Ensuring Best Practice for Passive Fire Protection in Buildings

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FOREWORD

I am pleased to introduce to you the revised ASFP Guide to *Ensuring Best Practice for Passive Fire Protection in Buildings.*

The previous version of this document was written following a Department of Trade and Industry sponsored project 'Ensuring Best Practice for Passive Fire Protection'. The objectives behind the research were to determine the problems existing in the specification and installation of passive fire protection in buildings and to analyse the reasons behind them.

This latest version has been updated to reflect changes in legislation, specifically the Regulatory Reform (Fire Safety) Order and its national equivalents and changes in standards and codes of practice for fire safety in buildings e.g. BS 7974, BS 9999 and BS 9991. It also now also covers legislation within the Republic of Ireland.

Passive fire protection plays a vital role in making buildings safe when fire occurs; by ensuring the building does not collapse and by subdividing it to prevent the spread of smoke and fire. It comprises those elements such as fire doors, walls, protection to the structural frame and protection to services passing through walls/floors which are specifically engineered to provide protection.

Passive fire protection offers building occupants extra time to evacuate safely in the event of a fire and aims to contain a fire within a single fire compartment, providing clear lines of safety for firefighters entering the building.

All passive fire protection measures must be correctly designed, specified and installed if the building is to behave as expected should fire break out. This document sets out the ways in which the process of design, installation and maintenance of passive fire protection may be undertaken with other protection measures to provide fire safe buildings for occupiers and to overcome the systemic failures identified by the earlier research.

I extend my congratulations to all of those involved in the production of this Guidance Document and believe that it will provide the reader with added knowledge that will help him or her to design, install and maintain passive fire protection systems to the highest standard.

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USING THIS GUIDE

This Guide is intended to offer architects, designers, constructors, building occupiers and others, practical and helpful recommendations and selection criteria for the use of passive fire protection (PFP) systems in buildings. It originated as the outcome of a three year 'Partners in Innovation' project, which was partly funded by the Department of Trade and Industry (now Department of Business, Innovation and Skills) and the Office of the Deputy Prime Minister (now Department of Communities and Local Government). The document has been updated to include reference to the Regulatory Reform (Fire Safety) Order, England and Wales and its national equivalents in Scotland and Northern Ireland. It has also been revised to cover developments and legislation in the Republic of Ireland.

The main objective of the original project was to determine the problems existing in the specification and installation of PFP systems in buildings and to analyse the reasons behind them, with the intention of producing effective and feasible guidance on the use of PFP. The guidance is also intended to have the additional benefit of providing Building Control Bodies and other enforcement authorities with summarised, accessible, and meaningful information that will enable them to more accurately assess the appropriateness of the passive fire protection systems intended for the building.

The Best Practice recommendations in this Guidance are shown highlighted in this manner.

A summary of important recommendations are shown at the end of each section.

1 INTRODUCTION

This guidance document is intended to assist all involved in the design, construction, administration, management or inspection of buildings or structures to establish 'Best Practice' in the provision of passive fire protection (PFP) measures.

It is intended to provide a reference document that contains basic details and directs the user to detailed sources of information. Only by applying due diligence at all stages of the process is it possible that these measures are likely to provide the expected performance.

1.1 Introduction to fire protection and passive fire protection (PFP)

PFP is vital to the performance of a building or structure in the event of a fire. PFP is built into the structure to provide stability and into walls and floors to separate the building into areas of manageable risk. These areas are designed to restrict the growth and spread of fire allowing the occupants to escape or the firefighters to do their job. Such protection is either provided by the materials from which the building is constructed, or is added to the building to enhance its fire resistance.

Most passive fire protection products are 'fire resisting'. Fire resistance is the ability of elements of construction such as beams/columns, walls, floors and doors etc. to 'resist fire' for certain periods of time. A component with a fire resisting function can resist fire in one or more of three ways. It must resist structural collapse and/or it must resist the passage of smoke and hot gasses (integrity) and/or it must resist heat conduction (insulation). A structural floor in a multi-storey building will require all three. A non-loadbearing compartment wall will have to provide insulation and integrity. A steel beam or column will only have to provide structural stability.

Loadbearing elements such as beams, columns, walls and floors have to be able to support their load under fire conditions. Separating elements such as doors, walls, glazed screens and suspended ceilings have to stop fire passing through them either as flames or by heat conduction. Loadbearing and separating elements such as loadbearing walls and floors have to do both. Any building services that pass through separating elements such as cables, pipes or fire resisting ducts need to be fire stopped to ensure that the service does not provide an easy route for fire. These are critically important since they are often located in concealed spaces which means that fire can pass unnoticed. It also makes evaluation of their correct installation difficult.

It is vital that all protection measures are correctly designed, specified and installed if the building is to behave as expected should fire break out. By their nature they are 'passive' until there is a fire and only then will their fire performance in-situ be demonstrated. The occupants of a building will attend to their daily business; visitors will shop, be entertained, or enjoy recreation without any knowledge of the PFP measures that will protect them in the event of a fire. However, it is essential that these measures will work if an emergency occurs.

1.2 Built-in fire protection and passive fire protection

Many construction materials have some natural resistance to fire and as such already have built-in fire protection. An example of such a material would be clay bricks, which, when constructed to form a wall is fire-resisting in its own right. Other materials e.g. timber used in the construction of a timber floor may have little such built-in fire protection and may require additional protection e.g. in the form of fire resisting boards fixed to the underside of the ceiling below. Fire resistance may be enhanced by the use of added materials or components that are known by the collective term passive fire protection (PFP). These are called passive because they do not need any special energisation or command signal to operate, (although some systems such as dampers and certain types of doors may be designed to operate from such methods). PFP includes:

- Fire protection to the structural frame of the building
- Fire-resisting doors and fire door furniture
- Fire shutters
- Compartment walls and floors
- Fire-resisting walls and partitions
- Suspended ceilings
- Fire-resisting glazing
- Fire doors and hardware
- Industrial fire shutters
- Fire fighting shafts and stairwells
- Fire-resisting dampers (mechanical or intumescent) used in horizontal or vertical air distribution ducts
- Fire-resisting ductwork
- Fire-resisting service ducts and shafts
- Linear gap seals
- Penetration seals for pipes, cables and other services
- Cavity barriers
- Fire-resisting air transfer grilles (mechanical or intumescent)
- The building envelope, e.g. fire-resisting external walls, curtain walls etc.

1.3 Active fire protection

Active fire protection is the fire protection which requires special energisation or a command signal to operate. It includes:

- Detection systems
- Alarm systems
- Sprinkler systems
- Other fire suppression systems
- Smoke control systems

Active systems all need to be actuated by a signal. Detectors will operate from heat, smoke, carbon monoxide (CO), carbon dioxide (CO_2) etc. A signal from a detector will be needed to operate any of the systems listed above. Alternatively, or in addition, these systems will usually be operable by manual triggering, e.g. from a control room or fire alarm call point.

The fire safety of many modern buildings is now engineered via a fire safety strategy that encompasses active fire protection, passive fire protection, fire safety management and other measures. In such buildings, the active and passive fire protection measures work holistically to provide a fire safe environment. This publication is limited to passive fire protection.

1.4 Why guidance is needed

The original research undertaken in support of the first version of this publication showed that the PFP in some buildings was not of the highest quality. This situation is compounded by alterations made to the building by the occupier as changes in occupancy, operations or systems take place.

Furthermore, the move within regulatory guidance from prescriptive rules to performance-based designs and risk assessment during occupation has resulted in there being greater responsibility for safety on construction companies and building owners or occupiers. The Regulatory Reform (Fire Safety) Order (RR(FS)O) (and national equivalents) requires employers to appoint a 'Responsible Person ' to take responsibility for fire safety within a building, this includes the installation and maintenance of passive fire protection systems.

1.5 The fire process

This section briefly describes the way a fire develops to become a life-threatening event so that the recommendations in this Guidance can be understood in context and their importance appreciated.

A fire in a building can start in a number of ways. These include:

- Careless use of smokers' materials e.g. smoking in bed
- Children playing with matches and cigarette lighters
- Faulty wiring or electrical equipment
- Incorrect use of electrical equipment
- Careless use of cooking equipment, especially leaving oil fryers (chip pans) unsupervised
- Drying of materials (e.g. fabrics) that will smoulder and burn near heaters such as gas fires and electric radiant, storage and convector heaters
- Putting portable heaters too close to furniture and curtains
- Poor detailing of hot flues, particularly when adjacent to combustible insulation material
- Hot work; inadequate compliance with hot-working procedures during construction or maintenance
- Items falling into open fires or other heat sources
- Incorrect use of paraffin heaters
- Covering of storage and convector heaters
- Irregular or poor servicing of heating appliances e.g. gas fires
- Lightning
- Self-heating of specific materials
- Electrical sparks, mechanical sparks
- Heat from the sun e.g. of a magnifying mirror
- Arson

A fire starts when the source of ignition (something very hot) is in contact with something ignitable (something readily combustible). Because a material is combustible does not mean it will always ignite easily, but the item ignited e.g. paper, may be in contact with other combustible materials e.g. furnishings. Once the fire has started, extra heat is produced by the first item and this can cause other items to burn. So the fire can grow very quickly, and this speed of growth is enhanced by being in a room which can contain the heat. Fires indoors grow more quickly than fires in the open. How the fire then develops depends on the quantity and density of combustible materials in the room or compartment and the materials used to line the wall and ceilings.

As the fire gets bigger, another factor becomes important; the amount of air available. In a small room, with all doors and windows closed, the fire will use up the air quite quickly and may just smoulder or even go out. But in a larger room, or where doors or windows are open, or the windows break because of the fire, it will grow more quickly. Eventually, the fire gets so hot that flammable volatiles are produced more quickly than the air can reach them. These volatiles leave through the various openings to burn outside a compartment. Once this stage is reached the fire is very dangerous since it can spread very quickly. The development of a fire depends on the source of ignition, quantity and layout of the material to burn, and the air supply.

As well as heat, the fire produces products of combustion which include smoke. This is often the first killer since it is produced in large quantities by most fires and it can spread a long way from the fire. It can be blinding, an irritant and toxic. As well as being dangerous in itself, even quite dilute smoke can reduce visibility and hinder escape. It is also known that some toxic gases affect a person's decision-making ability.

Some fires start off as smouldering hot spots. These fires do not grow very quickly and do not produce very much heat, but can produce very toxic smoke. Smouldering fires may suddenly turn into real flaming fires and grow very rapidly. They are particularly dangerous to people who are asleep.

There can be different risks in different occupancies. Not only will the content and use of the building affect how the fire starts and develops, but the function of the building will determine the type of people present. People who are familiar with a building will find the exit routes more easily than those who are new to the building, and when people are sleeping they are likely to take longer to react to an emergency than those awake. Similarly, people who are confused (for whatever reason), or have reduced capacity due to drink or drugs will be at particular risk. Occupants of a partially occupied building can be at particular risk if a fire breaks out in the unoccupied part.

1.6 Design response

The building designer has a range of techniques available to protect occupants against fire and smoke. These include:

- PFP measures to physically limit the spread and effects of the fire, protect escape routes against heat and smoke and stop the building collapsing
- Detection and alarm systems, to quickly alert occupants and ensure a rapid response
- Smoke control systems to limit the spread of smoke, or contain it so that it does not hinder escape
- Suppression systems such as sprinklers or water mist to either put the fire out or limit its growth
- Use of passive and active fire protection measures to 'protect in place' e.g. where occupants are immobile or by the use of refuges.
- Facilities designed into the building to assist the fire service in their efforts to extinguish or control the fire and rescue trapped occupants.

The fire safety design of a building to satisfy regulations will usually only consider life safety. However, other issues such as; protecting the building fabric/contents, business interruption, heritage, functionality and environmental protection may also be applicable. The building manager or 'Responsible Person' must be made aware where these additional criteria, if any, have been considered. In designing a building, the designer must specify PFP materials and constructions that will limit the growth and spread of fire and smoke.

1.7 Extreme events

Unless specified, fire safety systems, both passive and active, will not be designed or constructed to cope with a fire resulting from, or accompanying, an extreme event, such as an earthquake, an explosion or an impact from an aircraft. Materials are available which, properly designed and implemented, could provide protection, or, at least, some protection, against these consequential fires. This may entail significant weight and/or cost implications. The requirement for a PFP system that must withstand a defined extreme event needs to be defined very early in any building project.

Summary recommendations

- *Passive fire protection is provided to make buildings safe when fire occurs; by ensuring the building does not collapse and by subdividing it to prevent the spread of smoke and fire. PFP comprises those elements e.g. doors, walls, protection to the structural frame and protection to services passing through walls/floors which are specifically engineered to fulfil this function which may be in addition to their normal function in a building. PFP is essential for fire safety.*

2 REGULATIONS, STATUTORY GUIDANCE AND THE ENGINEERED APPROACH

2.1 Building regulations

Building regulations in the UK and the Republic of Ireland are applicable to most building work that is undertaken. The Regulations for England and Wales are functional and deal with life safety standards for design and building work in the construction of domestic, commercial and industrial buildings. The regulatory systems in Scotland, Northern Ireland and the Republic of Ireland differ from those in England and Wales. However, the underlying principles are similar (see section 17).

A summary of the applicable legislation and appropriate statutory guidance documents for fire safety is given in table 1 below.

Table1. Applicable legislation and appropriate statutory guidance documents for fire safety

Country	England & Wales	Scotland	N. Ireland	Ireland
Building Regulations	Building Regulations 2010	Building (Scotland) Regulations 2006	Building Regulations (N. Ireland) 2000	Building Control Regulations 1997– 2014. Building Control (Amendment) Regulations 2014 (S.I. 09)
Statutory or Supporting Guidance docs	Approved Document – B 2007	Technical Handbook 2013	Technical Booklet E 2012	Technical Guidance Document B 2006 (new TGD-B expected 2014)
Building Regulation 38 equivalent	Yes	No*	No	Fire Services Acts 1981 and 2003
CDM regulations or equivalent	'94 to '97	'94 on	'94 on	Safety Health & Welfare at Work (Construction) Regulations 2013 (S.I. 291)

**However, Scottish Building Standards Officers can apply 'continuing requirements' and fire safety design documents are part of those. In addition the Scottish Executive is considering an equivalent to Regulation 38.*

The Building Regulations in the UK do not give the end-user sufficient guidance to be able to design a building or specify the appropriate passive fire protection. In some cases e.g. for England and Wales, they simply state basic functional requirements such as:

> "B3: The building shall be designed and constructed so that in the event of fire its stability shall be maintained for a reasonable period… Where reasonably necessary to inhibit the spread of fire……measures shall be taken…comprising either or both of the following:
>
> a) sub-division… with fire resisting construction
> b) installation of suitable automatic fire suppression systems"

These simple functional statements naturally lead to the question – "how do I do that?" This is where the architect or building designer is faced with a number of choices. There are basically three routes which can be followed to ensure compliance:

2.2 Statutory guidance documents

Statutory guidance documents e.g. Approved Documents B (England & Wales), Technical Handbook (Scotland), Technical Booklet E (N. Ireland) and Technical Guidance Booklet B (Ireland) contain all the fire precautionary measures necessary to provide safety from fire and to safeguard building occupants, persons in the vicinity of buildings, and firefighters. These include guidance on the design of escape routes; provision of fire alarm and detection systems; fire performance of internal wall and ceiling linings; limits to compartment sizes; periods of fire resistance; provisions for fire doors; limitations on the performance of external walls and roof; and provisions for the fire service, including access.

The great majority of buildings constructed in the UK and Ireland follow the guidance contained in these documents. This is because most of these are relatively simple buildings, such as houses, shops, warehouses etc. Building designers are content to follow the 'Approved Document' (AD) route because it is tried and tested and there is less risk of liability if something goes wrong compared with the alternative approaches overleaf.

2.3 Engineered approach

There is, however, a general move by designers away from the 'prescriptive' methods in the Approved Documents towards performance or output-based specification. The building regulations make provision for projects as a whole or in part to be 'fire safety engineered' to provide alternative solutions to those contained in the Approved Documents. This allows the developer and his designer more freedom to innovate in both design and functional areas. For example, if the building is complicated – for instance a mix of shops, a theatre and a railway station in one complex or if it is an iconic building then often the Approved Document route can be too prescriptive and limiting.

