode when faced with a bright light. At night this has the potential to identify a fire in IR mode and switch to normal mode thus highlighting the fire against a dark background.

Where CCTV cameras are to be installed for security purposes, consideration shall be given to using enhanced IR cameras. These will be particularly useful in remote areas where attendance to alarms by trained personnel may be delayed.

Alarm equipment
Voice alarm systems are preferred as they are proven to improve evacuation times. Alarm sounders shall be enhanced with visual beacons such that a beacon can be seen in all escape routes, each room over 20sqm, toilets, plant rooms and other noisy areas.

Sounder levels near refuge communication equipment are to be reduced to allow for effective verbal communication.
Sounder levels in bedrooms are to provide 75Dba at the bed head.
Illuminated 'Fire No Entry' light boxes shall be provided outside each entrance to the building and each alarm zone; these must continue to function after sounders are silenced until the alarm panel is reset.

cause & effects
Programming must be agreed with the Competent Person for the University as management practices often vary from those normally expected; it will usually be such that one device evacuates the zone only, two devices evacuate the

building. Detectors in such areas as commercial kitchens will normally be programmed for heat during operating times and smoke out ofhours.

Ancillary equipment
Gas supplies and air handling systems must be interfaced to cut off on activation of the fire alarm and be provided with an automated reset. Computer server rooms may require specialised alarm systems. All such interfaced equipment must be provided with a key switch to allow independent testing of the system and equipment.

Access & facilities for the fire service

Any locked equipment for fire service use shall be provided with FB1 locks. This will include access gates and barriers, dry riser inlets and outlets, fire fighting lift controls, fireman's switches etc.

A copy of the Fire Safety Plan Drawing shall be provided, in A3 encapsulated form, readily available at the entrance to the building for Fire Service use.

The location of electricity supply switches, gas shut offs and unusual or high risks to firefighters shall be indicated by appropriate door signage.

Image courtesy of Britannia Fire

Firefighting equipment

The institution operates a general no fire-fighting policy; most staff and students are not trained in extinguisher use. Extinguishers provision will generally be lower than the usual standard; they shall be provided at the extremities of single direction escape routes and at the entrances to alarm zones.

The standard specification is water mist units suitable for all categories of risk except metal fires. Anti tamper alarms will be required as standard. Fixed hose reels are not generally accepted.

Specialist extinguishers and suppression systems may be required in science laboratories, computer server rooms, kitchens, areas with valuable contents or high voltage electrical risk.

Fire Blankets shall be provided in kitchens, science labs, and large sections of escape route corridors.

d. FIrE PrEvEntIon

The incorporation of fire prevention measures in the design stage can have significant benefits rather than attempting to apply such measures after completion. There may well also be cost benefits to designing in such features, not only in regards to installation costs but after completion in the form of reduced insurance charges. Input at the design stage from an experienced fire officer or fire engineer may well have significant benefits.

Fire/Fuel Loading

Information:

Consideration must be given not only to proposed use but also potential use in the future. With the need to create income by increasing student numbers there is likely to be pressure to increase the capacity of buildings above the original design in the future.

Information regarding fire loading capabilities for certain materials and products can be found in the PD 7974 series of documents, however they are more to assist in designing fire engineered solutions and must be used as a set rather than simply attempting to pick and choose bits of text to suit the need.

Clear explanations of fuel load limits imposed by the design must be supplied such that end users can interpret them; this is particularly important for escape routes and circulation spaces.

Furniture and fittings

Future potential furnishing and storage requirements should be considered, not least to discourage the desire to turn escape routes into storage areas.

Waste materials

In today's proactive approach to environmental issues establishments are required to provide various different receptacles for different materials. This leads to the following concerns emerging:

- Waste is retained on site for longer, often in more bulk, as it takes longer to fill receptacles. Lack of secure storage facilities for bulk waste receptacles resulting in an arson risk External storage close to buildings increasing the risk of external fire spread.
- Areas where intended activity or content involves a high risk of fire: plant rooms, workshops, laboratories, catering kitchens, sleeping risk etc.
- Voids above non-fire related ceilings when these bridge compartment partitions, doors etc.

The client must be consulted to gain information as the bulk of waste to be stored and the types and numbers of receptacles to be used.

The design should incorporate adequate secure storage for bulk waste and receptacles either externally at least 8m from buildings or in a 60min fire compartment within the ground floor only accessed via a locked external door.

Storage
Consideration must be given to the provision of lockable cleaners cupboards and storage areas not only for combustible materials but also bulky or temporary equipment and furniture to prevent the obstruction of escape routes.

In some instances storage space can be found in a vertical riser for pipe-work or cabling, however this should not be done unless they are designed or re-designed for such a use and have suitable compartmentation and means of warning in case of a fire.

Arson

Guidance on arson prevention can be found in the following: USHA Arson Prevention Document.

External Spread

The aim of considering external fire spread is to prevent a fire being able to traverse floors externally and to prevent a fire in one building spreading to neighbouring buildings.

There should be no combustibles within 5m of the building. If the outside of the building may be used for display purposes such as large advertisement banners, small neon signs or external awnings, such items may present a risk which must be addressed.