It is also recognised that the Approved Documents cannot and do not attempt to provide all the answers for all building types. Their provisions cannot guarantee a safe solution in all instances and that in some buildings, especially large and complex buildings; a fire engineered solution may be the only way to ensure that the building is safe in fire. An engineering approach can also be used to provide solutions to specific problems in certain buildings. In these cases, the designer has two alternative options available:

2.3.1 BS 9999 Code of practice for fire safety in the design management and use of buildings

This is a code of practice for fire safety design beyond the limits of the Approved Documents. It is not a fire engineering guide, although it uses fire engineering principles to formulate the guidance it provides. It sits in between the 'Approved Document (AD)' and the full fire safety engineering approach. It promotes a more flexible approach to fire safety design through the use of structured risk-based design, where designers can take account of varying human factors. Additional guidance within BS 9999 includes:

- Evaluation of risk profile and assessment of risk
- Assessment of fire growth with/without sprinklers
- Role of fire detection and alarm systems
- Compartment sizes and periods of fire resistance (with/without sprinklers)
- Design of the building structure: Load bearing and non-load bearing elements
- Grading of fire safety management procedures into three levels, and the effect they have on fire safety in conjunction with other factors.
- Managing occupied buildings
- Consideration of occupant response time and allowable travel time
- Phased evacuation and refuges

BS 9999 is a useful step forward over the relatively simple one size fits all 'AD' type approach. However, its use in designing buildings has not been as great as was expected when it was introduced. This may be because is it not radical enough (it is still not suitable for truly innovative buildings), or it may be that its potential users feel they need to be fully qualified fire safety engineers. These professionals are more likely to use BS 7974, which offers more freedom. It should be noted that in Scotland, the use of BS 9999 is seen as an engineered solution.

2.3.2 BS 7974 Application of fire safety engineering principles to the design of buildings

Fire safety engineering can be used for any building but is particularly applicable to complex buildings and offers a lot of advantages to the building owner, the occupier and the developer/contractor. These include:

- Innovative design
- Extended escape distances
- Reduced fire resistance periods for the structure
- Increased compartment sizes
- Removal of stairs resulting in an increase in the useable floor plate
- Flexibility in the use of space for the end user
- Reduced construction costs

To enable this, fire engineered buildings are reliant upon a number of engineering techniques, such as hot smoke extraction systems, smoke venting, smoke curtains, extensive automatic fire detection, fire suppression systems, compartmentation of high risk areas and well-defined operational procedures and fire safety management.

BS 7974 is a code of practice for the use of such systems and procedures. Its application almost certainly requires the designer to be or to employ the services of a fully qualified fire safety engineer. There are many interacting systems and philosophies in fire safety engineering and it takes individuals with the relevant skills and qualifications to use these to ensure they don't create a building which may have inherent fire safety flaws, due to the inappropriate use or application of particular fire engineering techniques.

2.4 Other regulations

2.4.1 Construction (Design and Management) (CDM) Regulations (UK only)

For a building constructed after 1994, the Construction (Design and Management) Regulations (Statutory Instrument 1994 No. 3140), Safety Plan should provide details of the fire safety provisions, including the appropriate PFP measures. Statutory Instrument 1994 No. 3140: Construction (Design and Management) Regulations 1994. More information on regulations is given in section 17.

2.4.2 Building Regulation 38 (formerly Regulation 16b) - England & Wales only

In addition to the CDM Regulations, if the building was constructed after April 2007, Regulation 38 (formerly 16b) of the Building Regulations applies in England and Wales. This requires that sufficient fire safety information be provided for persons to operate and maintain the building in reasonable safety. An overview of what information is required in terms of PFP measures is provided in Annex G of Approved Document B Volume 2: Fire Safety. The information, which should have been passed on by the main contractor in compliance with Regulation 38 is vital to ensure that an appropriate and effective fire risk assessment under the RR(FS)O can be undertaken (see 4.1). Such information, whether arising from the CDM Regulations or Regulation 38 will include details of fire-resisting construction on escape routes, fire compartmentation and other PFP information specified to satisfy AD-B and should include the fire test and assessment reports and any third party certification (see section15).

2.4.3 Fire Services Acts 1981 & 2003 – Ireland

Owners of buildings constructed or materially altered since Building Regulations came into force in 1991 will have a Fire Safety Certificate issued by the local authority prior to construction. This approves the design but not the construction and it is the legislative responsibility of the new owner to ensure that the finished building complies with the approved design. It is reasonable to assume that if a building is constructed and maintained in compliance with the Fire Certificate issued by the Fire Prevention Office of the local authority it will meet the requirements of other legislation.

Summary recommendations

- *Building Regulations in the UK and Ireland deal with life safety standards for the design and construction of domestic, commercial and industrial buildings. The provisions are expanded in Statutory Guidance Documents such as Approved Document B (and national equivalents) which give detailed guidance on how to meet the regulations. Alternative ways to satisfy the Building Regulations using less prescriptive methods include the engineered approaches embodied in BS 9999 and BS 7974 which are increasingly used as designers seek more freedom to innovate in building design.*
- *The Construction (Design and Management) Regulations 1994 Safety Plan should provide details of the fire safety provisions, including the appropriate PFP measures for buildings constructed in the UK.*
- *Regulation 38 of the Building Regulations (England and Wales) requires that sufficient fire safety information on all fire protection systems (including passive fire protection) be provided for persons to operate and maintain the building in reasonable safety. Similar provisions apply in Ireland and are being developed for Scotland.*
- *The fire safety design of a building to satisfy regulations will usually only consider life safety. However, other issues such as; protecting the building fabric/contents, business interruption, heritage, functionality and environmental protection may also be applicable. The building manager or 'Responsible Person' must be made aware where these additional criteria, if any, have been considered. In designing a building the designer must specify PFP materials and constructions that will limit the growth and spread of fire and smoke.*

DEMONSTRATING PERFORMANCE

Before a manufacturer can place a product on the market, the expected performance of the product has to be demonstrated to the purchaser/specifier and those involved in the building control process.

3 DEMONSTRATING THE PERFORMANCE OF PFP PRODUCTS

Before a manufacturer can place a product on the market, the expected performance of the product has to be demonstrated to the purchaser/specifier and those involved in the building control process. For the fire performance this is usually achieved by conducting tests against British Standards (BS) or European Standards (BS EN) recommended in AD-B (or national equivalents).

Only passive fire protection products which can be shown to have a fire performance that satisfies the relevant test standard(s) should be put into the market-place. Relevant documents to verify this must be available to the user and enforcement authorities.

The fire performance will be demonstrated in a variety of documents which are listed below:

3.1 Fire test reports

These documents give a full and comprehensive account of the British or European Standard fire test that has been performed upon the product. Test reports will include:

- a detailed description of the test specimen
- details of the test procedure
- comprehensive details of measurements made, and
- the results of the test

The results given in the test report relate only to the actual product, component or assembly that was tested and not to any variation thereof e.g. different thicknesses, densities or dimensions.

Greater confidence may be gained if test reports have been produced by a laboratory that has been accredited by the United Kingdom Accreditation Service (UKAS) for that specific test procedure.

Further guidance on the types of test report can be found in ASFP Advisory Note on indicative or ad-hoc testing.

3.2 Assessment/expert judgement reports

These documents give a detailed opinion on the likely performance of the product if it were to be tested to the appropriate standard fire test method. They are often used to support variations to the product from that which was actually tested or to support application of the product within the context of national regulations.

Assessment reports will include:

- a detailed description of the construction being assessed or will refer to test reports that contain this information
- a detailed opinion on the likely performance of the product if it were tested to the appropriate fire test method. This opinion will be supported by a detailed argument which should be able to be followed by the end user and may include expert judgement
- a reference to all test reports used in formulating the opinion
- a prediction of the results of the test that might be achieved
- If undertaken by a FTSG or PFPF member*, a statement of compliance with the PFPF *Guide to undertaking assessments in lieu of fire tests*, and
- a statement concerning the period of validity of the assessment

Assessment reports reflect opinion and should have been produced by a competent authority/persons appropriate to the complexity of the evaluation undertaken. Advice is given in the PFPF *Guide to undertaking assessments in lieu of fire tests*.

*The Fire Test Study Group (FTSG) is the UK group of laboratories offering fire testing and assessments for building control purposes. The Passive Fire Protection Federation (PFPF) is a group of trade associations of manufacturers and installers of PFP and includes representatives from FTSG.

3.3 Certificates of third party product certification

Third party product certification is a process whereby a third party validates the performance of the product as manufactured in the factory. It increases confidence in the quality and reliability of PFP because it provides the link between the product as supplied to the market and the fire performance of that product determined by fire tests and assessments. Product certification schemes typically require the following:

- selection of samples from the factory (or the market) – prevents manufacturers obtaining a result from a 'tuned' specimen
- determination of characteristics by testing, inspection, design appraisal or assessment
- process and product review (evaluation)
- decision and licensing (i.e. granting, maintaining, extending, suspending, withdrawing the right to use certificates or marks)
- surveillance by testing, certification and surveillance of factory production control, ongoing audit procedures and evaluation of quality management systems to ensure consistency of production
- labelling that identifies the certification body
- maintenance of a register of certificated products

Such schemes provide the end-user with a certificate which identifies the product and its achieved fire performance including all the variations that would normally be covered by assessments. These certificates are short and easy to follow documents, so, in addition to guaranteeing the performance of the product, they are also easier for the end user to assimilate.

It is strongly recommended that wherever possible, passive fire protection products should be supported by third party certification and that clients, end-users and specifiers should always specify third party certificated products.

The Approved Documents advise that fire protection products may be more reliable if supplied under Third Party Certification schemes. For example, AD-B (England & Wales) advises:

> *Confidence that the required level of performance can be achieved will be demonstrated by the use of a system, material, product or structure which is provided under the arrangements of a products conformity certification scheme…*

and

> *Use of Guidance; Materials and Workmanship – Independent certification schemes: There are many UK product certification schemes. Such schemes certify compliance with the requirements of a recognised document which is appropriate to the purpose for which the material is to be used. Materials which are not so certificated may still conform to a relevant standard. Many certification bodies which operate such schemes are accredited by UKAS. Since the fire performance of a product, component or structure is dependent upon satisfactory site installation 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.*

The ASFP strongly supports the take up of third party certification (see section 15) for manufacturers of PFP products. It publishes a series of 'colour books' which give detailed guidance on the testing, assessment and evaluation of passive fire protection products. These are listed in section 18. It is a condition of entering products in the ASFP colour books that all products are either CE marked, or third party certificated. Schemes are available from the providers listed in section 18.3.3.

3.4 CE marking

The Construction Products Directive (CPD) was superseded by the Construction Products Regulation (CPR) in 2013. However, many of the provisions, procedures and documents used in the CPD have been carried over into the CPR and so it is necessary to have an awareness of both. Furthermore, many manufacturers' products will have already been assessed under the CPD and it will be some time before a reassessment under the CPR is completed for all products currently CE marked.

3.4.1 Construction Products Directive (CPD)

The Construction Products Directive required Member States to enact legislation in accordance with its provisions which were drafted to facilitate the free movement of construction products on the EU market. Under the legislation the manufacturer was responsible for demonstrating that his/her product met the necessary essential requirements of the CPD in order to place the product on the European market. These requirements covered more than just fire performance and the product characteristics designed to meet them are detailed in the relevant European Technical Specification for the product, which is either:

- a harmonised product standard (hEN) or
- a European Technical Approval Guideline (ETAG).

hENs are prepared by the European standards body CEN in response to a 'mandate' (an order) from the European Commission. European Technical Approval Guidelines (ETAGs) are prepared by the European Organisation for Technical Approvals (EOTA) also in response to a mandate from the Commission. A list of harmonised standards can be found at http://ec.europa.eu/enterprise/newapproach/nando/index.cfm?fuseaction=cp.hs. A list of published ETAGs can be found at: http://www.eota.eu/en-GB/content/etags-used-as-ead/26/ (websites accessed at Feb 2014).

The evaluation of a product against a European Technical Specification will usually require the involvement of a third party e.g. a certification body that will be responsible for checking the manufacturer's factory production control and selecting samples for tests.

The Construction Products Directive led to a large number of new fire test methods which are incorporated in all of the statutory guidance documents to building regulations listed in table 1. These provide for 'visible recognition' of all the European fire test methods, extended application methods and classifications so that products that satisfy these standards do not have to be tested or evaluated against existing British Standards.

Once the performance has been demonstrated against European test methods, this is accepted across the EU; and so current systems of testing to national fire test standards will gradually decrease. A manufacturer can demonstrate that his/her product has undergone the relevant attestation procedures by CE marking the product.

The documents used to demonstrate the performance of the PFP product under the CPD are the Declaration of Conformity and the fire classification document. However, these are often very limited in scope and may not give enough information for the end-user to be able to evaluate the performance of a particular product in a particular configuration, size or end use application. In such cases, the end-user may still need to look at the existing documents i.e. test reports, assessments and certificates arising from third party certification (see section 15).

3.4.2 Construction Products Regulation (CPR)

In response to criticisms and weaknesses of the CPD, the European Commission drafted the CPR and it became law in 2012 with all provisions coming into effect in July 2013. Unlike the CPD which is interpreted by individual Member States, the CPR is European law and automatically becomes the law in every Member State. Under the CPR, CE marking is mandatory for those products covered by a hEN. Some PFP products are covered by hENs and proposals are being drafted to make almost all products so covered and thus subject to mandatory CE marking.

Mandatory CE marking for some products started on 1 July 2013. It is difficult to accurately predict when CE marking will become mandatory for each and every product; in most cases it depends on the availability of the product standard (hEN). Some product standards are available now while others are some years away; readers should contact the ASFP or other relevant trade association for the latest situation. The ASFP has produced a short guide – *ASFP Short Guide to the Construction Products Regulation* – which is regularly updated to show the situation for each type of PFP product (see section 18). In most other respects, the CPR is similar to the CPD and the effect on those manufacturers who have already CE marked their products will not be great. However, there will be a significant effect on those manufacturers who have not CE marked their products because it was voluntary; since if their product is within the scope of a hEN, it is illegal to place it on the market without a CE mark after 1 July 2013.

Table 2: CPD v. CPR

CPD	CPR
Essential Requirements	Basic Requirements for construction works
Declaration of Conformity (DoC)	Declaration of Performance (DoP)
CE Marking - Voluntary	CE Marking - Mandatory
European Technical Approval	European Technical Assessment
European Technical Approval Guideline (ETAG)	European Assessment Document (EAD)
Harmonised Product Standard (hEN)	Harmonised Product Standard (hEN) (no change)
European Organisation for Technical Approvals (EOTA)	Organisation for Technical Assessment Bodies (OTAB)
Attestation of Conformity (AoC)	Assessment & Verification of Constancy of Performance (AVCP)
Fire classification document	Fire classification document (no change)

The document used to demonstrate the performance of the PFP product under the CPR is the Declaration of Performance (DoP) and the fire classification document. However, as with the CPD, these are often very limited in scope and do not give enough information for the end-user to be able to evaluate the performance of a particular product in a particular configuration, size or end use application. In such cases, the end-user may still need to look at the existing documents i.e. test reports, assessments and certificates arising from third party certification (see section 15). However, if a product is subject to mandatory CE marking, then the end user must ensure that this is present as it will be illegal to sell such products once a harmonised product standard is published and available.

3.4.3 Product quality and voluntary certification schemes post CE marking

It is important to understand that CE marking is not a quality mark per se; it is just a manufacturer's claim that the product has undergone the necessary attestation procedures set out in the EN product standard or ETAG. CE marking does not preclude the additional use of voluntary certification schemes. Such schemes may set additional technical requirements for the product e.g. in respect of durability, or fitness for purpose. Such schemes may also set a more rigorous system of surveillance or require higher values for characteristics evaluated under CE marking. However, they cannot conflict with CE marking.

3.4.4 Installer certification

Whilst legislation does not generally cover installation of PFP products, the Construction, Design & Management Regulations require installers to be competent so that products are installed completely, correctly and will work as intended in the building.

Schemes are available for certification of installers (see section 18.3.3) and an appropriate scheme should be selected by the main contractor unless the client has already specified a scheme. Any scheme chosen should have UKAS accreditation and will include:

- Verification of the skills and training of management, designers and estimators
- Suitable materials to be used in accordance with approved details
- Operatives and supervisors to be trained and certificated
- Random inspection of sites to monitor the quality of work
- Provision of a 'Certificate of Conformity' for completed work
- Provision of an audit trail
- UKAS accreditation for the scheme
- Verification of the limitations of certification to product areas covered under the scheme

The ASFP strongly supports the take up of third party certification (see section15) for installing contractors; it is a condition of membership of the association.

3.5 Influence of Building Information Modelling (BIM)

The increasing use of BIM will mean that manufacturers will have to have their products identified as 'objects' (data files) which contain all the attributes of the product. In this publication we are mainly concerned with the fire performance, but BIM objects will also contain all pertinent product information. There are several providers of services who can assist manufacturers in this process, including the development of BIM libraries for such products. At the time of writing, it is clear that BIM platforms and standards are still evolving, but eventually most if not all projects will be designed, constructed and maintained using BIM and so it will be imperative for manufacturers to embrace this process.