Location of high fire risk areas

Where practical, high fire risk areas should be located such that any fire arising in them would have the minimum impact for example locating science laboratories, kitchens etc. on the top floor. However, access for firefighting must be considered and additional compartmentation at ground floor level may present a more suitable solution.

Gas cylinders, hazardous chemicals and substances are necessary in some areas. As the Fire Service may decide not to enter such areas in a fire particular consideration is required. Suitable external storage is preferred (with piped supplies if gas).

- Highly flammable and oxidising materials –bulk amounts will require a blast proof fire compartmented and suitably vented storage area. The vent shaft or ducting should be fire resisting or compartmented to the same level as the storage area and it should vent as directly as possible to fresh air. The venting for each store should be self contained if it passes through a building, i.e. it should only ventilate that store and should not be used for venting of fumes from other areas or stores within a building. Where the vent shaft/ducting passes through a fire compartmented wall or floor fire dampers must be installed to prevent fire spread.
- Compressed gas or liquid gas cylinders – All compressed gas cylinders have the potential to react or explode in a fire. Wherever possible all cylinders will be stored externally with the relevant gases being piped around the building. Where that is not possible only one cylinder of each substance should be stored internally with all others being stored in a secured external area. Where gases are stored internally, Hazardous Chemical signage will be required at the external entrances into the building and on the door leading into the room where the cylinder/s is kept.

- In a fire situation, the fire service may prefer to remove the cylinders where it is safe to do so therefore consideration should be given as to the layout of a building where work areas will require cylinders. The higher up a building the cylinders are being stored the more difficult and time consuming it is for fire fighters to transport cylinders out of the building. Where gases are required at higher levels, strong consideration must be given to the piping of gases from external storage.

Equipment, plant etc

Sufficient electrical sockets on sensitive RCD devices must be provided to negate the need for multi point adaptors and compensate for the managerial limits on Pat testing.

Easily accessible emergency gas shut-offs shall be provided in each room fed.

Automated cooking fume extraction sufficient to prevent operation of corridor smoke detection shall be considered.

Automated cooker cut-offs to prevent leaving cooking unattended shall be fitted.

Future management provision requirements

Fire Safety Management must be regarded as of equal importance to fire protection measures. A building with first rate fire protection measures yet poor management, may pose a greater risk than a building with limited fire protection measures and good management. Management issues must be considered throughout the design process and detailed in the Fire Safety Manual.

The aim will be to accommodate the circumstances of the establishment and fit with their standard practices. The managerial burden should be reduced as far as is reasonable practicable. In line with good risk control, engineered solutions are preferable to those reliant on management.

Fire risk management objectives, procedures and a programme of audit and management review shall be formalised and implemented.

Expertise and training burden
The future management of fire safety systems is a considerable burden which must be considered at design stage bearing in mind the 'fire related challenges' indicated earlier in this document. The aim shall be to minimise the resources that will be required. Examples of how this may be achieved include:

Small alarm zones, with compartmentation, such that those responding to alarms can also deal with evacuation and firefighting issues.

Evacuation systems which negate or reduce the need for specialist equipment or assistance; allowing for self evacuation of disabled people for example.

Systems which are common to other campus buildings as this can reduce the training requirements for all users.
See also the 'Materials' section of this document.

Fire Engineering

Where Fire engineering is proposed for a specific means of escape solution the additional challenges of the institution must be included in thorough sensitivity analysis testing. Where evacuation simulation models are to be employed, 3rd Party accreditation is obligatory.

Adequate safety margins must be built into evacuation time studies allowing for 'fire related challenges' in particular slow response times and the potential numbers of users who may have difficulty evacuating which will include staff and students with temporary issues as well as disabled persons.

A Fire engineered solution that relies on Level 1 or enhanced management as a component may require a management solution tailored specifically to the design of a building. This must be agreed with the client before the solution can be accepted.

Responsibilities

Designer - It is the responsibility of the designer to ensure there is a suitable fire strategy and to initiate the fire safety manual ensuring it is populated as design information becomes available.

Fire Safety Advisor (Establishment), the 'competent person' for fire safety within the University - advise on all fire related issues in building design from inception to completion of projects. This will include agreeing:

- The Fire Strategy.
- The preliminary fire risk assessment in accordance with the Building Regulations, if it is to be used as part of the submission.
- All variations from standard practice.
- Content of the Fire Safety Manual.

On hand over, the fire safety advisor will be responsible for the fire safety manual and will populate it with the institutions fire safety policy statement, operational records and other fire safety documentation.

Principle contractor
In consultation with the Fire Safety Advisor (Establishment), conduct a fire risk assessment and ensure that suitable control measures are implemented, supervised and monitored.

Ensure the Fire Safety Advisor is consulted before implementing any changes which may affect the arrangements in respect of fire, during or on completion of the build.

Update the information in the fire safety manual with as built information before hand over.

Fire Safety Manual

The CDM Regulations, Building Regulations and B.S.9999 Annexe H require the supply of information. This should be in the form of a 'Fire Safety Manual' which will contain design information and the fire strategy as M.S.Word documents supplemented with plan drawings in CAD format.

These shall be provided to the University, as designed or specified, during the early design stages, revised and completed during the project. The completed versions shall be confirmed 'as built' before hand-over.

The required content is detailed in the Appendices.

Fire Risk Assessment preparation

All fire safety features, equipment, signage and the Fire Safety Manual shall be in place before handover. This is to facilitate completion of the Fire Risk Assessment by the 'competent person' for the establishment which must be in place prior to occupation.

Before accepting a building for occupation it is essential that the safety of the staff and public (as well as that of construction personnel if the building is being completed in phases) is assured by ensuring that all safety systems are properly installed and operational. On completion of the fire safety system, the complete installation should be checked for conformity to the approved drawings and system design.

F. SlEEPIng AccommodAtIon

These areas present the highest life risk therefore extra precautions are required. They are likely to be used both for student living accommodation and, effectively, as hotel accommodation outside term time. Use by people not familiar with the building will be common. Design based simply on student accommodation or flats is unlikely to be suitable. Installation of a sprinkler or mist system and bi-directional means of escape from all normally occupied rooms is expected.

Challenges

Design standards must account the following additional challenges:

- Increasing use for conference visitors and the public.
- Privately owned, designed and operated accommodation in the vicinity, often not to expected standards, resulting in pressure to cut cost.
- Limited supervision and enforcement of fire safety rules.
- Extremely varied and unpredictable sleep, work and social behaviour patterns.
- Inexperienced people cooking with unfamiliar equipment (cause of over 90% of fires in the sector).
- Extensive and often inappropriate use of electrical equipment commonly including items which do not conform to British Standards.
- Smoking often permitted in individual bedrooms and cultural or religious use of Hooker Pipes, candles etc. where naked flame and smoking would normally be banned.
- False fire alarms; mainly due to cooking with the kitchen door open, steam from en suite showers and use of aerosols near detectors.
- There is not normally a managerial presence in the residential buildings, particularly at night. Checking on evacuation is problematic and failure to evacuate is common.
- Although disabled accommodation is often provided separately, use of all areas by temporarily disabled students, staff and disabled visitors is common; means of escape from all areas must be suitable.

Automatic fire detection and alarm systems

We require alarm sounders and beacons in all escape routes, common areas and normally occupied rooms. Sounders to be set at 75Dba measured at the bed head in bedrooms. There must be facility to fit vibrating alarms for hearing impaired residents.

Image courtesy of Hochiki

Cause and effect programming of detection and alarm systems is crucial.

False alarms caused by smoke detector activation by cooking fumes, shower steam and aerosol use are historically common. Systems should be designed to reduce these as far as reasonably practicable including enhanced automated cooking extraction and careful positioning of detectors.

Call points should be sited on escape routes in secure areas (i.e. inside flat exits) rather than by final exits to reduce malicious activations suffered when sited in common areas. Sufficient points shall be installed to ensure that anyone leaving a room shall pass one on their escape. Alarmed covers and CCTV coverage are likely to be required for any that have to be in common areas.

Kitchens

Communal kitchens in residential accommodation with single direction means of escape must be located at the furthest end from the exit to facilitate escape.

Measures to reduce fires caused by students cooking must be taken. These could include purpose designed water mist or other suppression systems, cookers with thermostats set below fat ignition temperatures, cooker timers which require manual reset after 15 minutes.

Self closing kitchen doors are frequently wedged open therefore free swing door closers linked to the fire alarm are required; a test switch is essential to allow for the closing device to be regularly inspected. This will necessitate automatic extraction linked to a PIR unit to prevent operation of smoke detectors in corridors.

g. mAtErIAlS

Specification & Installation

General
Passive fire protection systems if designed, specified and installed correctly will provide many years of reliable protection to the building. However, because they are part of the building, it is often considered that they can be installed by general builders with no specific training or competency evaluation of staff. This can lead to incomplete or inappropriate installation.

In order to achieve the most effective and reliable fire protection, it is recommended that all passive fire protection products are third party certificated and that they are installed by contractors holding third party certification for that product type. Third party certification for both products and installers should be provided by a body holding UKAS (United Kingdom Accreditation Service) accreditation for the product or services they certificate.

Image courtesy of Checkmate Fire

Structural Steel Protection Systems
Fire protection systems to structural steelwork come in a variety of materials. All systems need to be installed within the parameters of the manufacturer's fire test/assessment data or third party certification, otherwise they are unlikely to provide the fire resistance that was specified.

Board materials; normally applied to form a box around the steel sections. It is relatively easy to check if they have been correctly installed, or rectified if necessary, paying particular attention to joints and fixing details.

Sprays and renders; such non-combustible cementitious or gypsum based products, sprayed or troweled around the section to provide an insulating layer, tend to be installed by specialist contractors to the required standard.

Intumescent paints; react to heat by swelling up to form and insulating char. Base coats must be applied evenly onto a compatible primer in good condition to specified loadings within the right time frame and within certain ambient temperature and humidity limits. It is neither easy to check, nor rectify if incorrectly applied.