Summary recommendations

- *Passive fire protection products are 'proven' by being fire tested in specialist independent laboratories. The scope of the performance may be further enhanced by assessments (engineering judgements) undertaken by the laboratories or fire consultants.*
- *Only passive fire protection products which can be shown to have a fire performance that satisfies the relevant test standard(s) should be put into the market-place. Relevant documents must be available to the user and enforcement authorities.*
- *The best guarantee of a product's quality is by third party certification which links the tested/assessed product with the actual factory production control and ensures traceability from raw material to finished product. It is strongly recommended that wherever possible, passive fire protection products should be supported by third party certification and that clients, end-users and specifiers should always specify third party certificated products.*
- *CE marking is a welcome step in the raising of quality for fire protection products because many of the elements of third party certification are included. However, stakeholders should always check the scope of the CE marking to ensure it covers the particular end-use application. In addition, it is not yet applicable to many PFP, so specifiers and other should always look for third party certification where CE marking does not yet apply.*
- *Whilst legislation does not generally cover installation of PFP products, installers have an obligation to install products completely, correctly and so that they will work as intended in the building. The best way of guaranteeing this is to use a third party certificated installer whose skills, training and competence will have been validated by a third party organisation backed up by random inspection of completed works.*
- *Schemes are available for certification of installers (see 18.3.3) and an appropriate scheme should be selected by the main contractor unless the client has already specified a scheme. Any scheme chosen should have UKAS accreditation.*

4 FIRE SAFETY ON BUILDING OCCUPATION

In addition to Building Regulations, which control building work, fire legislation also exists to ensure that adequate levels of safety are maintained once the building is occupied and that the precautions provided are kept under review to ensure that they are appropriate to any changes in fire risk that may occur over time. For more detailed references to fire safety legislation see section 17.

4.1 Regulatory Reform (Fire Safety) Order 2005 (and national equivalents)

The move within regulatory guidance from prescriptive rules to performance-based designs and risk assessment during occupation puts greater responsibility for safety onto building owners or occupiers. The establishment of the 'Responsible Person' under the RR(FS)O (and national equivalents) means that those who are responsible for the operation of a business within a building need to be aware of their responsibilities which include the installation and maintenance of passive fire protection systems.

The 'Responsible Person' is the employer, where there is one, and where there is not it will be the person responsible for the activity undertaken on the premises which might give rise to a risk to those present. It includes;

a) the employer in relation to any workplace which is to any extent under his control;
b) in relation to any premises where there is no employer:
    i) the person (whether the occupier or owner of the premises or not) who has the overall management of the premises; or
    ii) where there is no one with overall management responsibility, the occupier of the premises; or
    iii) where neither (i) or (ii) apply, the owner of the premises

A brief summary of the appropriate legislation is given in table 3 overleaf.

Table 3. Summary of UK and Ireland legislation relating to provision of fire risk assessments

Country	England & Wales	Scotland	N. Ireland	Ireland
Relevant Act	Regulatory Reform (Fire Safety) Order RR(FS)O	Fire Safety (Scotland) Regulations & Fire Scotland Act	Fire and Rescue Services (Northern Ireland) Order 2006	General Application Regulations 2007 under the Safety, Health and Welfare at Work Act 2005. Fire Services Acts 1981 & 2003
Person responsible	Responsible Person	Duty Holder	Appropriate Person	Responsible Person (Employer/landlord)
Person to do risk assessment	Responsible or Competent Person	Responsible or Competent Person	Responsible or Competent Person	Responsible or Competent Person
People affected in building	Relevant Persons	Relevant Persons	Relevant Persons	Employees and persons connected with the workplace

Under the legislation the 'Responsible Person' (England, Wales and Ireland) the 'Duty Holder' (Scotland) or the 'Appropriate Person' (N. Ireland) has to undertake a 'suitable and sufficient' fire risk assessment for the premises for which they are responsible. Where it is considered that such expertise is not available in-house then the 'Responsible Person' (and equivalent in Scotland and N. Ireland) may seek to employ a competent person in the form of a consultant or company to undertake the assessment.

Where external professional fire risk assessors are employed, it is important that they are competent, as criminal liability will arise for the 'Responsible Person' (or national equivalents) if the fire risk assessment is inadequate and people are placed at risk of death or serious injury as a result.

In response to concerns raised over the competency of fire risk assessors and the quality of some fire risk assessments, a Competency Council drawn from a range of industry stakeholders, including the ASFP, was established to agree the requisite skills and competencies needed by fire risk assessors. The Competency Council has published two documents:

- *Competency Criteria for Fire Risk Assessors*
- *A Guide to Choosing a Competent Fire Risk Assessor*

These documents provide end-users with the information they need to be able to choose a suitable fire risk assessor.

The ASFP strongly recommends only using assessors who are on the registers listed in *A guide to Choosing a Competent Fire Risk Assessor*.

The Competency Council which has now been incorporated into the Fire Sector Federation and the documents are available from the Fire Sector Federation website (section 18) http://firesectorfederation.co.uk/

The 'Responsible Person' also has to have in place a system for ensuring that the integrity of any PFP measures is not compromised when alterations are carried out on the building e.g. for the installation of new pipes, cables and other services. Records of these should be made available for inspection by the fire risk assessor.

Further detailed information on the Regulatory Reform (Fire Safety) Order 2005 (and national equivalents) can be found in the Association for Specialist Fire Protection (ASFP) *Guide to inspecting passive fire protection for fire risk assessors*. In addition to including valuable pragmatic guidance on what and how to inspect; it includes information on how and where to select an appropriate assessor if the 'Responsible Person' cannot or does not feel competent to undertake the assessment himself.

4.2 Insurance requirements

Whilst not mandatory, insurance requirements should not be forgotten and may be more demanding than the life safety standards advised in the relevant statutory guidance documents. They are becoming increasingly important.

Insurers may have higher requirements than Building Regulations to minimise the damage to the property and to the business itself. In addition, the compartment area may require enhanced fire resistance to the walls and roof within a 'protected zone' on each side of the compartment wall. Details are contained in *Approved Document B: Fire Safety (Volume 2) - Buildings Other Than Dwellinghouses (2008 Edition): Incorporating Insurers Requirements for Property Protection*. RISC Authority, RIBA Publishing, Oct 2008.

Summary recommendations

- *The move within regulatory guidance from prescriptive rules to performance-based designs and risk assessment during occupation puts greater responsibility for safety onto building owners or occupiers. The establishment of the 'Responsible Person' under the RR(FS)O (and national equivalents) means that those who are responsible for the operation of a business within a building need to be aware of their responsibilities which include the installation and maintenance of passive fire protection systems.*
- *Where external professional fire risk assessors are employed, it is important that they are competent, as criminal liability will arise for the 'Responsible Person' (or national equivalents) if the fire risk assessment is inadequate and people are placed at risk of death or serious injury as a result.*
- *The ASFP strongly recommends only using assessors who are on the registers listed in* A guide to Choosing a Competent Fire Risk Assessor.

5 PROCUREMENT OPTIONS

5.1 Traditional designer led

The traditional process sees the client or developer appoint an architect in the early stages of the project to seek planning consent for the building and produce designs and specifications according to the regulations and the client needs.

For anything more than simple designs the architectural team will seek assistance from specialists such as structural or environmental engineers and quantity surveyors to produce a 'Bill of Quantities' and specification for the project.

The next stage in this process is for construction companies to tender for the work and be appointed as the main contractor. Specialist sub-contractors will be sought for 'packages' of work and during construction the whole project will be supervised by the design team, led by the architect who has the overall responsibility for ensuring that the building satisfies the brief originally agreed with the client.

5.2 Management contracting

This system differs from the traditional, principally in that the management contractor/construction manager, who takes responsibility for delivering the construction of the project, is brought into the process at a much earlier stage, as are key specialists. This type of procurement is most commonly used for complex or fast track projects where risks tend to be high. Some design responsibility may be included in the arrangement.

5.3 Design and build

Under this option a client will offer the basic concept, or a brief, to construction companies who will undertake (with their own design team) to deliver the completed building largely to performance-based requirements. The design and construction will be the contractor's responsibility and he will deliver a building to meet the client's needs. Competition will have been between companies offering a variety of design solutions to meet these needs and the client will have to select the contractor whose ideas most closely fit his requirements both conceptually and financially.

This system sees the contractor responsible for designing all aspects of the project to meet the performance requirements of the client within the agreed budget. It also gives rise to some of the worst examples of installation of different types of PFP because, the installations e.g. at compartment walls/floors are not designed properly in advance and the fire stopping contractor has to design something 'on the hoof'. Budgetary and time constraints often mean that the resulting installation is not covered by the appropriate fire test evidence and may not work satisfactorily.

5.4 Public Private Partnerships and Private Finance Initiative

Government uses partnerships with the private sector to deliver public services. Public Private Partnerships (PPPs) place risks with the party best placed to manage them; the private sector partner puts its own capital at risk, encouraging innovation and the effective management of risks, which helps to deliver projects on time and on budget through the lifetime of the project. Public Private Partnerships are intended to offer better services, delivered more efficiently and thus providing better value for money for the taxpayer.

Public Private Partnerships are not a single model applied to every circumstance but rather offer a tailored approach to the particular circumstances of public services. The Private Finance Initiative (PFI) has been the main vehicle for delivering PPPs. PFI projects can only go ahead where they demonstrate clear value for money against a 'traditional' procurement. This involves a comparison between the PFI proposal and a Public Sector Comparator which estimates the costs of a 'traditional' procurement in which separate arrangements will exist for the construction, maintenance and operation of a service.

Within the concept of the 'Private Finance Initiative' government departments and local authorities seek Companies who will provide a facility that may be a building or some other construction, such as a road or a bridge at their own expense. The cost will be met by the main contractor drawing funds from either the users or the authority for the use of the facility over an agreed period of time.

In this way it is intended that the original design will meet the requirements of the client in functional terms but will also have to be capable of being maintained over a long period within projected income limits if the main contractor is to meet his cost and profit objectives from the construction and use of the facility over the agreed period.

ROLES AND RESPONSIBILITIES – INTRODUCTION TO KEY PLAYERS

The final specification for the PFP within any of the above options will be a combination of the decisions on fire strategy taken by the client and the design team and the interpretation of that strategy by those who contract to provide the building.

6 ROLES AND RESPONSIBILITIES – INTRODUCTION TO KEY PLAYERS

The final specification for the PFP within any of the above options will be a combination of the decisions on fire strategy taken by the client and the design team and the interpretation of that strategy by those who contract to provide the building. The roles for each participant in the process are set out in the following sections and include both the construction of new buildings and the subsequent occupation and use of those buildings.

7 THE CLIENT/DEVELOPER

The client is the person or company who will own and/or operate the facility on completion of the project. He/she is responsible for ensuring that the building meets the legal requirements and is then operated in accordance with the law. A developer may be the client or a person or company who develops facilities for others to operate or own. He/she will take responsibility for ensuring that the building meets the legal requirements but may not, in the long term, retain ownership of the facility.

Where a developer passes ownership on to others, then they accept the responsibility for the fire safety of the building (subject to the terms of any contract or agreement) and must ensure compliance with all regulatory requirements at handover.

7.1 Duties and responsibilities

7.1.1 Appointing the team

Whatever the procurement option for constructing the facility, there is a responsibility for ensuring that those involved are capable of undertaking the required tasks within the law. By appointing a person or persons the client may 'sub-contract' the decision-making process since the required skills may be outside his own capability but the ultimate responsibility for meeting the legal requirements will remain with him/her.

The team must be selected from qualified persons or companies and in this particular guidance the aim is to explain how their ability to supply or install fire protection materials should be judged for best results.

7.1.2 Setting the design and construction standards

The ultimate responsibility for fire safety of the building as constructed rests with the client and/or developer; it is essential that the basic fire strategy for any project should be agreed as early as possible in the design process so that the activities of all sectors involved in the process may be co-ordinated.

Any safety objectives that go beyond life safety (i.e. building fabric, contents, business interruption, heritage or environment) must be agreed with the client and specified at an early stage.

'Best Practice' in PFP will be achieved by setting out the requirements at the start of the project, stating that all PFP measures, wherever possible, should use third party certificated products and be installed by third party certificated installers.

This will ensure that expert companies select these life safety measures in accordance with the design requirements whether they are laid down by the design team against the guidance contained in AD-B and its equivalent Scotland, Northern Ireland and the Republic of Ireland or to fire safety engineered designs.

The principal construction companies will be required to seek quotations from qualified contractors who in turn will select materials from manufacturers who have adequate third party certification or test evidence for their products.

7.1.3 Commissioning and handover

When the construction programme is completed the contractor must hand over to the client/occupier the Construction Design and Management Safety File (CDM File) (UK only). If a certificated installer has been used for the PFP work as recommended, this will include a copy of a Certificate of Conformity. This will also constitute suitable information to discharge the installer's obligations under Regulation 38 (England & Wales).

Specialist contractors are required to provide full details of all materials used, their location and purpose, for the CDM files. Overall this is known as the CDM Regulations Safety Plan and must be handed over on completion of the building. The handover must also include details of the Fire Strategy that has been established for the building. This should be considered alongside the CDM File as the building is commissioned.

The occupier will install his/her own equipment and processes. If these require mechanical fixing, wiring, ductwork or any other services that pass around or through the building he must understand the impact on the fire safety measures incorporated in the structure.

During this process should any of the fire protection be affected by, e.g. breaches of fire separating elements or removal of structural protection, then these must be restored to their original condition.

It should be noted that the requirement of the 'Responsible Person' (or national equivalents) to undertake a fire risk assessment under the Regulatory Reform (Fire Safety) Order 2005 (or national equivalents) starts on occupation of the building (see 4.2).

The fire risk assessment must consider if the fire safety measures provided and the fire strategy adopted are adequate for the purposes for which the building is being used. Without the CDM File, Regulation 38 information and the Strategy details this risk assessment cannot be undertaken adequately. Failure to carry out a suitable and sufficient risk assessment is a criminal offence under the Regulatory Reform (Fire Safety) Order (and national equivalents).

7.1.4 Fire safety manual

The design of large or complex buildings needs to be documented for the benefit of the management of the premises, with all relevant information included in a fire safety manual.

The fire safety manual is an essential part of any successful building operation. It is strongly recommended that a manual be compiled by the designer for the occupier/'Responsible Person'.

The manual needs to set out the basis on which the means of escape is planned, the type of management organisation envisaged for running the building and the consequential staff responsibilities. It needs to explain the operation of all the mechanical and electrical systems and to give information on routine testing and maintenance requirements. The fire safety manual must be available for inspection or tests by auditors and enforcers, and for operational purposes by the fire and rescue service.

Depending on circumstances the manual may need to be separate from the CDM Regulations Safety Plan, in which case the information from these should be duplicated in the manual. The actual form of the manual will depend on the type of occupancy involved.

The fire safety manual should include the following items:

- fire safety policy statement
- fire safety specification for the building
- a description of the passive fire safety measures
- a description of the active fire safety measures
- integration of active and passive fire safety measures
- planned inspection, maintenance and testing schedules
- CDM Regulations information
- copies of all certificates and licences
- maintenance requirements and records
- changes to building structure
- information for regulatory requirements (e.g. Building Regulations approvals, Regulation 38 information)
- detail routine inspection and maintenance activities, with frequencies and routine test measures
- documentation from contractors and manufacturers (including any instructions, guarantees and test certificates) and spare parts.
- as-built drawings and specifications, equipment operating parameters and drawings for all fire protection measures, both active and passive, incorporated into the building.

The manual will form part of the information package that will contribute to the risk assessment required under the Regulatory Reform (Fire Safety) Order 2005 (and national equivalents).

7.1.5 Maintenance and repair

Once the building is in use it is the responsibility of the 'Responsible Person' (or national equivalents) to maintain all fire protective measures in an appropriate manner. He or she must regularly review the fire risk assessment for any changes in occupation, processes, equipment or structure that impinges on fire safety.

The 'Responsible Person' (or national equivalents) must either undertake these reviews or appoint a suitable qualified Fire Risk Assessor to do so. Where work is carried out on the structure of the building it is recommended that this be done by certificated installers wherever possible.

If this is not done the contractors or staff concerned must be able to identify such items as fire separating elements and work accordingly. Suitably marked drawings of the building should be part of the instructions for any work on the building.