Image courtesy of British Gypsum

Image courtesy of Alufire

Fire Wall Systems

Fire walls may be loadbearing or non-loadbearing and are made from a variety of materials including masonry, plasterboard, calcium silicate board and sandwich panels for larger buildings.

Buildings will move in the event of a fire and floor slab deflection can cause stress in partitions. The partition's structural soffit junction detail must be designed to accommodate anticipated movement. The deflection head detail must be correctly installed. A robust method of quality assurance for the fire compliance of dry-lined walls must be in place prior to installation. There are many systems that can accommodate this, for example the British Gypsum 'White Book', contains 568 pages of technical detail and can be readily accessed and downloaded from their website.

Fire Resisting Glazing Systems

Fire resistant glass should always be marked with a stamp to advise exactly what type and properties of fire performance the glass provides. If such a symbol is not clearly displayed then it should be assumed that the glass is not fire resistant.

Fire resistant glazing systems have to be installed as tested, assessed or certificated, using the correct, supplier specified, compatible components. Any site application that deviates from the test, especially those involving the installation of larger panes, must to be re-tested or assessed by a competent person.

The commonest fire resistant glass types provide integrity but no significant level of insulation protection; this cannot be used, for example, to protect a refuge area. Other types are available that provide either full insulation (same period of insulation as integrity) or partial insulation, e.g. the insulation value is approximately half the integrity value.

Security or safety glass cannot be expected to provide any tested fire performance unless expressly stated.

Expert advice and more detailed information on glazing systems can be sought from the Glass and Glazing Federation: www.ggf.org.uk

Fire Doors

A fire door 'assembly' is a system where all or several items (door leaf or blank, frame, glazing, hinges and other hardware) are sourced separately and typically assembled on site. Research would suggest that a significant proportion of fire doors in the UK created in this way will not achieve the fire rating to which they were tested due to a combination of poor procurement, installation, maintenance and management procedures.

A fire 'doorset' is a door system where everything has been supplied from one source (typically a 3rd party certified door manufacturer), partly or completely pre-assembled where all of the components are fire tested as a unit.

Pre-assembled doorsets are generally preferred as they are the best method of attaining fire compliant installations and can be more cost effective as they reduce installation time.

All fire doors must be fully 3rd party certified, which will normally be identified by being plugged in accordance with the BM TRADA Q Mark Assurance scheme or carry the BWF Certifire label, backed by the Manufacturers Primary Fire test evidence in accordance with BS476: Part 22.

Image courtesy of Noberne Doors

Fire door frames must be kiln dried to prevent non-compliant gaps through warping. The minimum density for FD30 frames is 500KG/m3, either softwood or hardwood; for FD60 doorsets the minimum is 650gk/m3 and the timber must be hardwood.

10mm lippings and bushed bearing hinges should be specified for high usage doors to reduce the likelihood of defects and maintenance burden.

Fire doors to a refuge area must have adequate seals to the threshold to ensure that the refuge area will actually perform as intended.

The RRO requires that fire doors *"are subject to a suitable system of maintenance and are maintained in an efficient state, in efficient working order and in good repair"*; they must be inspected and maintained by a competent person.

The Fire Door Inspection Scheme (fdis.co.uk) is a useful source of information on all aspects of fire door compliance.

Firestopping and linear gap sealing

When firestopping around services a number of factors must be considered:

- required period of fire resistance
- type, number and size of services contained within the aperture
- how the fabric of the building will react in a fire
- later addition or removal of services

- load bearing or impact resistance requirements
- thermal movement or other ambient conditions
- acoustic or other non-fire issues

Products should only be installed as fire tested/assessed/certified and systems should not be mixed and matched as manufacturer's products will vary and products from one manufacturer may not work with complementary products from another manufacturer. Similarly seals damaged by the introduction of additional services should be repaired with the same product.

Urethane foams are rarely tested or suitable for sealing service penetrations. They must not be used unless evidence is provided to confirm they are tested and certified as suitable for each application.

Image courtesy of Firetherm

The correct type of intumescent mastic must be specified for each application:

- Acrylic mastics are the most basic in terms of fire performance. 3rd Party certification is a key requirement.
- Silicone mastics are waterproof and generally more flexible– they should to be used in cavity voids and other areas where thermal movement of the structure and moisture may occur.
- Graphite mastics generally have both a high expansion capability and the ability to exert pressure. They should be used around cables and small plastic pipes as they will displace and dam penetrations as such services melt.

Linear gaps occur where different components of a building interface. Firestopping requirements must be expertly determined, taking into account a number of factors such as the level of fire resistance required and how the interfacing components might behave in a fire in terms of expansion and deflection, to guarantee compliance. The attainment of fire compliant linear gap seals can be problematic if the passive fire protection of a building has been fragmented into different sub-contractor's work's packages. The responsibility for the linear gaps must be unambiguously allocated by the Principal Contractor.

Within a roof void, in addition to the installation of vertical barriers, firestopping should be carried over the full thickness of the wall and the roof covering is to be designated for penetration by fire spread of flame. If roof support members pass through the wall, fire protection to these members for a distance of 1500mm either side of the wall may be needed.

Cavity Barriers

Any voids within a building need to be effectively separated at determined locations with cavity barriers to limit the unseen spread of fire and smoke. Barriers for fire and smoke should provide at least 30 minutes fire resistance including insulation and integrity; those just for smoke require integrity only.

Image courtesy of Checkmate Fire

Where vertical fire separation is specified between floors, a cavity barrier to the required fire rating is necessary between floors and curtain walls or other adjoining substrates. They must be installed to the manufacturer's fire tested detail to ensure that wall deflection due to thermal movement and other factors, will not compromise effectiveness.

Suspended ceiling cavity barriers not forming structural fire separation are typically created by flexible 'curtain' products made from mineral wool or woven glass fibre fabric.

Cavity barriers to extend a fire wall to the soffit or to fill a gap between a door set and the soffit must provide both integrity and insulation and are typically made from a 'coated batt' system.

Raised floor cavity barriers can also be used to provide acoustic barriers and / or an air seal, especially if forming an integral part of a building's air plenum. They are typically made of foil faced mineral wool systems where they are not likely to be disturbed or breached by services. Where they may be breached, coated batt systems or similar, fire tested for this detail must be specified, potentially inclusive of cable transit sleeves.

Ducts and dampers

In some situations, particularly in escape routes, there can be a requirement to fire rate ductwork to prevent fire from breaking out of or entering ducts in order to maintain compartmentation. Dampers should be fixed either within or directly adjacent to fire barriers and be robustly supported, independently of the connecting ductwork, so that in a fire situation they will not distort or collapse but remain as an integral part of the barrier. Where they are installed within a penetration seal, the seal should be as per the damper manufacturer's detail.

Where ducts penetrate drywalls they must be framed with the studwork, lined with plasterboard and effectively sealed as per the duct manufacturer's detail.

All dampers must be accessible for future maintenance.

Image courtesy of Checkmate Fire

Electrical cables etc

There is a tendency for cables to be run and installed throughout buildings in densities that cannot be effectively fire sealed. The use of fire tested transit sleeves, pre-installed to cater for such runs, should be seriously considered.

It should also be noted that BS 5839 precludes the use of plastic tie clips, cable ties or trunking where these products are the sole means of cable support. Electrical trunking boxes almost invariably have no external fire rating and should be firestopped.

Fire curtains and shutters

Care must be taken in ensuring that what is specified and installed provides the fire resistance required; for example if it is intended to create a 30 minute escape route then fire curtains must possess 30 minute insulation from excessive heat together with hot and cold smoke protection and not just 30 minutes fire integrity. Fire Shutters provide a similar function and are often used to provide 120min fire separation. Both types of products should only be installed and maintained by 3rd Party certified installers.

Suitable arrangements must be in place to ensure that the escape of building users is not impaired.

Timber Frame Buildings

Timber frame buildings are unforgiving of poor passive fire protection. Softwood framework has very little fire resistance and mainly relies on plasterboard for protection. Unless expertly clad and sealed, adhering strictly to the board manufacturer's instructions, there can be a risk of fire entering wall cavities where it can be extremely difficult to locate and fight. Any actions or changes to the building that might breach the internal cladding must be strictly managed.

competent Installers

The need for competent workmanship is widely accepted and for this reason it is recommended to only use installation contractors who hold third party certification for the types of passive fire protection to be installed. The 'Fire Protection Association Passive Fire Protection Handbook' states: *"The use of any product can be undermined by poor application. Any work that is not of the correct quality could lead to premature collapse of a building in a fire situation. This in turn could threaten the lives of the occupants and fire fighters. Thus it is imperative that contractors who have the appropriate credentials for the work install passive fire protection products … fully in accordance with the manufacturer's instructions".* Under the RRO the Responsible Person is charged with ensuring that Competent Persons are used. It is therefore

important to unambiguously specify the standard of workmanship required. However, standard specifications will often cover 'workmanship' in a generic way that will provide little practical or specific guidance. Instructions such as "unless otherwise specified the standard of workmanship required shall be to BS 8000", are not sufficient as the BS is very general and contains little detail on passive fire protection.

Modern methods of construction often include materials which are less robust and forgiving of latent defects caused by poor workmanship than in the past; there is a very small margin for error if the required fire performance is to be achieved.

Image courtesy of Prestige Fire Door Services

Passive fire protection is rarely a complete package of work delivered by a specialist installer. Elements are typically split into related sub-contractor packages and often undertaken by persons not adequately skilled leading to poor standards of installation. As stated in the ASFP document „Ensuring Best Practice for passive fire protection in buildings' *"as the objective of passive fire protection material installation is to protect the life of the building occupants the work should not be allocated to contractors for whom it is an add-on function".*

The CIBSE Fire Engineering Guide also recognises these issues, stating that "it is common that the fire separating elements are not properly installed or maintained" and "the fire-resisting performance of a compartmentation element is only as good as the weakest link".

With all built-in components, especially those concealed within the fabric of the building, it is difficult to assess the quality of workmanship once installed. It is often equally difficult, and potentially very costly, to upgrade the performance of a system that has been incorrectly installed.