Summary Recommendations

- *Where a developer passes ownership on to others, then they accept the responsibility for the fire safety of the building (subject to the terms of any contract or agreement) and must ensure compliance with all regulatory requirements at handover.*
- *'Best Practice' in PFP will be achieved by setting out the requirements at the start of the project, stating that all PFP measures, wherever possible, should use third party certificated products and be installed by third party certificated installers.*
- *When the construction programme is completed the contractor must hand over to the client/occupier the Construction Design and Management Safety File (CDM File (UK only)). If a certificated installer has been used for the PFP work as recommended, this will include a copy of a Certificate of Conformity. This will also constitute suitable information to discharge the installer's obligations under Regulation 38 (England & Wales).*
- *The fire safety manual is an essential part of any successful building operation. It is strongly recommended that a manual be compiled by the designer for the occupier/'Responsible Person'.*
- *The manual will form part of the information package that will contribute to the risk assessment required under the Regulatory Reform (Fire Safety) Order 2005 (and national equivalents).*
- *Once the building is in use it is the responsibility of the 'Responsible Person' (or national equivalents) to maintain all fire protective measures in an appropriate manner. He or she must regularly review the fire risk assessment for any changes in occupation, processes, equipment or structure that impinges on fire safety.*
- *The 'Responsible Person' (or national equivalents) must either undertake these reviews or appoint a suitable qualified Fire Risk Assessor to do so. Where work is carried out on the structure of the building it is recommended that this be done by certificated installers wherever possible.*

8 DESIGNERS

In considering the list of PFP measures contained in the introduction to this document it will be realised that the design may be the result of contributions from anyone involved in producing part of the specification of the building. Architects, structural engineers, mechanical and electrical specialists, and sub-contractors may all have responsibility for fire protection measures, as well as fire engineers.

Increasingly Building Information Modelling (BIM) will be used by designers to as part of the Government's drive to have BIM level 2 for all government projects by 2016. This will have a major impact on designers, manufacturers and installers. Designers will only be able to design in and specify products that have e.g. the correct fire resistance for the location they are to be installed in. Manufacturers will have to redefine their products in terms of BIM 'objects' which can be used by the software in the development of the model. Installers will have installations that are designed correctly and will thus be easier to install as they will be programmed correctly and not have to design something 'on the hoof'.

8.1 Designers and the fire strategy

The fire safety objectives (life safety, building fabric, contents, business interruption, heritage or environment) need to be specified at an early stage. If this recommendation is adopted, then the activities of all sectors in the design process may be co-ordinated.

Although there is a general move by designers away from prescriptive towards performance or output-based specification, many designers are not very familiar with fire safety engineering and rely on normal (building) regulation guidance and manufacturers' claims when setting the fire resistance for constructional elements, fire compartments and when deciding on travel distances and means of escape. Approved Document B of the England and Wales Building Regulations (and national equivalents) use building types and/or purpose groups and the experience gained from previous designs to inform the designer on these issues. Approved Document B also provides 'deemed to satisfy' data and sources of data on the fire rating of many common construction materials. With this information the designer will know whether additional protection is required.

Designers should be aware that the recommendations in AD-B and its national equivalents provide only a 'life safety' standard and they may need or wish to adopt a higher 'best practice' standard e.g. via the *Approved Document B: Fire Safety (Volume 2) - Buildings Other Than Dwellinghouses (2008 Edition): Incorporating Insurers Requirements for Property Protection*. RISC Authority, RIBA Publishing, Oct 2008.

Where the design involved fre safety engineering, the structure may be designed or contain features that differ from those suggested in AD-B and its equivalent Scotland/Northern Ireland/Republic of Ireland guidance. Any changes in the operation or occupation of the building may have a more critical impact on the Fire Safety Strategy.

An example of the changes that can have an unexpected impact on the fire safety strategy and fire risk assessment is that escape distances and routes may have been calculated for originally proposed occupancy levels or layout or activities. Changes in the number and type of personnel in a particular location, or the building layout, or the activities undertaken in the building may mean the calculations used for the original design are not appropriate any more. Such changes may have an impact on the passive fire protection provided for escape routes and compartments.

The 'Responsible Person' should be aware of any critical areas, particularly if fire safety engineering was a part of the design process, as the calculations may limit the freedom of the occupier to make changes. This latter point is particularly critical when a building changes ownership.

Where the occupier is responsible for part of a building, e.g. as the tenant of premises within a shopping mall or large office complex, the safety of those that work in or visit this part of the building must be considered. This may involve them in using common parts of the complex for escape in the event of fire. The safety of these areas for access/egress should also be considered in the fire risk assessment and maintenance. Liaison with other tenants and the building management is essential in this matter.

8.2 Extreme events

The fire safety systems, both passive and active, may, in certain circumstances and for certain types of building, be required to cope with a fire resulting from, or accompanying, an extreme event, such as an earthquake, a deliberate or accidental explosion or an impact from an aircraft. It needs to be recognised that there may be significant weight and/or cost implications from such protection.

The requirement for a passive fire protection system that must withstand a defined extreme event would need to be specified very early in any building project.

8.3 Duties and responsibilities

The design specification will be based on the agreed fire strategy. For the different elements of the building, this specification may show a required performance, or may identify a specific proprietary product. It is important that the design specification is adhered to during the procurement and construction of the building, despite pressures of time, money and availability. Breaking of the specification to save money is likely to give poorer performance in the longer term because contractors and sub-contractors competing solely on the basis of cost will be under great pressure to cut corners which can lead to inadequate protection.

It is the duty of everyone involved in the specification or design of an element of the building to be aware of the fire strategy and to ensure that any element with which they are concerned complies with it. Clear instructions must be given and fire performance requirements should be shown on drawings and in written specifications.

The consideration of fire rating or fire protection after the design of an element has otherwise been completed may add considerable extra cost. An example of this is the design of the steel framework of a building where the careful use of slightly varying steel member sizes or types can reduce the amount of added fire protection required.

Contractors who are bidding for specialist work will require extra payments for additional fire safety materials. Best value will not be achieved if such additions are carried out piecemeal.

8.4 Relationship between specialists

Certain elements of a building are often subject to specialist sub-contracts for added fire protection. For example, in the case of structural steel protected on-site, a specialist engineering company will supply the steelwork, but the additional fire protection will usually be added by someone else. Steel is usually supplied prepared and painted with an appropriate priming system appropriate to the selected fire protection materials. The timing of the contract for the application/fitting of this protection is critical; applying the protection too soon can result in damage that has to be made good, whilst leaving the steel in primer too long could result in corrosion and/or delays to other fitting out trades. The steel designer should consider the added protection as noted above and plans can then be made for the incorporation of the whole process in the programme.

Similarly, there will be many individual cable, pipe and ductwork penetrations within a service duct or above suspended ceilings, for example. It is wasteful to have each penetration sealed by the tradesman concerned only to have a later trade destroy the work as they fit their particular service. A far better job will result, often at lower overall cost if the mechanical and electrical designer recognises the areas where untrained or inexperienced trades may be working and prepares the specification accordingly to allow specialist contractors to price for the work.

It is crucially important that the installation of passive fire protection, including the correct and timely scheduling of all the sub-contractor work, is included as part of the main work programme. Only if this occurs will the passive fire protection measures be installed in the correct order preventing rework later when often an unsatisfactory ad-hoc solution is applied.

8.5 Understanding and applying standards

The research undertaken for the first edition of this guide showed that specialist trades and even specialist designers in some cases were generally unaware of the detailed requirements for fire safety within the completed building.

The designers of all sections of any building must ensure that they are familiar with the fire safety standards that apply not only to their speciality but also to any other sectors that are likely to interact. Guidance on the various codes of practice is contained in the reference section (18) of this document.

Summary recommendations

- *The fire safety objectives (life safety, building fabric, contents, business interruption, heritage or environment) need to be specified at an early stage. If this recommendation is adopted, then the activities of all sectors in the design process may be co-ordinated.*
- *Designers should be aware that the recommendations in AD-B and its national equivalents provide only a 'life safety' standard and they may need or wish to adopt a higher 'best practice' standard e.g. via the* Approved Document B: Fire Safety (Volume 2) - Buildings Other Than Dwellinghouses (2008 Edition): Incorporating Insurers Requirements for Property Protection. *RISC Authority, RIBA Publishing, Oct 2008.*
- *Where the design involved fire safety engineering, the structure may be designed or contain features that differ from those suggested in AD-B and its equivalent Scotland/Northern Ireland/Republic of Ireland guidance. Any changes in the operation or occupation of the building may have a more critical impact on the Fire Safety Strategy.*
- *It is the duty of everyone involved in the specification or design of an element of the building to be aware of the fire strategy and to ensure that any element with which they are concerned complies with it. Clear instructions must be given and fire performance requirements should be shown on drawings and in written specifications.*
- *It is crucially important that the installation of passive fire protection, including the correct and timely scheduling of all the sub-contractor work, is included as part of the main work programme. Only if this occurs will the passive fire protection measures be installed in the correct order preventing rework later when often an unsatisfactory ad-hoc solution is applied.*
- *The designers of all sections of any building must ensure that they are familiar with the fire safety standards that apply not only to their speciality but also to any other sectors that are likely to interact. Guidance on the various codes of practice is contained in the reference section (18) of this document.*

9 MAIN CONTRACTORS AND SPECIALISTS

9.1 The main contractor

The main contractor is responsible for co-ordinating the work of all the trade contractors on the project. This includes:

- Programming activities so as to minimise clashes between the trades
- Ensuring good communications
- Control of shared facilities such as hoists, cranes, access scaffolding etc.
- General site housekeeping, site safety and security

Main contractors should select sub-contractors who carry third party certification wherever possible (see section 15).

As a very minimum, site labour involved in activities concerned with fire protection should hold a CSCS (Construction Skills Certification Scheme) blue card in PFP installation for the work being undertaken.

Sub-contractor workers who are not specialists must be properly supervised and their work individually inspected as the CSCS card scheme does not cover supervision and inspection directly.

9.2 Specialist installers

Specialist sub-contractors will be identified for many sections of the work in a building and PFP should be one of the specialist trades with whom separate contracts are placed. The trend towards including such packages of work within e.g. M & E or dry lining packages is likely to result in the use of less skilled labour.

As the objective of PFP 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 ASFP strongly recommends that all contractors installing PFP hold third party certification for the products they install. It is a condition of membership of the ASFP that any installer wishing to join the association must hold third party certification (see section 15).

The principal areas where such contracts should be set up are:

- Structural fire protection
- Fire resistant glazing
- Penetration sealing and linear gap sealing
- Partitions
- Sealing of service ducts
- Suspended ceilings
- Fire barrier installation
- Dampers
- Fire doors

It may be desirable to group as much as possible of such work under one contract and the detailed sections where PFP is required are set out in section 1.2.

By placing this work with specialists, and with careful programming, it is possible to ensure that the correct materials are specified and installed, and damage and rework can be avoided. Other trades will then be free to perform their own speciality.

9.3 Programming

It is crucially important that the installation of passive fire protection, including the correct and timely scheduling of all the sub-contractor work is included as part of the main work programme. Only if this occurs will the passive fire protection measures be installed in the correct order preventing rework later when often an unsatisfactory ad-hoc solution is applied. The increasing use of Building Information Modelling (BIM) should assist main contractors and installers in the timely and structured programming of work.

Careful programming of the work by the main contractor should:

- Allow the specialist to work continuously with a regular supply of areas becoming available for work.
- This allows the specialist PFP contractor to plan for a consistent supply of personnel and equipment, and to plan deliveries
- Ensure that other trades are not required to work in the same area at the same time, or carry out PFP work for which they are not qualified
- Ensure that the PFP contractor is not required to carry out difficult or dirty work above or adjacent to sensitive equipment or materials
- Ensure that barriers, segregated areas, screens and protection are installed correctly
- Plan work by other trades to be carried out in advance where possible to minimise subsequent damage
- Ensure hoists, cranes etc. are available for the delivery of materials and to move equipment
- Allow the PFP contractor sufficient time to complete the work before the area is handed over to other trades

The work of the PFP contractors is sometimes prone to damage, possibly for a number of reasons:

- The materials are easier to damage than steel and concrete
- The programme usually involves the PFP contractor working at the same time as, or just ahead of many of the other trades
- The PFP work is not perceived by other trades to be of high value or importance so they have little inhibition about poking a hole through a fire seal, or removing an area of board or spray. The assumption is that 'someone will fix it if necessary' and/or that it will never be found out
- Follow-on trades destroying installed PFP.

9.4 Inspection

A final round of inspection is recommended before areas are handed over for closing up, or access is finally removed. The re-inspection will check for damage that may have occurred after the work was originally approved.

If there is only a limited amount of damage it is sometimes convenient to carry out the final inspection jointly with all concerned parties, and with a repair team in attendance to carry out minor repairs on the spot.

A systematic approach to quality checks and inspection will take the following form:

- The PFP operative will carry out a self-check and rectify any defects. For structural fire protection this check may not be recorded, but for fire seals the PFP operative should affix a label giving details of the seal type, date of installation and the name of the operative.
- The contractor's supervisor (or quality checker) will check the work, using an agreed check list and record sheet. For fire seals, the supervisor will countersign the label.
- If the contractor's supervisor finds the installation is satisfactory, the PFP contractor will ask the inspection agency to inspect the work. This refers to an inspection agency rather than a third party accreditation organisation as discussed in section 13.3.
- Following the inspection by the inspection agency the PFP contractor will offer the work for the main contractor to check. Depending on project specific arrangements, the main contractor may invite the architect and/or the enforcing authority (e.g. Building Control) to inspect.
- The formality with which this process is followed depends on the scale of the project and the working relationships. Some of the steps above can be taken simultaneously provided there is a consistently good standard of work being offered.

The ASFP has published a number of codes of practice for the installation of PFP which incorporate inspection regimes.

Summary Recommendations

- *Main contractors should select sub-contractors who carry third party certification wherever possible (see section 13.3). As the objective of any PFP 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.*
- *It is crucially important that the installation of passive fire protection, including the correct and timely scheduling of all the sub-contractor work is included as part of the main work programme. Only if this occurs will the passive fire protection measures be installed in the correct order preventing rework later when often an unsatisfactory ad-hoc solution is applied.*
- *A final round of inspection is recommended before areas are handed over for closing up, or access is finally removed. The re-inspection will check for damage that may have occurred after the work was originally approved.*
- *The ASFP has published a number of codes of practice for the installation of PFP which incorporate inspection regimes.*

10 MANUFACTURERS & SUPPLIERS

10.1 Manufacturers

PFP manufacturers produce materials and products that enhance the fire performance of building so that each element of construction such as a beam or wall of a floor can achieve the requisite loadbearing capacity, integrity and insulation appropriate to its function. PFP manufacturers have a duty to test materials and products in accordance with the relevant test methods and a responsibility to supply in a form or manner that allows installation contractors to use the products correctly, either for factory assembly or on site.

Materials or products may be supplied either direct to the contractor or through distributors. In some specialist cases, e.g. certain types of fire doors or fire rated ductwork, the manufacturer may also be the installer. The manufacturers of materials and material systems will usually offer advice on the selection of a suitable material and methods of application.

Product literature must show the correct use of the materials and the range of the product that is covered by test evidence and any third party certification (see section15). Vague usage claims should be rigorously questioned as the product test evidence may limit the extended application of the product and result in an unsafe application if not made clear. The increasing use of Building Information Modelling (BIM) objects by manufacturers that will include the relevant and correct information should enhance the process of appropriate product acceptance.

10.2 Suppliers

Product suppliers may be distributors and/or other persons or companies that are not the manufacturers of the products. They supply materials or products that meet the required fire performance. As is the case with manufacturers, product suppliers have a duty to ensure that the materials they supply have been tested in accordance with the relevant standards and a responsibility to supply in a form or manner that allows installation contractors to use the products correctly, wherever required.

Suppliers may also offer advice on the selection of suitable materials and methods of application, provided that they have been adequately trained by a suitable authority to do so.

Suppliers must be able to provide clients with product literature showing the correct use of the materials and the range of the product that is covered by test evidence and any third party certification (see section 15).

It is recommended that clients contact the manufacturers direct for confirmation that the materials or systems are correctly installed. As in the case of manufacturers above, vague usage claims from suppliers who are not the manufacturers of a product must be treated with caution and verified.

10.3 Relationship with specialist installers

Training in the use and application of materials is common with manufacturing companies and some may operate a scheme for licensing or recommending PFP contractors who are recognised as being experienced and competent.

Some manufacturers will provide site advisory personnel, at no extra cost, to ensure that queries and/or inappropriate use of their materials is minimised and ultimately eradicated. The personnel may carry out checks on the materials, application, installation, thickness and all aspects of the work to ensure that this is in line with their test evidence.