A sufficient level of competence and expertise with evidence of a robust Quality Assurance system is required to ensure that fire protection systems meet the required standard.

Monitoring of 'passive' fire protection is often extremely difficult and failures not apparent until a fire occurs. There is a reluctance to carry out invasive inspections or access hidden voids at the 'handover' stage of a project or later in the life of buildings.

In addition 'passive' fire protection is often prone to 'out of sequence' damage as additional services are installed.

If damage to the fire separating components takes place it is very important that such damage is repaired by those who are competent to do so. As stated on page 34 of the FPA 'Passive Fire Protection Handbook' *"never allow on-site modifications that are not approved or use an installation contractor that cannot demonstrate the appropriate level of competence and experience".*

Quality Assurance

Third Party Certification

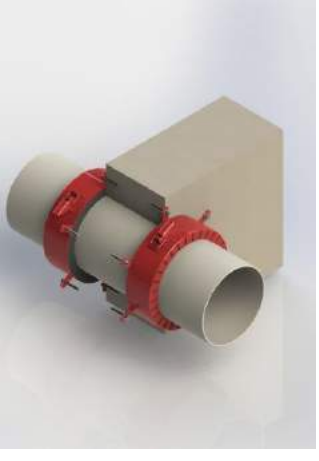

Image courtesy of Firetherm

Products

Active and passive fire protection products to be installed should be 3rd Party certificated. Manufacturers in such schemes will be pleased to provide details of their certification, typically provided by UKAS accredited bodies such as BRE / LPCB, Warrington Certification, BM TRADA, IFCC, FM Global and UL. Should there be any doubt or ambiguity as to product listing then clarification can be readily sought by visiting the appropriate website.

Installers

Although there is currently no legal requirement of 3rd Party Certification for structural fire protection installers, Building Regulations Approved Document B states:
"Since the performance of a system, product, component, or structure is dependent upon satisfactory site installation, testing and maintenance, independent schemes of certification and registration of installers and maintenance firms of such will provide confidence in the appropriate standard of workmanship being provided. Third party accreditation provides a means of ensuring that installations have been conducted by knowledgeable contractors to appropriate standards, thereby increasing the reliability of the anticipated performance in fire".

The 'FPA Essential Principles Design Guide' states: *"All fire protection products / systems shall be installed by adequately trained specialist installers …. installers shall be third party certified to install the specific product / system when an appropriate scheme is available".*

Limitations on installers

It is necessary to understand some of the limitations to ensure that all potential workmanship issues are covered. Stakeholders should check that 3rd party certificated contractors hold certification for each & every product they install. For example BRE/LPCB scheme LPS 1531 covers the requirements for the approval and listing of companies installing or

Image courtesy of BRE (Global)

applying the following passive fire protection products:

- Penetrations, Cavity Barriers and Linear Gap Seals
- Fire Rated Board and Cladding to Steels
- Intumescent Coatings to Structural Elements
- Fire Rated Spray Materials
- Fire Rated Ductwork Systems
- Fire Resisting Dampers
- Fire Resistant Compartment Wall Systems

Very few if any companies are in the scheme for all types of products.

It should also be noted that this scheme does not apply to fire doors; these are covered by two separate schemes: LPS 1271 for installing Fire and Security Doors, Doorsets, Shutters and Active Smoke / Fire Barriers; LPS 1197 for repairing and maintaining them. Some organisations will be licensed for only one or more but not all of the products within these two schemes.

It should also be noted that some schemes will allow a member of the scheme to undertake work outside of the scheme, potentially to a lower QA standard. It is therefore crucial that the Responsible Person ensures that all aspects of the work being undertaken by a 3rd party accredited installer is covered by the scheme in which they claim to operate and that ALL work they are undertaking can be fully certified upon completion.

Alternative to third party certification

The alternative to 3rd party accreditation schemes to guarantee competent installations is by using inspection and auditing services to guarantee that fire safety components are being installed competently to the required standard of workmanship. Suitable organisations to undertake such inspections include BRE, Warrington Certification, BM TRADA, IFCC and the BWF.

In house quality assurance checks

This may be an option where a suitably competent person is employed and has access at relevant stages in the construction. Where used, proof of competence and a schedule of inspection must be provided.

Planned Preventative Maintenance

The future management of fire safety components is an important function which must be considered at design stage; a primary aim being to minimise the resources that will be required.

The Responsible Person must ensure that all fire safety components, including compartmentation, are adequately managed and maintained. A key aspect of this is ensuring that the workmanship and expertise on repairing and maintaining the various components does not fall below that employed at installation.

Image courtesy of Checkmate Fire

3rd Party Certification warranties will be rendered invalid if they are not adequately managed and maintained. As stated on LPCB LPS 1531 Certificates, they only remain valid "providing that the passive fire protection is checked on an annual basis and any damage or defects rectified by a competent person in line with the Regulatory Reform Order 2005". Most 3rd Party certificated installers will be able to offer such a service at building completion stage.

Maintenance, test, check and training burden:
It may well be difficult to recruit, organise and train people to carry out functions such as first responders to alarm activations, fire wardens, evacuation stewards, operators of evacuation equipment, extinguisher users etc.
The factors to consider include:

- Time: the duration of tasks
- Expertise: Level of knowledge required and training implications
- Access: Requirements to work at height, confined spaces etc.
- Lifespan: frequency of tasks and working life before replacement
- Expected examples of equipment include:
- Service free water mist extinguishers to cover all except risk of metal fires or in high voltage electrical equipment areas
- Self test facilities on emergency lighting systems
- Quality doors and fittings and hold open devices
- How hidden spaces and cavities within the building can be readily accessed to both inspect and maintain the in-built fire safety components

h. APPEndIcES

Fire Strategy content

The Fire Strategy document shall:

- Provide a full description of the assumptions and philosophies that led to the fire safety design, including explicit assumptions regarding the management level and designated use of the building, housekeeping and other management functions;
- Explain the nature of the fire safety planning, construction and systems designed into the building, and their relationship to overall safety , evacuation and management;
- Describe the basic fire precaution measures;
- Provide information, etc., relating to other reasons for protecting the building – property, contents, fabric, heritage, environment, insurer's requirements.

Fire Safety Manual content

The Fire Safety Manual shall include:

- Fire Strategy.
- The design limits of the maximum numbers of persons who may safely use each space including escape routes, staircases, exits etc. This shall be augmented with the maximum numbers of mobility impaired persons.
- Design imposed restrictions not shown on the plan drawing i.e. fire loading etc.
- Any pre-planned procedures agreed with the fire and rescue service
- Documentation to describe the use, test, servicing and maintenance of the fire safety features and equipment.
- Detail the prevention and security measures (including measures for the prevention of arson);
- Details interactions with security, building management, other safety systems, etc.;
- A fire safety plan drawing will show all fire safety related features i.e.
    a. Escape routes indicating maximum as built capacity, minimum width to meet the client occupancy levels and any not suitable for disabled persons or specifically provided for them.
    b. Room use and maximum as built occupancy numbers.

c. High fire risk areas.
d. Hazardous areas and storage.
e. Compartmentation including fire resistance of partitions, floors, fire shutters etc. All passive fire protection components and elements must be shown
f. Fire and final exit doors indicating securing, hold open or self closing devices.
g. Detection and alarm equipment including zones, ancillary and interfaced items.
h. Emergency lighting units
i. Fire fighting equipment including hydrants, dry risers and items for Fire Service use.
j. Electricity and gas supply cut-offs.
k. Ventilation systems controls, ductwork and dampers.
l. Fire related signage.
m. Smoke control zones and equipment.
n. Fire fighting and evacuation lifts and controls
o. Control points for any other fire related equipment (ventilation, gas, electricity etc).
p. Access (exterior and interior) for the fire and rescue service and hazards to fire-fighters (e.g. some types of sandwich panels)
q. Fire refuges and specialist disabled equipment.
r. Assembly points and/or muster stations.

CDM etc.

Prior to any construction, refurbishment or installation works being undertaken, the extent that the building's fire safety arrangements that could be affected by the works must be established.

Notifiable Works i.e. any construction, alterations, conversions, fitting out, redecoration or other maintenance / installation works over 30 days or 500 man-hours.

The building's fire safety arrangements under these works will form part of the appointed CDM Coordinator's (CDM-C) role to provide all relevant information to the Principal Contractor as part of the Pre-Tender Safety Information Pack. The universities Project Manager will need to discuss, collate and provide all relevant information to the CDM-C as soon as they have been appointed, so that the fire control measures are in place before any works are started.

Non-Notifiable Works i.e. fewer than 30 days or 500 man-hours.
A CDM-C coordinator between universities and the Contractors will not normally be appointed. Therefore, the building's fire protection and control measures will be undertaken by the universities Project Manager. The Project Manager is responsible for providing all relevant information to the contractors & design team, as part of the Pre-Tender Safety Information Pack.

The Fire Safety Legislation requires a fire risk assessment with suitable control measures by both the institution for their premises and the Principle Contractor for sites and those affected by site operations. Those projects where the building is occupied at the same time as construction works are being undertaken are of particular concern.

The aim shall be to protect the occupants, buildings and equipment from fire commensurate to the risks and size of the project or undertaking. Arrangements on site are the responsibility of the Principal Contractor but potential effects on others must be considered by the Fire Safety Advisor.

Due consideration must be given to the affect of work activity on existing fire safety arrangements. Permit to work schemes may prove invaluable for obvious risks such as disabling fire alarms and impeding means of escape but more subtle effects may be missed without the expertise of the Fire Safety Advisor.

Construction Phase Safety Plan

The Principal Contractor or establishment's Project Manager will be responsible for the site fire risk assessment and the implementation, supervision and monitoring of suitable control measures prior to and for the duration of the project. These shall be conducted in consultation with the Fire Safety Advisor and arrangements recorded in the Safety Plan. Note: these documents may be requested by any authorised Fire Brigade Officer attending site.