This direct advice from the manufacturing company is recommended since it should provide both designer and contractors with reassurance concerning the correct use of the products.

10.4 Certification of specialist installers

Whilst legislation does not directly cover installation of PFP products, installers have an obligation to install the products completely, correctly and so that they will work as intended in the building. Many specialist installers are members of third party certification schemes for contractors (see section 15). Such schemes ensure that the quality of installed PFP is maintained through a regime of auditing records, site inspection and issuing of certificates of conformity. Further details are in section 13.3.

Schemes are available from the providers listed in section 18.3.3.

The ASFP strongly supports the take up of third party certification for installing contractors; it is a condition of membership of the association.

Summary Recommendations

- *Product literature must show the correct use of the materials and the range of the product that is covered by test evidence and any third party certification. Vague usage claims should be rigorously questioned as the product test evidence may limit the extended application of the product and result in an unsafe application if not made clear. The increasing use of Building Information Modelling (BIM) objects by manufacturers that will include the relevant and correct information should enhance the process of appropriate product acceptance.*
- *Suppliers must be able to provide clients with product literature showing the correct use of the materials and the range of the product that is covered by test evidence and any third party certification.*

11 REGULATORS AND ENFORCERS

11.1 Who are the regulators and enforcers - duties and responsibilities?

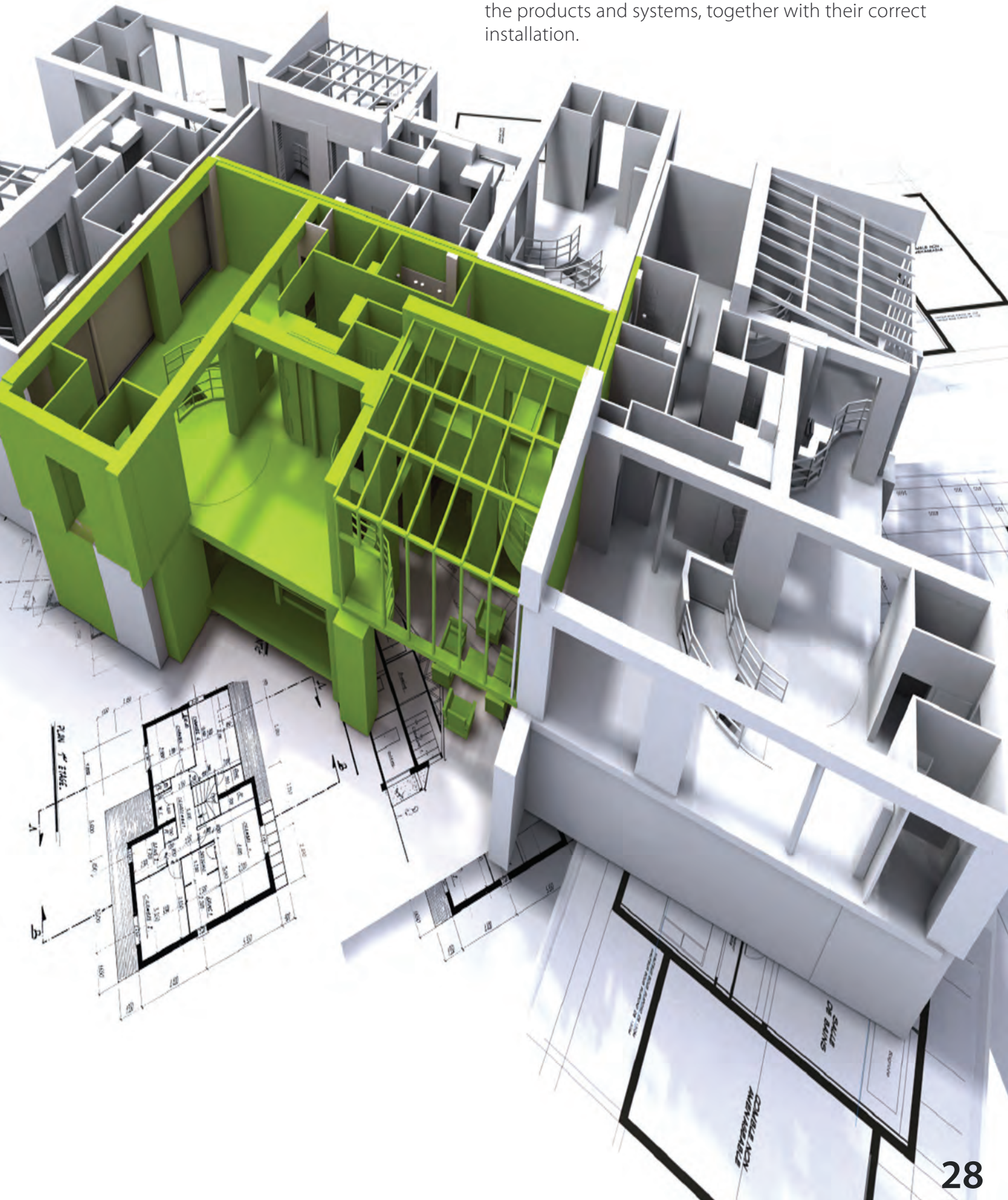
During the construction stage, the Building Regulations are overseen by either a Building Control Surveyor who will work for the Local Authority or by an independent Approved Inspector. In either case, the developer must agree plans, designs and construction details with the selected authority until a Completion Certificate is issued. The Building Control Surveyor or Approved Inspector has a duty to ensure that the agreed designs comply with the regulations and that the construction follows the design specification.

Once the building is occupied, the enforcement authority under the Regulatory Reform (Fire Safety) Order (and national equivalents) is the Fire Authority who can issue alterations notices, enforcement notices and prohibition notices. The Fire Authority is also the body that prosecutes under the RR(FS)O (and national equivalents). Fire authorities may vet fire risk assessments carried out under the order, but will not undertake them.

Products that infringe the Construction Products Regulation e.g. by not having CE marking when it is mandatory will be investigated by local authority Trading Standards Departments.

DESIGNING FOR PASSIVE FIRE PROTECTION

Having identified the regulatory requirements and developed and agreed a fire safety strategy with the enforcement authorities this has to be translated into physical fire protection by designing and specifying the products and systems, together with their correct installation.



12 DESIGNING FOR PASSIVE FIRE PROTECTION (PFP)

12.1 Introduction

Having identified the regulatory requirements and developed and agreed a fire safety strategy with the enforcement authorities this has to be translated into physical fire protection by designing and specifying the products and systems, together with their correct installation. A number of parties may have reasonable claim to influence the specification including the building owner, occupier, architect, insurer, fire safety engineer, main contractor and/or fire protection contractor.

The number of interested parties can give rise to problems not least because they are rarely involved at the same time. Consequently a specification drawn up by the architect implementing the fire safety strategy may subsequently be changed by others. This is a necessary part of the process but there is potential for specifications to be inadequate or to compromise the requirements of the original fire safety strategy. The increasing use of Building Information Modelling (BIM) should ensure that any changes made by different stakeholders will not compromise the requirements of fire safety because e.g. the substitution of inferior or inadequate products will not be permitted by the model.

It is strongly recommended that only a limited and controlled number of parties be authorised to change the specification and that any changes to the specification be carefully monitored and recorded.

12.2 Components of passive fire protection that need consideration

12.2.1 Protecting the structural frame

Structural frames are usually constructed from concrete, steelwork or timber. However, increasingly the most popular type of structural frame is steel. The fire protection of steel framed structures is covered in detail in the ASFP publication *Fire Protection for Structural Steel in Buildings* (Yellow Book). This publication describes the principles of PFP on steelwork and the testing of materials in line with the standards given in the relevant statutory guidance documents (AD-B and national equivalents). It also provides a wide range of comparable data for independently assessed fire protection systems from ASFP Member Companies for fire protection from 30 minutes to 4 hours exposure. The book is a reference document quoted in AD-B and guidance produced by the ASFP should be used by designers. See section 18 for contact details.

Proprietary fire protection systems available to the designer include:

- a wide variety of board materials, and metal cased systems
- reactive (intumescent) paint coatings
- various cementitious based spray-on systems
- flexible blanket systems.

Concrete frames generally do not require PFP because they are designed to achieve a specified fire resistance period. In certain circumstances spalling may be an issue and PFP is required. Only products intended for this application, and which have been demonstrated to provide the necessary protection should be used.

Timber framed buildings tend to fall into two broad categories in terms of fire. There is the heavy timber construction seen in e.g. supermarkets; this is usually 'Glulam' or other similarly fabricated beams. In this case, fire resistance is provided by providing a sacrificial layer that chars in a fire. The second type is lightweight timber framing which requires fire protection, usually by a board system, for example, plasterboard. Most manufacturers of these products provide guidance on their installation and use. See section 18.

Further guidance:

ASFP Yellow Book – *Fire protection for structural steel in buildings, 4th Edition;* http://is.gd/K3NgQs
ASFP Technical Guidance Documents; http://is.gd/NgFyv4 or www.asfp.org.uk

ASFP TGD 11 - Code of practice for onsite use of Intumescent coatings for fire protection of structural steelwork
ASFP TGD 15 - Code of practice for sprayed nonreactive coatings for FP steelwork
ASFP TGD 16 - Code of Practice for off-site applied intumescent coatings

ASFP Guide to Passive Fire Protection for Fire Risk Assessors

12.2.2 Fire-resisting doors and fire door furniture

Fire-resisting doors are specially designed to resist the spread of fire and products of combustion through walls or along corridors containing escape or access routes. There are essentially two types of fire resisting doors; door assemblies and doorsets. Door assemblies are usually assembled on-site by a joiner or specialist sub-contractor from components which have been fire tested and or assessed as being capable of working together. Doorsets are supplied as complete items with door frames and door hardware as a matched set of components. Either type may be third party certificated. Increasingly, the trend will be towards fire doorsets as these will be able to be CE marked and the fact that they are supplied by one legal entity will ensure the highest level of quality, reliability and traceability. All essential hardware used on fire doors is subject to mandatory CE marking.

Fire-resisting doors must be supplied in accordance with the details contained in the test report or assessment provided by the manufacturer or as required by third party certification. Doorsets should be included on a schedule that will describe the swing, the size of opening, appearance and requisite building hardware. To achieve best practice, the building hardware schedule should be prepared by an architectural ironmonger who has specialist knowledge regarding the overall requirements for functionality and performance, this route is more likely to result in the desired performance.

In order that fire-resisting doors fulfil their mechanical and movement functions, movement gaps in the 'fit' with the door frame are essential. These gaps have specially selected sealing strips fitted adjacent to the movement spaces which will expand in fire conditions to seal the movement gap.

It is important that the doors and hardware are maintained in good condition, including sealing strips, hinges, latches and vision panels if fitted. Each product should have been tested to the appropriate BS or BS EN Standard, with timber doorsets complying with the door-to-frame gap tolerances covered by the test reports or third party certification – usually 3-4mm.

Fire-resisting doors are not effective unless they are closed. Self-closing devices ensure that fire-resisting doors re-close each time they are opened.

Fire-resisting doors, frames, self-closing devices and latch systems are all fire tested together to achieve the stated fire performance - the matched set of components is essential to the fire performance. Substitute components must be avoided.

It should be noted that hardware does not carry its own fire test report but is recorded in the fire test report as contributing to the successful performance of the doorset in the fire resistance test.

Further guidance:

BS 8124: 2008: *Code of Practice for Fire Door Assemblies*

Door and Hardware Federation and the Guild of Architectural Ironmongers, *Code of Practice – Hardware for Fire and Escape Doors;* http://www.firecode.org.uk/

British Woodworking Federation; http://is.gd/41xxUa or www.bwf.org.uk

Appendix B of the fire risk assessment guides for each building type published by DCLG; http://is.gd/peEScR or www.communities.gov.uk

Association for Specialist Door Manufacturers, *Best Practice Guide;* http://is.gd/hhGmoi or www.asdma.com

ASFP Guide to Passive Fire Protection for Fire Risk Assessors www.asfp.org.uk

Intumescent Fire Seals Association *Information sheets and Risk Assessment Communiqués on the use of intumescent seals in doors and glazing system;* http://is.gd/gUY7nO or www.ifsa.org.uk.

12.2.3 Fire shutters

These can be collectively defined with fire-resisting doors as: 'a door, or shutter, provided for the passage of persons, air or objects, which together with its frame and furniture as installed in a building, is intended (when closed) to resist the passage of fire and/or gaseous products of combustion, and is capable of meeting specified performance criteria to those ends'.

It may have one or more leaves, and the term includes a cover or other form of protection to an opening in a fire-resisting wall or floor, or in a structure surrounding a protected shaft.

Rolling shutters across means of escape should only be released by a heat sensor in the immediate vicinity of the door, and not initiated by smoke detectors or a fire alarm system, unless the shutter is also intended to partially descend to form part of a smoke reservoir.

12.2.4 Compartment walls and compartment floors

Compartment walls and floors are specifically intended to ensure that fire is contained in the compartment of origin, and is not allowed to spread horizontally or vertically through a building. Compartmentation is the first line of defence in any fire strategy.

The objectives are:

a To prevent rapid spread of fire and products of combustion which may endanger occupants

b To prevent a small fire growing to threaten occupants, people in the vicinity of the building, and firefighters who may have to enter a building to extinguish the fire. The compartmented structure provides demarcated lines of safety for firefighters and occupants.

The allowable size of a compartment will vary with the height and use of a building and the ability of firefighters to intervene effectively. In some cases, the availability of a dependable sprinkler system may allow larger compartment sizes, but it should be recognised that sprinkler systems require adequate water pressures and regular maintenance practices to ensure reliable performance.

Any compartment wall below a service void such as a suspended ceiling should be designed to run continuously up through the ceiling to prevent the spread in the void. The junctions of compartment walls or floors with each other must provide continuity of the expected fire-resisting performance.

Any element (including structural elements) passing through compartment walls or floors should be designed with associated fire stopping at the point of penetration and the aperture should be kept as small as practicable. The design should ensure that the failure of a penetrating structure because of fire in one compartment will not cause failure in the adjacent compartment.

Most guidance documents to building regulations provide recommendations for allowable compartment sizes and guidance on junctions with other walls and roofs. It should be noted that resilient fire stopping systems are recommended where compartment walls meet roofs, and double skinned roof sheeting should incorporate bands of material of limited combustibility centred over each compartment wall.

Insurers may have higher requirements than building regulations to minimise the damage to the property and within the 'protected zone' on each side of the compartment wall.

Details are contained in the *Building Design and Management Guide BDM 7* published by the RISC Authority; https://www.riscauthority.co.uk/riscauthority_home/document_library/

12.2.5 Fire walls or fire separating elements

Fire walls or fire separating elements can be defined not only as compartment walls and floors as above, but also as cavity barriers and construction enclosing a protected escape route and/or place of special fire hazard e.g. subdivision of concealed roof space; escape corridors; enclosures to cooking machines in a food factory; or enclosure of fuel storage space.

The junctions of fire walls or fire separating elements with each other, with external walls or roofs should be designed to provide continuity of the expected fire-resisting performance. Any element passing through a fire wall or fire separating element should have associated fire stopping at the point of penetration and the aperture should be kept as small as practicable. The design should ensure that the failure of a penetrating element will not cause failure of the fire wall or fire separating element or vice versa.

Further guidance

ASFP Purple Book: *Fire-resisting partitions, A guide to internally framed non loadbearing partitions,* 2nd Edition; http://is.gd/ot8fEN or www.asfp.org.uk

ASFP Guide to Passive Fire Protection for Fire Risk Assessors www.asfp.org.uk

12.2.6 Floors

Floors are usually formed of timber, concrete or steel composite or non-composite steel/concrete systems. The fire resistance of a floor will depend on the material from which it is formed, the properties of that material in fire, on the materials essential to the stability of the floor, and on the means by which these materials or products are fixed together.

Timber floors will char, the wood will be progressively but predictably consumed by fire. The timber thickness is critical to the performance in fire and therefore must be correctly specified. Fire resistance is usually afforded by a combination of protection to the underside and ensuring there is enough sacrificial timber in the joists.

Concrete floors contain entrapped moisture. They may well be reinforced with steel. In fire, the entrapped moisture will heat up and turn to steam. The steam pressure will increase and try to find relief by escaping from the concrete. The escape mechanism can be violent and large pieces of concrete may become detached by explosive spalling. Any steel reinforcement in the concrete will be initially protected by the concrete, until spalling exposes the steel and it will substantially expand to threaten the viability of use as a floor. The extent of concrete cover over reinforcement is therefore critical to the fire resistance available and must be correctly specified.

Composite floors perform differently in fire, because the metal base will conduct heat from fire laterally. The metal face will attempt to expand. The rate of temperature increase in the critical parts of the floor may be lessened compared to concrete alone. The composite floor will also be fixed through shear connectors to the supporting steel structure. Steam formed in the concrete may force out the metal decking, distorting it and causing gaps and subsequent failure. The steel reinforcement will transfer the load and the heat from fire. The composite structure may ultimately deform under the heat and sag under the load of the concrete.

The fire performance of all floors can be enhanced through the use of added passive fire protection systems. These PFP systems act to insulate the timber, concrete, or steel from the effects of fire for given periods of time. The protecting mechanism depends on the characteristics of the PFP system and careful design based on fire test evidence is essential.

Manufacturers' test evidence must be understood and incorporated into the specification to ensure that the anticipated performance is achieved.

The choice of PFP can also be important if the performance is not to be negated by deformation of the floor system. Some PFP materials will deform more than others, which may fracture under deformation in fire.

Further guidance

ASFP Guide to Passive Fire Protection for Fire Risk Assessors, www.asfp.org.uk

12.2.7 Fire resisting ceilings

Fire-resisting ceilings can form a critical component of the fire resistance of a building. Ceilings are generally constructed of gypsum, mineral wool or calcium silicate-based products supported on a lightweight steel framework. Three of their more common uses are:

a to protect a structure above, such as a timber floor or structural steelwork
b to separate building services from the space below; or
c to form one side of a smoke plenum.

Whatever type is selected, it should have documented test evidence to show that it meets the appropriate level of fire resistance for the relevant application, and should be designed, specified and constructed to fully satisfy the manufacturers' instructions. Light fittings, and other penetrations through the ceiling, must also have the same demonstrated standard of fire resistance, and be appropriate for the type of ceiling.

The ceiling design and fitting must allow for those occasions when any part of the ceiling system needs to be removed for maintenance, access, etc. Management procedures should be put in place and the ceiling must be restored to its original condition.

12.2.8 Cavity barriers

Cavity barriers are defined as a construction, other than a smoke curtain, provided to close a concealed space, such as in a cavity wall or ceiling void, against the penetration of smoke or flame, or provided to restrict the movement of smoke or flame within such a space.

Cavity barriers require special attention from the designer. By their very nature they are often hidden once installed and are therefore difficult to inspect after installation, handover and subsequently through the life of the building.

Those who install cavity barriers must have the necessary expertise and the requirements and responsibilities upon them must be clearly stated in the contract. The designer should indicate where there is a need for a cavity barrier. Because it is an important element that is often accidentally missed out during construction, the responsibility for its installation and performance must be clearly identified.

Unless clearly defined, it is possible for an inappropriate sub-contractor to be given the task of installing cavity barriers.

The requirements and responsibilities for the provision of cavity barriers must be clearly stated in the contract(s). Proprietary systems must be designed in accordance with manufacturer's instructions. Guidance recommendations on the provision of cavity barriers are given in AD-B and its equivalent Scotland/Northern Ireland guidance. Co-ordination between different trades and contractors is essential, particularly when aligning or joining one cavity barrier system with another.

The insulation and integrity requirements may be different from those required by the compartment walls and floors of the building. Care should be taken therefore with their use, particularly for large barriers. It should be noted that barriers in a roof space, for example, which are located above the fire separating divisions must provide the same level of insulation and integrity as the division. The recommended positioning and spacing of cavity barriers is given in regulatory guidance documents.

12.2.9 Fire stopping

Fire stopping materials are sealing products that take up imperfections of fit or design tolerance between the fire-resisting fixed elements of a building to restrict the passage of fire and smoke. They continue to take up the imperfections of fit at all times and have the same fire rating as the fixed elements of which they form a part. In reaction to a fire condition they swell, spread or deform to achieve their performance.

Unless clearly defined, it is possible for an inappropriate sub-contractor to be given the task of installing fire stopping. For example, where fire stopping is needed behind a cladding system at floor level, the responsibility may fall to the floor installer or the cladding contractor.

Like cavity barriers, fire stopping requires special attention from the designer. It is frequently hidden once installed and is therefore difficult to inspect after installation, handover and subsequently through the life of the building.

Those who carry out fire stopping must have the necessary expertise and the requirements and responsibilities upon them must be clearly stated in the contract. Proprietary systems must be designed in accordance with manufacturer's instructions. Recommendations on the provision of fire stopping are given in Approved Document B and the ASFP Red Book. Guidance on the installation and inspection of fire stopping is given in ASFP TGD 17; details of both publications are in section 18.

12.2.10 Fire curtains

Fire curtains are not defined, as such, in guidance. They should not be confused with cavity barriers, which may have specific lower fire resistance criteria. It is suggested that fire curtains are considered as flexible materials used to extend a fire-resisting wall, sometimes in a normally hidden void, often above ceiling level. The fire performance of the division is dependent on the fire performance of the support, top and edge fixings as well as jointing systems. Services penetrating the fire curtain should be protected to maintain the fire performance of the entire fire division.

If smoke barriers are used, these will not have the same high fire resistance criteria as fire barriers/curtains. They can only be expected to provide fire integrity, not insulation, and will not provide continuity of the fire-resisting division. They may be helpful to provide a smoke reservoir as part of a different and separate fire strategy. Again edge and joint fixing and sealing must be correctly specified.

12.2.11 Operable fire curtains

Increasingly, operable or 'drop-down' fire curtains are being used. These are retracted in normal use and only drop down or are powered into position on the activation of the appropriate fire alarm or detection signal. In addition to the factors listed above for static curtains, it is essential that these are checked regularly and records of checks for operation are inspected as part of any fire risk assessment. They are also dependent on a high level of fire safety management to ensure that the floor areas the curtains descend into remain free of obstructions which could render their operation ineffective.

All fire curtains should be installed in accordance with the manufacturer's instructions.

12.2.12 Air distribution systems

The detailed design of ducts for air movement (ventilation, air conditioning or heating) is frequently left to the services contractor. The consultant services engineer will define the performance required of the duct - e.g. how many air changes are required from a given space - and the services contractor is left to develop the most economical combination of duct size, route and fan power. The use of ductwork to distribute air around a building may compromise the overall expected fire performance, unless the possibility of fire entering the duct, and/or breaking out of a duct is considered. Both the consultant and services contractor may find that the use of dampers is a more expedient way to control of the spread of fire via ductwork in preference to using fire resistant ducts. Where air handling ducts pass through fire separating elements the integrity of those elements is maintained by using one of three basic methods:

- Method 1: Protection using fire dampers;
- Method 2: Protection using fire resistant enclosures;
- Method 3: Protection using fire-resisting ductwork

It is important that whichever method is chosen that it is properly documented so that all persons involved in the supply, installation and approval are aware of:

Method 1: Protection using fire dampers

A fire damper is a device used to prevent fire and reduce smoke spreading from one fire compartment to another through the air ductwork system which may penetrate fire separating walls and floors. Fire dampers should be situated within the thickness of the fire separating element (unless otherwise demonstrated by fire test) and be securely fixed. Fire dampers must fail safe closed and have a thermal release mechanism.

The fire damper allows the ventilated air in normal conditions to pass through a duct, wall or partition. In a fire situation it closes automatically to prevent the passage of fire for a stipulated time period. Closing of fire dampers can be effected by e.g. fusible links (heat sensitive devices e.g. solders) which releases a spring-activated mechanism, closing the damper (usually metallic or other inorganic construction). Alternatively, the fire damper may be an intumescent variety comprising a matrix of material coated with intumescent which swells up and closes the opening on heating.

Fire dampers should be CE marked complying with BS EN 15650, and classified to BS EN 13501-3. Fire dampers are classified 'E' (integrity) and 'ES' (integrity) (reduced smoke leakage). Intumescent fire dampers used for air distribution systems should be tested to BS ISO 10294-5 & classified to BS ISO 10294-2

Intumescent fire dampers and those activated only by fusible links are not suitable for protecting escape routes. Only an ES classified fire and smoke damper which is activated by a suitable fire protection system may be used.

Where the use of the building involves sleeping risk, such as an hotel or residential care home, fire dampers should be actuated by a smoke detector-controlled automatic release mechanism, in addition to being actuated by thermally actuated devices.

Fire dampers should be provided with adequate means of access to allow inspection, testing and maintenance of both the damper and the actuating mechanism.

Method 2: Protection using fire resistant enclosures

In this method, the fire protection of the air handling system penetrating any fire-resisting construction is provided by fire resistant enclosures e.g. a service duct or protected shaft. Such fire-resisting enclosures may be made from traditional construction, for example, plasterboard shaft wall, or they may be proprietary service ducts and shafts using e.g. calcium silicate, cement-based or other fire-resisting board materials.

Method 3: Protection using fire resistant ductwork

Steel ductwork systems for air movements around buildings are generally constructed to the Building and Engineering Services Association (formerly Heating & Ventilation Contractors Association) guide DW/144, which covers construction standards in the manufacture of sheet metal ductwork. However, general purpose ventilation ductwork systems constructed to this standard offer little or no protection against fire spread and cannot be used or converted into fire-resisting ductwork unless the system has been tested against the appropriate standard.

There are a variety of proprietary tested and certificated fire-resisting ducts which, provided they are adequately supported and sealed where they penetrate the element, obviate the need for fire dampers in fire-resisting walls and floors forming escape routes.

The duct should be designed to the same fire rating as the fire separating element through which it originally passes. This is especially important when the duct is intended to remove smoke from a compartment exposed to fire, or a kitchen extract system where the duct may become lined with ignitable fatty deposits if poor filtration or maintenance persists.

For this last application, additional insulation criteria are specified in the test standard.

Where a fire-resisting duct system has been specified, it must be fully tested or independently assessed to the requirements of BS 476: Part 24 or BS EN 1366 -1. The test should include the method of support and the type of seal used around the ducts where it penetrates a wall or floor whose fire resistance must be maintained. Also, it should have been tested for fire outside (duct A) and fire inside (duct B), both in horizontal and vertical orientations unless the end use conditions are to be restricted.

Types of product used to make steel ductwork fully fire resistant typically include:

- Fire protection boards, typically calcium silicate and vermiculite boards
- Rock fibre mineral wool (not glass fibre mineral wool)
- Sprayed fire protection coatings
- Hybrid systems, comprising at least two of the above

Care should be taken when utilising any of the above to make steel ducts fire resistant, that adequate test evidence is available for the particular circumstances, or a valid independent assessment has been obtained. Materials typically used for self-supporting ducts include fire protection boards, typically calcium silicate and vermiculite boards.

Further Guidance - ducts

ASFP Blue Book (BS) – *Fire-resisting ductwork tested to BS 476 Part 24,* 2nd Edition; http://is.gd/aQiygX
ASFP Blue Book (EN) – *Fire-resisting ductwork classified to EN 13501: Parts 3 & 4, 1st Edition;* http://is.gd/LzCkpB
HVAC DW 144 – *Specification for sheet metal ductwork;* http://is.gd/s7NGMF

BRE Good Building Guide 81: Installing Fire-Resisting Ductwork and Dampers; http://is.gd/ilcDjr or http://www.brebookshop.com

Further Guidance - dampers

ASFP Grey Book – *Fire dampers (European standards), 2nd edition;* http://is.gd/NDJ9pF or www.asfp.org.uk
HVCA DW 145 – *Guide to good practice for the installation of fire dampers;* http://is.gd/uM0fCW

12.2.13 Pipe, cable and service penetrations (including linear gap seals)

Wherever services penetrate elements of structure, any fire resistance criteria of the element of structure must be maintained. Any apertures must be kept as small as possible and fire-stopped in such a way that differential movement of the service and the element of structure will not disturb the fire stopping (see section 12.2.9). The services must also be adequately supported using fire rated supports at the centres covered by the test or certification evidence. Using centres dictated by the service provider may mean the penetration seal may not work as intended.

It may be required to extend the fire stopping along the service to ensure that high temperatures are not conducted along the service to the side isolated from the fire to prevent fire spread. The exact solution will depend on the system provided and manufacturer's advice is essential for compliance with the available test data.

In certain cases, the vertical penetration of compartment floors may necessitate large apertures to be formed for the passage of the services. This introduces an additional hazard if the aperture could permit maintenance staff to fall through it. Any fire stopping used to block the aperture should be capable of maintaining the expected load or be reinforced/supported adequately and should be labelled with the safe working load (SWL). If the fire stopping is not capable of supporting any significant load, it should have access to it restricted e.g. by barriers and should be signed to alert people to the potential dangers of falling through. See *ASFP Advisory Note No.1*.

Further guidance:

ASFP Red Book – *Fire-stopping: linear joint seals, penetration seals and small cavity barriers;* http://is.gd/HrATV1 or www.asfp.org.uk
ASFP TGD 17 *ASFP Guide to the installation and inspection of fire stopping* *http://is.gd/FCjaV1*
ASFP Advisory Notes:

No.1 Safe use of horizontal firestopping
Using Polyurethane foams for firestopping
Firestopping of combustible pipes with an internal diameter of 40 mm or less
http://is.gd/ldJems or www.asfp.org.uk

Intumescent Fire Seals Association *Information sheets and Risk Assessment Communiqués on the use of intumescent seals in doors and glazing system;* http://is.gd/gUY7nO or www.ifsa.org.uk.

12.2.14 Fire-resisting glazing systems

Whilst the limitations in use of uninsulated glazed elements on escape routes, stairways, walls and door leaves is provided by some statutory guidance documents, the use of insulated glazing, which reduces thermal transmittance of fire by radiation is becoming more popular. The choices and formulations of different types of insulated glazing are increasing rapidly, so there are many different solutions which can be used. Glasses that incorporate

e.g. polyvinyl butyrate, intumescent or siliceous intermediate layers can be selected to reduce the radiation intensity through glazed screens to acceptable or reduced levels e.g. along escape routes.

Effective glazing requires mounting in an appropriate frame together with all the correct components required by the glazed system.

Fire-resisting glazing systems must be suitable for the required application and designed in accordance with the manufacturer's instructions.

Further guidance:

Glass and Glazing Federation, *Guide to Best Practice in the Specification and Use of Fire-Resistant Glazed Systems;* http://is.gd/T2zbwO or www.ggf.org.uk

12.2.15 The building envelope

A wide variety of cladding systems are currently used in the construction industry. The cladding system can be of a variety of types, e.g. masonry, mixed masonry or brick /cladding systems, externally rendered thermal insulation systems on new and refurbished structures, built-up cladding systems where the metal and insulation components are brought together on site, or prefabricated composite sandwich panels using an insulation material between the two metallic outer leaves. Some high rise residential buildings have been refurbished using decorative panel systems for aesthetic appeal.

Recommendations for the construction of external walls are given in guidance to Building Regulations. Specific design principles are given in *BR 135, Fire Performance of external thermal insulation for walls of multi-storey buildings,* which also provides a method of assessing the fire performance of these systems using BS 8414-1:2002 *Test method for external cladding systems.*

Built-in fire protection may be formed from a wide range of ordinary (but mostly low-combustibility) construction products (i.e. materials not specifically marketed as passive fire protection). Such products include brick and block, concrete, cement, plaster board and timber. Such products are used, for example, to form fire-resisting compartment walls and floors, or to provide cavity barriers, cavity closures or fire stopping. Cavity barriers in cavity walls, or in roof constructions, may need to be installed as part of the construction process. Others, such as cavity barriers in roof spaces, may be fitted later.

It is essential that those elements of construction that comprise the built-in fire protection are properly designed, installed, inspected and maintained. This is particularly important for ordinary (non-specialist) products since their role as passive fire protection can be overlooked and difficult to inspect.

12.2.16 Checking designs

It is good practice, and especially when a building has had its fire safety system designed using fire safety engineering, for the fire safety design to be properly checked. This might be done by an in-house colleague of the designer, or a third party fire safety engineer. In any case, the design should be checked by the relevant Building Control Authority and the Fire Authority.

For most buildings, designed using AD-B and national equivalents, it is only necessary to check that the passive fire protection proposed for the building corresponds in both location and value to that recommended in the relevant statutory guidance document. However, insurers' requirements may also need to be considered.

Where a building has had its fire safety system designed using fire safety engineering then more detailed analysis may be needed, since, for example, the fire resistance specified might be reduced because sprinklers are fitted. It is vitally important that where a fire engineer is used, he or she is involved in the project at the earliest possible stage, preferably when the Fire Strategy is being agreed so that all aspects of his/her proposals are considered before any work is implemented.

It is important for the design checker to be satisfied that the PFP offered does meet the recommendations or can otherwise be justified, and that it is of a type that is appropriate for the actual use of the building, e.g. a soft coating may not be appropriate if trolleys are going to impact it.