The Safety Plan will include:

- The Fire Risk Assessment
- Procedures for Serious & Imminent Danger
- Records of monitoring, training, tests and checks etc.
- Method statements, permits to work etc.
- The plan must be kept up to date and revised as appropriate.

The following fire prevention and fire safety guidance documents (or equivalent) shall be used as a basis:

- Fire Prevention on Construction Sites *(Joint Code of Practice on the Protection from Fire of Construction Site & Buildings Undergoing Renovation - Seventh Edition),*
- Construction Site Fire Prevention Checklist *(A Guide for Insurers, Surveyors and Construction Industry Professionals - Seventh Edition)*

The risk assessments and control measures must include consideration of the impact of the proposed works on the following areas:

- Prevention of fire and control of ignition sources.
- The Means of Escape for occupants to a place of safety; this includes the physical protection of routes, floor surfaces, locks & door furniture and emergency & safety lighting for escape routes etc.
- The building's Fire Compartmentation to protect occupants and escape routes; this includes fire door management, demolitions, fabric removals, penetrations of fire compartment walls & floors by services, pipe work and electrical & data cabling etc. The provision of passive fire protection element of structure and to maintain fire compartmentation.
- The storage and use of hazardous goods by contractors that increases the fire loading or introduces hazardous materials to the site; which includes combustible waste removal, storage and use of hazardous materials such as gas cylinders & flammable liquids and hot works etc.
- The elimination of unwanted fire alarms caused by automatic fire detection being contaminated due to dust, construction activities or works to the fire alarm system within the site or the immediate project site boundaries.

These considerations should generate suitable control measures and **documented arrangements to protect all 'relevant persons'.** These control measures must be in place prior to works starting.

Recommended 3rd Party approval schemes, FIRAS & LPCB

FIRAS is a third party certification scheme for installation contractors of both passive and active fire protection systems, accredited by UKAS to EN45011, operated by Warrington Certification www.warringtoncertification.com

LPCB (The Loss Prevention Certification Board) is part of BRE (Building Research Establishment) Certification www.bre.co.uk and runs many passive and active fire safety schemes to Loss Prevention Standards (LPS), developed by various stakeholder groups over many years

.

Both schemes provide:

- Technical assessment of the installer's competence
- Approval of the installer's quality management system to ISO 9001 (or assessment against the requirements of the relevant Loss Prevention Standard (LPS) where ISO 9001 is not appropriate)
- Regular surveillance inspections of on-going installations
- Surveillance of the installer's quality management system
- Certificates of Conformity which are issued for each installation to demonstrate compliance with the specification
- Listing of the approved installers on their websites.
- LPS schemes additionally require the installer to complete an inspection checklist defining the frequency of inspection as a quality test sign off, completed by an experienced or qualified nominated person in the installation company.

Other schemes for the installation and inspection of fire doorsets are provided by UKAS Accredited body BM TRADA and the British Woodworking Federation (BWF)

Competent Person at handover check list

The issue of the Practical Completion Certificate will be in accordance with the Conditions of Contract and the decision of the Project Manager.

	Yes	No	N/A
Has the Fire Alarm been commissioned for the Project and has the Test Certificate been issued? (Please note this applies to new systems, new zones for existing buildings or the re-commissioning of existing systems)			
• Design Certificate – to be signed by the designer.			
• Installation Certificate – to be signed by the installer.			
• Commissioning Certificate – to be signed by the commissioning engineer.			
• Acceptance Certificate – to be signed by the Project Manager (on behalf of the University)			
Have the Fire Alarm mimic diagrams been erected adjacent to the Fire Alarm Panel?			
Have the Fire Alarm Strategy drawings and description been submitted together with a copy of the marked up plan showing audibility record for Fire Alarm sounders?			
Has the Emergency Lighting Test Certificate been issued?			
• Design Certificate – to be signed by the designer.			
• Installation Certificate – to be signed by the installer.			
• Commissioning Certificate – to be signed by the commissioning engineer.			
• Acceptance Certificate – to be signed by the Project Manager (on behalf of the University)			

	Yes	No	N/A
Have all fire resisting doors within the scope of the project been subjected to an inspection by a competent person?			
Has the necessary fire signage (including Fire Action Notices) been supplied and fixed in accordance with Health & Safety (Safety Signs & Signals) Regulations 1996 and BS 5499?			
Have commissioning certificates been provided for specialist equipment for Fire & Rescue Service use (i.e. Smoke Extract & Control Systems, Dry Rising Mains, Fire Fighting Lifts etc) been provided were necessary?			
Is fire fighting equipment (such as portable fire extinguishers) fixed in place accordance with BS 5306: Part 8?			
Is there evidence that firestopping and other passive fire protection components have been installed by 3rd Party accredited installers to a manufacturer s fire tested system?			
Have details of all passive fire components installed, including dry-lined fire walls and fire doors been included in the Fire Safety Manual?			
Has the Fire Safety Manual been supplied, does it contain all required information and are arrangements in place to revise these as built?			
Has the Fire Risk Assessment been conducted?			
Are arrangements in place to ensure fire safety during the fit oout and occupation period?			

Signed: Project Manager .....

Date: .....