It is recommended that the design check should determine that

- The passive fire protection is located properly
- The fire resistance periods proposed are appropriate
- The product specified is appropriate for its end-use
- The product specified has appropriate test reports showing it to be fit for purpose
- Adequate documentation (for CDM purposes and on maintenance, testing etc.) is available for the 'Responsible Person'/building managers
- The person or body confirming the suitability of the design should record his/her acceptance of the proposal.

It is essential that where designs or proposals do not follow the guidance document recommendations, the enforcers should have access to suitably qualified persons to verify the proposals.

Summary recommendations

- *It is strongly recommended that only a limited and controlled number of parties be authorised to change the PFP specification and that any changes be carefully monitored and recorded.*
- *Fire-resisting doors must be in accordance with the details contained in the test report or assessment provided by the manufacturer or as required by third party certification. Doorsets should be included on a schedule that will describe the swing, the size of opening, appearance and requisite building hardware. To achieve best practice, the building hardware schedule should be prepared by an architectural ironmonger who has specialist knowledge regarding the overall requirements for functionality and performance, this route is more likely to result in the desired performance.*
- *Fire-resisting doors, frames, self-closing devices and latch systems are all fire tested together to achieve the stated fire performance - the matched set of components is essential to the fire performance. Substitute components must be avoided.*
- *Any compartment wall below a service void such as a suspended ceiling should be designed to run continuously up through the ceiling to prevent the spread in the void. The junctions of compartment walls or floors with each other must provide continuity of the expected fire-resisting performance.*
- *Any element (including structural elements) passing through compartment walls or floors should be designed with associated fire stopping at the point of penetration and the aperture should be kept as small as practicable. The design should ensure that the failure of a penetrating structure because of fire in one compartment will not cause failure in the adjacent compartment.*
- *The junctions of fire walls or fire separating elements with each other, with external walls or roofs should be designed to provide continuity of the expected fire-resisting performance. Any element passing through a fire wall or fire separating element should have associated fire stopping at the point of penetration and the aperture should be kept as small as practicable. The design should ensure that the failure of a penetrating element will not cause failure of the fire wall or fire separating element or vice versa.*
- *Cavity barriers and fire stopping require special attention from the designer. By their very nature they are often hidden once installed and are therefore difficult to inspect after installation, handover and subsequently through the life of the building.*
- *Fire dampers should be CE marked complying with BS EN 15650, and classified to BS EN 13501-3. Fire dampers are classified 'E' (integrity) and 'ES' (integrity) (reduced smoke leakage). Intumescent fire dampers used for air distribution systems should be tested to BS ISO 10294-5 and classified to BS ISO 10294-2.*

- *Any fire-resisting duct should be designed to be constructed to the same fire rating as the fire separating element through which it originally passes. This is especially important when the duct is intended to remove smoke from a compartment exposed to fire, or a kitchen extract system where the duct may become lined with ignitable fatty deposits if poor filtration or maintenance persists.*
- *Where a fire-resisting duct system has been specified, it must be fully tested or independently assessed to the requirements of BS 476: Part 24 or BS EN 1366-1. The test should include the method of support and the type of seal used around the ducts where it penetrates a wall or floor whose fire resistance must be maintained.*
- *It is good practice, and especially when a building has had its fire safety system designed using fire safety engineering for the fire safety design to be properly checked. This might be done by an in-house colleague of the designer, or a third party fire safety engineer. In any case, the design should be checked by the relevant Building Control Authority and the Fire Authority.*

CONSTRUCTING, SUPPLYING AND INSTALLING

The main contractor should seek to ensure that the PFP is correctly specified and designated in all contract documents. The main contractor is responsible for ensuring the material is properly procured and installed, and is inspected and recorded by all interested parties.

13 CONSTRUCTING, SUPPLYING AND INSTALLING PFP

13.1 Main contractor

The main contractor should seek to ensure that the PFP is correctly specified and designated in all contract documents. The main contractor is responsible for ensuring the material is properly procured and installed, and is inspected and recorded by all interested parties.

Assuming the fire strategy and compartmentation for the project has been designed and approved by others (architects and design consultants, building control bodies, etc.) the main contractor should ensure this information is correctly converted into scope documents, drawings and specifications for the work. Careful attention should be paid to the interface arrangements between the trades. This will increasingly be undertaken by Building Information Modelling (BIM).

Note: see Relationships between main contractor (section 9.1) and specialist installers (section 9.2).

If it is inevitable that following trades will sometimes have to remove small areas of passive fire protection e.g. to structural steel or to penetration seals around air handling equipment and other services. This should be properly addressed in the contracts of those trades to ensure that excessive damage is not caused and that the fire resistance is reinstated.

13.2 Ordering by main contractor

The placing of sub-contracts is a vital element in the process and the main contractor should have in mind his/her legal responsibility to ensure that all such work is correctly undertaken. It should not be assumed that responsibility in the event of failure can automatically be passed to a sub-contractor. The main contractor should be totally satisfied as to the competence of sub-contractors where life-safety is involved, as is the case with PFP.

The main contractor should identify competent contractors for the work concerned. If a manufacturer's product has been specified, advice should be obtained on approved or recommended installers. The scope of work should include a requirement that the PFP contractor carry out inspection of work in progress and when completed. This should include a requirement that the PFP contractor employs or is an approved third party independent inspector, whose reports will be issued to the main contractor.

The contract should be awarded only to a contractor whose submittal complies with these tender requirements.

For the work of installing fire seals around penetrations in compartment walls and slabs, traditionally this has been included in the scope of work for each of the service trade contractors. This traditional approach can raise problems because of interface problems, and sometimes the seal installation has been left to untrained personnel.

An alternative approach, which has proved successful and is recommended, is to remove the penetration and fire seals from the scope of work of the service trades, and appoint a competent specialist contractor to carry out all this work throughout the project.

13.3 Third party certification (see also section 15)

Various certification and inspection schemes for contractors are available. The main contractor should select an appropriate scheme if the client has not already specified one. The ASFP recommends that third party certificated contractors are used as they are competent in the specialist installation methods required.

Approved Document B recognises the benefits in confidence and reliability obtained by the use of accredited installers. All contractor members of the ASFP are third party certificated as a condition of membership.

Any certification scheme should include the following:

- Verification of the skills and training of management, designers and estimators
- Suitable materials to be used in accordance with approved details
- Operatives and supervisors to be trained and certificated
- Random inspection of sites to monitor the quality of work
- Provision of a 'Certificate of Conformity' for completed work
- Provision of an audit trail
- UKAS accreditation for the scheme

For the most effective use of this system the main contractor can ask the PFP contractor to provide a list of names of operatives and supervisors, with copies of their certificates. The overall majority should be certified but a small number in training can be allowed to work under supervision. (See section 18.3.3 for available third party certification and inspection schemes).

13.4 Structural protection

The fire protection system chosen will be dictated by a combination of the level of fire rating required, appearance (unless hidden), environmental conditions such as humidity and temperature during application, prior to occupation and during use, robustness (impact damage), consideration of future adaptations, fitting out (partitions), capital and maintenance costs. Some of these considerations may influence the selection of materials.

The designer will usually provide a full specification if masonry or in-situ concrete is chosen as the fire protecting media. In cases where proprietary spray or panel systems including pre-cast concrete are to be used, the designer will indicate the required fire rating to the specialist installer who will select the materials and specification accordingly.

Where steel protection is required the issue of corrosion protection must be considered. Some PFP systems do not require the use of anti-corrosion primer; others require that a compatible anti-corrosion priming system is applied prior to installation of the fire protection. Guidance should be sought from the PFP manufacturer in order to properly co-ordinate the steel protection programme.

The ASFP recommends that third party certificated contractors are used as they are competent in the specialist installation methods required. The protection thickness required will vary for the specific steel section, the perimeter of steel which could be exposed to fire, the critical temperature for the section, as well as the fire resistance period. Specialist contractors will understand the requirements and ensure that the correct thickness of material is used.

The interfaces between different elements of structure need careful planning for the expected performance in fire. The ASFP suggests that sample situations are agreed before general work commences, so that all parties are aware of the issues. Simple steel protection may well be the norm, but more complex areas will always occur, especially where different trade packages interface – e.g. protection of perimeter steel adjacent to prefabricated cladding, and interfaced by internal fire walls, storey decks and services.

Where these fire protection systems abut profiled decking the fire protection period/ system type will dictate whether the re-entrant profiles need fire stopping or not and whether fire protection thicknesses should be increased, according to good practice developed by the Steel Construction Institute and the ASFP (See ASFP Yellow Book – *Fire protection for structural steel in buildings,* 4th Edition; http://is.gd/K3NgQs).

13.5 Fire-resisting doorsets

The designer will specify the fire resistance for fire-resisting doorsets and leave it to the contractor to select an appropriate supplier. The rating will be dictated by the rating of the compartment wall or corridor it is in. If the designer is looking for additional features, not necessarily related to the fire rating, he/she may identify a number of acceptable suppliers and include details of glazed panels, finishes and building hardware (ironmongery).

It is recommended that only doors covered by third party certification (see section 15) which includes factory production control should be used. Doorsets should be included on a schedule that will describe the swing, the size of opening, appearance and requisite building hardware.

Current practice is that the building hardware (ironmongery) will often be selected by a member of the project design team and included as a prime cost (PC) sum. Certain procedures may follow the alternative route of selecting catalogue items, usually covered with the caveat of 'equal and approved' to preserve the ideals of fair competition and choice. This route can lead to incompatible specifications which are further down-graded by the main contractor or the purchaser (doorset supplier, sub-contract installer etc.). Confirmation of the fire performance compatibility must be obtained from the door manufacturer and/or the hardware supplier for all components.

To achieve best practice, the final building hardware schedule should be prepared by an architectural ironmonger who has specialist knowledge regarding the overall requirements for functionality and performance, this route is more likely to result in the desired performance.

Attention should be paid to the use of auxiliary items such as electro-magnetic hold-open and swing-free door closing devices for use where doorsets are required for fire compartmentation but where the door otherwise creates an inconvenience in day-to-day use. There may be requirements under the Discrimination Act with particular reference to AD-M where there may be possibilities of conflict between user friendliness and function in case of fire.

It should be remembered that from all the PFP products included in any building the doorset with its hardware is the item which withstands the greatest use and abuse. The door is required to function correctly at all times, being the most handled product in the circulation area of any building. It is expected to play a dual role of conventional door for security, privacy, separation, sound reduction and/or air movement control BUT in the event of a fire it has to perform 100% as a fire barrier.

This can only be achieved if the correct items are fitted at the time of construction and maintained throughout its whole working life. Any replacement MUST be on a 'like-for-like' basis.

13.6 Fire-resisting shutters

Fire-resisting shutters can be used to protect openings in compartment walls ranging in size from serving hatchways upwards and usually are operated on a fusible or smoke activated link basis or connected to the fire alarm system.

As such, they will require regular testing; apart from this aspect, they will be designed or specified in the same way as fire doors.

13.7 Compartment walls and floors

Designers will usually specify in some detail the construction of compartment walls and floors. Floors in particular will have functions other than fire separation, such as structural load carrying capabilities and stiffening of the general structure of the building. Concrete floors will normally be designed to provide a required fire rating. Steel beams and some composite flooring such as the use of permanent corrugated steel shuttering will usually require additional fire protection (bolt on or sprayed passive or intumescent systems) and this will be the subject of a performance specification prepared by the designer and supplied and fixed by a specialist.

The designer will fully specify the structural performance of load bearing compartment walls. The fire resistance may be covered by the structural specification, but a specialist will provide details if additional protection is needed. Partition or non-load bearing walls may also be fully specified, although if a stud system has been specified, the supplier will be expected to certify that the required performance has been achieved.

13.8 Ceilings

Fire-resisting ceilings should be constructed to fully satisfy the manufacturer's instructions and allow for parts of the ceiling to be removed for maintenance. Light fittings, and other penetrations through the ceiling, must be appropriate for the type of ceiling.

13.9 Cavity barriers

The successful installation and maintenance of cavity barriers is dependent on the supports, top fixing, edge fixing and jointing systems. Cavity barriers are usually tested in fire conditions for a maximum of 3m vertical drops. Higher drops are viable provided the barrier and support/fixing systems can accept the higher load of the extended drop and that the application at longer drops is covered by assessment or third party certification. In many cases this may require additional support elements and manufacturers can provide the necessary detail. Some will offer site advice free of charge. Unless clearly defined, it is possible for an inappropriate sub-contractor to be given the task of installing cavity barriers.

The requirements and responsibilities for the provision of cavity barriers must be clearly stated in the contract(s). Proprietary systems must be installed in accordance with manufacturer's instructions. Recommendations on the provision of cavity barriers are given in AD-B and its equivalent in Scotland, Northern Ireland and the Republic of Ireland. Advice on preventing fire spread between buildings at roof level is given in *BRE Defect Action Sheets 7 and 8* available from the BRE bookshop at: http://is.gd/hrgLHB

13.10 Fire stopping

Fire stopping materials are sealing products that take up imperfections of fit or design tolerance between the fire-resisting fixed elements of a building to restrict the passage of fire and smoke. They continue to take up the imperfections of fit at all times and have the same fire rating as the fixed elements of which they form a part. In reaction to a fire condition they swell, spread or deform to achieve their performance.

Like cavity barriers, fire stopping requires special attention from the installer. They are frequently hidden once installed and are therefore difficult to inspect after installation, handover and subsequently through the life of the building.

Because it is an important element that is often accidentally missed out during construction, the responsibility for the installation of fire stopping must be clearly identified. This is all the more important as fire stopping is often hidden after its installation.

Unless clearly defined, it is possible for an inappropriate sub-contractor to be given the task of installing fire stopping. For example, where fire stopping is needed behind a cladding system at floor level, the responsibility may fall to the floor installer or the cladding contractor. Whoever carries out the task must have the necessary expertise.

The requirements and responsibilities for the provision of fire stopping must be clearly stated in the contract(s). Proprietary systems must be designed and installed in accordance with the manufacturer's instructions. Recommendations on the provision of fire stopping are given in AD-B and national equivalents and the ASFP Red Book – *Fire stopping: linear joint seals, penetration seals and small cavity barriers;* http://is.gd/HrATV1 or www.asfp.org.uk and guidance on installation is given in the *ASFP TGD 17 Guide to the installation and inspection of fire stopping:* http://is.gd/FCjaV1

13.11 Fire-resisting ductwork and dampers

It is important that when a fire-resisting ductwork system has been specified, it has been fully tested to the requirements of BS 476: Part 24 (or BS EN 1366-1).This must include the method of support and the type of seal used around the ducts where it penetrates a wall or floor whose fire resistance must be maintained. Also, it should be tested both for fire outside (duct A) and fire inside (duct B), both in horizontal and vertical orientations unless the end use conditions are to be restricted.

Typically, there are two types of fire-resisting ducts.

1. Steel ducts protected with a fire protection system, which typically includes:
   - Fire protection boards, e.g. calcium silicate and vermiculite boards
   - Rock fibre mineral wool (not glass fibre mineral wool)
   - Sprayed fire protection coatings
   - Intumescent coatings
   - Hybrid systems, comprising at least two of the above. Where any of these materials are included, the complete assembly must be tested, as noted above, to BS 476 Part 24, or BS EN 1366-1.

2. Self-supporting duct systems constructed entirely from fire protection boards e.g. calcium silicate and vermiculite boards.

Fire dampers with fusible links (or those designed to be operated when smoke is detected) are designed to be installed in the line of the cavity barrier, fire wall or compartment wall/floor through which the ductwork passes. If they are not in the line of the fire division, then fire can by-pass the damper system.

Fire dampers should be independently supported so that failure of the duct will not cause failure/collapse or disturbance of the damper mechanism in the line of the wall. Ducts also need to be adequately supported so that no undue load is applied to the damper due to distortion of the duct (this can prevent the damper from closing properly or not at all).
It is also important that the damper has been tested (or assessed) for the particular type of wall or floor in which it is to be installed.

13.12 Service ducts and shafts

Protected shafts should be restricted to stairs, lifts, escalators, chutes, ducts and pipes, which are invariably vertical and pass through compartment floors. Protected shafts are therefore normally constructed to provide the same degree of fire resistance as the compartment floor through which they are passing - indeed the shaft may be an integral part of the structure, in which case the structural engineer will provide a detailed design solution.

If the shaft is independent of the structure, e.g. non-load-bearing, the designer (probably the architect) will provide a performance-based specification, tempered by aesthetics or other non-fire related issues.

13.13 Pipe, cable and service penetrations

Approved Document B and its national equivalents provide guidance on the maximum pipe size, depending on its type, which may penetrate a compartment wall or floor. More combustible larger diameter pipes are permitted if they are sleeved with a non-combustible material. The designer may specify the material for pipework generally, e.g. steel which is considered non-combustible in buildings such as schools because they will be subject to harsh treatment. The designer may not be aware of the services which will penetrate fire walls and floors because the use of performance specification will leave the detailed design of the service routes to the specialist services sub-contractor. The performance specification will state that penetrations should meet the provisions of the building regulations, i.e. putting the responsibility for compliance on the contractor.

It is essential that both the designer and the specialist contractor are fully conversant with the fire protection requirements for pipe, cable and service penetrations.
It is recommended that third party certificated products and installation contractors are used for such work.

13.14 Fire-rated glazing systems

Modern interior designers favour lightness and airiness – particularly for places of work, retail and entertainment. Accommodation stairs that connect one or two floors to aid and encourage staff or movement and communication, need to be as open as possible so as not to obscure internal views on office floors. The accommodation stair is not included in the Building Control calculations for escape purposes. Designers prefer to use screens glazed in something more elegant than wired glass and the new fire-resistant glasses are now becoming popular. Designers will need to provide full architectural details of such screens but will expect the installer to warrant the fire performance. This can only be done after reference to manufacturer's fire test information. Third party certificated installers should be used.

Fire-resisting glazing systems must be suitable for the required application and installed in accordance with the manufacturer's instructions.

13.15 The building envelope (walls and roofs)

Wall cladding and structural walling need to fulfil a number of performance criteria - resist rain, wind, temperature, noise, pollution, spread of fire between floors and to and from beyond the boundary, provide light, views, ventilation and comfort, support for the structure and services, plus aesthetics. Roofs will also need to fulfil most of these criteria and may form part of an escape route. Roofs and external walls will contribute to the overall thermal insulation and air tightness of the building.

Providing a balance for these criteria involves co-ordination of all the design disciplines and many sub-contractors. Because of the wide ranging criteria that the building envelope has to satisfy, the lead designer will usually need to take on the role of co-ordinator and provide detailed designs and prescriptive specifications for most of the system, although applied fire protection will be subject to a performance specification.

Design consultants and contractors need to appreciate the implications of selecting materials that increase the fire load. The amount of combustible material that is permitted will depend on building height, size, use and distance from the boundary.

Built-in fire protection may be formed from a wide range of ordinary (but mostly low-combustibility) construction products (i.e. materials not specifically marketed as passive fire protection). Such products include brick and block, concrete, cement, plaster board and timber. Such products are used, for example, to form fire-resisting compartment walls and floors, or to provide cavity barriers, cavity closures or fire stopping. Cavity barriers, in cavity walls, or in roof constructions, may need to be installed as part of the construction process. Others, such as cavity barriers in roof spaces, may be fitted later.

It is essential that those elements of construction that comprise the built-in fire protection are properly designed, installed, inspected and maintained. This is particularly important for ordinary (non-specialist) products since their role as passive fire protection can be overlooked and difficult to inspect.

13.16 Other considerations

Selection of fire protection systems by designers, and contractors will need to include consideration of a number of criteria common to all elements:

- Life cycle cost considerations and how frequently the system or its components will need to be replaced
- Maintenance requirements to ensure that the specified fire rating is not compromised
- Access for periodic inspection and replacements during life
- Durability issues – wetting, freeze-thaw, movement and aggressive environments may reduce performance over a period of time
- Environmental considerations e.g. embodied carbon, dangerous substances and end of life disposal

All the design disciplines and key personnel in the supply chain involved in the project should be properly informed of the PFP philosophy so that they avoid compromising agreed principles. Co-ordination of designers and suppliers along with supervision of the works is essential. Procurement routes need to be established at the outset of the project.

13.17 Suppliers' role

The PFP measures will usually be supplied to a building through the specialist contractor appointed by the main contractor, who must install the fire protection in line with the manufacturers' tested or recommended details. The requirement will be shown in either a detailed specification or often a performance specification, whereby the choice of materials may be left with the specialist contractor. Therefore, the manufacturer and the distributor, who are often relied upon by the specialist contractor for technical advice, play a significant role in the procurement chain.

Both the manufacturer and the distributor have a duty to ensure that the products supplied conform to the specified requirements and have the required supporting evidence test/ assessment reports, third party certification) to demonstrate this compliance. The increasing use of Building Information Modelling (BIM) objects by manufacturers that will include the relevant and correct information should enhance the process of appropriate product acceptance.

This document has stressed the importance of using certificated specialists throughout and such specialists will understand the test and certification requirements for products in their field of expertise. The placing of contracts that include PFP in the scope with contractors inexperienced in such matters places a greater burden on the suppliers.

Ordering by untrained staff will be vague and lack detail and suppliers must accept responsibility for the materials that are provided as the life safety of the occupants and users of the building may be put at risk by the use of the wrong materials, probably wrongly installed. Documentation giving the scope of test evidence and full installation information in an unambiguous manner is essential with all limitations of application clearly defined.
This latter supply problem is most prevalent when the PFP element is a minor part of work that may be of a skilled nature in another field and it is recommended grouping all PFP work into specialist contracts to avoid such problems.

13.18 On-site quality checks and audits

Each specialist contractor should undertake their own quality assurance checks to ensure that the work meets the specification. This is often complemented by checks or audits that manufacturers undertake to ensure that their products are being installed correctly and/or by checks carried out by bodies certificating the installer.

Approved Document B recognises the benefits in confidence and reliability obtained by the use of certificated installers for such materials and all ASFP contractor members have to be third party certificated.

Third party certificated contractors, who are trained in the specialist installation methods required, should be used to minimise the risk of additional expense that may be incurred when unsatisfactory work is found.

The main contractor should include in the PFP contract:

- Suitable scope of work/specification, which should define the type and frequency of checks required
- Contractor to provide a Quality Plan or other documents describing the procedures and resources for quality assurance including site testing and inspection
- For PFP to structural steel, contractor to employ an approved independent inspection agency to carry out tests and inspections to verify the work is complete and in accordance with the specification
- For all other, PFP contractor to affix a suitable permanent label to each item with a reference number, installation date and other suitable information e.g. period of fire resistance, to provide traceability
- The need to reinstate any passive fire protection e.g. to structural steel or to penetration seals around air handling equipment and other services that have been removed by follow-on trades or for other purposes
- The right to inspect all work

The contractor shall also maintain a summary record of this information in the form of marked-up drawings or similar.

Wherever products are specified by name for a contract it is the usual practice to include the option of 'or other approved' in some form in the specification. The subsequent substitution of alternatives requires careful control, as the primary reason for such a change may be a reduction of cost. Where alternatives are being offered, expert knowledge of such matters as test evidence, scope of application, installation skill requirements, ease of maintenance and other related points is required to approve the alternative being offered.

When such products are accepted within the contracting chain the responsibility for the 'in use' performance rests with those accepting the substitution and the decision should not be taken lightly where life safety matters such as PFP are concerned. This responsibility for changes to the design specification starts with the main contractor and applies down the contractual chain through sub-contractors and suppliers of materials in all sectors of PFP work.

Summary Recommendations

- *Assuming the fire strategy and compartmentation for the project has been designed and approved by others (architects and design consultants, building control bodies, etc.), the main contractor should ensure this information is correctly converted into scope documents, drawings and specifications for the work. Careful attention should be paid to the interface arrangements between the trades. This will increasingly be undertaken by Building Information Modelling (BIM).*
- *The main contractor should identify competent contractors for the work concerned. If a manufacturer's product has been specified, advice should be obtained on approved or recommended installers. The scope of work should include a requirement that the PFP contractor carry out inspection of work in progress and when completed. This should include a requirement that the PFP contractor employs or is an approved third party independent inspector, whose reports will be issued to the main contractor.*
- *Various certification and inspection schemes for contractors are available. The main contractor should select an appropriate scheme if the client has not already specified one. The ASFP recommends that third party certificated contractors are used as they are competent in the specialist installation methods required.*
- *The main contractor should include in any PFP contract:*
    - *Suitable scope of work/specification, which should define the type and frequency of checks required*
    - *Contractor to provide a Quality Plan or other documents describing the procedures and resources for quality assurance including site testing and inspection*
    - *For PFP to structural steel, contractor to employ an approved independent inspection agency to carry out tests and inspections to verify the work is complete and in accordance with the specification*
    - *For all other, PFP contractor to affix a suitable permanent label to each item with a reference number, installation date and other suitable information e.g. period of fire resistance, to provide traceability*
    - *The need to reinstate any passive fire protection e.g. to structural steel or to penetration seals around air handling equipment and other services that have been removed by follow-on trades or for other purposes*
    - *The right to inspect all work*
- *Each specialist contractor should undertake their own quality assurance checks to ensure that the work meets the specification. This is often complemented by checks or audits that manufacturers undertake to ensure that their products are being installed correctly and/or by checks carried out by bodies certificating the installer.*
- *Because it is an important element that is often accidentally missed out during construction, the responsibility for the installation of fire stopping and cavity barriers must be clearly identified. This is all the more important as fire stopping and cavity barriers are often hidden after installation.*
- *Fire dampers should be independently supported so that failure of the duct will not cause failure/collapse or disturbance of the damper mechanism in the line of the wall. Ducts also need to be adequately supported so that no undue load is applied to the damper due to distortion of the duct (this can prevent the damper from closing properly or not at all). It is also important that the damper has been tested (or assessed) for the particular type of wall or floor in which it is to be installed.*
- *It is essential that both the designer and the specialist contractor are fully conversant with the fire protection requirements for pipe, cable and service penetrations. It is recommended that third party certificated products and installation contractors are used for such work.*

MAINTAINING PASSIVE FIRE PROTECTION

One of the first requirements for adequate maintenance of fire protection measures in a building is a full understanding of the Fire Strategy that was used during the design and construction process

14 MAINTAINING PASSIVE FIRE PROTECTION (PFP)

14.1 General

One of the first requirements for adequate maintenance of fire protection measures in a building is a full understanding of the Fire Strategy that was used during the design and construction process. Reference was made to this earlier in this guidance and the need for the provision of a Fire Safety Manual for the building. Any relevant documents should be given to the 'Responsible Person' at the handover of the building. (See section 7.1.3) Building managers will need to be aware of the Regulatory Reform (Fire Safety) Order 2005 (and national equivalents).

The provision and maintenance of the PFP within the building should form part of the risk assessment for the building, carried out under these regulations. Where PFP systems have to be removed or have become damaged for other purposes, they must be made good as soon as possible.

It is essential to ensure that future modifications to the building do not negate the effectiveness of the system to which the supporting evidence (fire test or assessment report, or certificate of third party certification) applies.

It is also essential for those elements of PFP that need regular inspection and maintenance e.g. fire and smoke dampers, that provision is made for this in the maintenance programme.

The Construction Design and Management Regulations (CDM) applicable in the UK require all concerned in the process from design inception to completion of the building to prepare a file (the CDM file) containing details of all the work done and materials used where safety is concerned. The CDM file can be an invaluable source of information on all aspects of fire safety work in the construction of the building that may be used by the occupant when preparing maintenance plans, modifications to the building or fire risk assessments as required by the Regulatory Reform (Fire Safety) Order 2005 (and national equivalents). Likewise, the fire safety information for all fire protection systems collected under Regulation 38 of the Building Regulations (England and Wales) will also assist in the operation and maintenance the building in reasonable safety.

In general, the fire safety specification for a building will primarily be concerned with life safety. However, there are other issues that may need to be addressed by the fire strategy and these include; business interruption, contents, heritage, functionality and/or environmental protection.

The building manager must be aware where these additional criteria have been considered. Ideally, where the operation and maintenance data for a building is available and the 'as-built' products can readily be procured, any changes and repairs should be carried out with the materials originally specified. Suitably skilled, experienced and certificated personnel must carry out such work in accordance with the manufacturer's recommendations.

14.2 Building life issues

The selection of PFP products at the construction stage and the quality of installation will have a direct impact on the longevity of the fire protection. The use of materials that are susceptible to damage, e.g. through impact and/or dampness in inappropriate locations, will greatly reduce the life of the PFP. Materials that are subject to deterioration during the life of the building or which are installed in aggressive environments must be identified and be subject to a suitable maintenance procedure to meet the manufacturers' guaranteed lifetimes. Notwithstanding these reservations, most modern passive fire protection materials are durable and, if properly maintained, are more than capable of delivering a sustained level of fire resistance throughout the life of a building (e.g. 40 years).

The primary concern in the maintenance of PFP should be focussed on the control of change (alterations/ breaches) and the quality and efficacy of repair.

14.3 Building services

The interfaces between fire-resisting elements of construction and building services are commonly described as penetrations.

It is a requirement of building regulations and insurers' rules as well as good practice that breaches created by the penetration of services be made good to the extent that the fire-resisting performance of the penetrated element is fully restored in terms of their load-bearing capacity, integrity and insulation.

Modern commercial and public buildings are dynamic environments in which change may be endemic. Building services are the principal cause of breaches in this scenario and, because of their frequency and obscure locations, often give rise to the greatest uncontrolled risk of fire spread. In general, it is accepted that a modern commercial building will see a complete change of services every 25 years.

Planning of breaches in compartment walls/floors and their repair are of prime importance in controlling the risk of fire and smoke spread.

The planned duration of new service installations or modifications should also be assessed for risk and consideration given to the deployment of temporary penetration seals.

Care must be taken in selecting an appropriately rated penetration repair solution, compatible with the original installation and substrate and suited to the type, configuration and number of penetrating services. This care should be extended to the delivery and verification of the solution by a third party certificated specialist.

14.4 Permits

The need for control of hot work processes is widely recognised and it is common practice to forbid such activities without the deployment of controlling 'hot work' procedures and permit systems.

Often these permits will be highly restrictive, limiting activities, and durations and stipulating protective measures to be taken before, during and even for some time after the activity. Contrast this with the introduction of new services, facilitated by the creation of multiple breaches in fire-resisting elements or the removal of structural protection within the construction. Whilst there is apparently much less immediate risk of starting a fire, there is potential for the circumvention of fire-resisting elements in such a way as to greatly increase the risk to both life and property through the spread of fire and smoke.

Where it is impractical to plan and control such work through conventional methods, consideration should be given to the operation of 'cold work' procedures and permit systems to control and record access to, and activity within, areas of a building.

14.5 Facilities managers

Facilities managers have a key role to play in the management of breaches in passive fire protection. They are often empowered to plan and supervise the installation of new services on behalf of building owners and occupiers and yet also to fulfil duties in respect of fire safety compliance. Without adequate consideration and planning these two roles can be contradictory. The facilities manager must use care in the planning and control of new works in order to have minimal impact on the passive fire protection measures in the building.

Understanding the design concept of fire-resisting compartmentation as well as the contradictory nature of our need for more open and highly-serviced buildings gives experienced facilities management professionals the ability to recognise the inherent risks. Thus they can successfully plan and control change without placing occupants and buildings at risk. Having access to the fire strategy documents, the CDM file and Regulation 38 information will materially assist in the performance of this function.

14.6 Fire safety managers

Fire safety managers, where appointed, have a primary role in the compliance management and monitoring of passive fire protection in buildings and must base their work on the agreed fire strategy and have knowledge of the fire safety design principles that were used in the construction of the building.

Trained in the behaviour of fire, smoke and people they will often have a greater understanding of the nature of the risk from uncontrolled breaches in fire-resisting elements. They are a powerful force in auditing the condition of the building and can provide early warning of unplanned activity and breaches and, as with facility managers, they should have access to the CDM file (UK only).

Additionally, they will have a role in the provision of training and guidance to personnel, building management and managing contractors. They will probably ensure that both active and passive fire protection measures in the building design are delivered at hand-over and are maintained to the required standard throughout the life of the building.

It is strongly recommended that a 'fire safety manager' be appointed for all large or complex buildings. The fire safety manager who may be the facilities manager should have overall responsibility (and powers and resources) for all issues relating to fire safety, and liaise with the other engineering professionals looking after the building.

14.7 Fire safety policy statement

In order to develop and maintain the safety of the building, the building management team should formulate a policy statement appropriate to the building configuration, location, occupation, and if relevant, to the building users.

This policy statement should contain a description of the levels of passive fire protection required throughout the building including recommendations for structural protection, compartmentation, protected shafts, fire fighting shafts, cavities/voids and their respective protective barriers, and fire-resisting doorsets, etc.

An important aspect of the fire safety specification is the link between active and passive fire safety measures employed throughout the building. The extent to which this linkage applies should be taken into account within the fire safety specification.

14.8 Fire safety manual

Location and access: The fire safety manual should be kept in a secure and fireproof container on the site (but preferably not within the building), readily accessible to fire officers attending an incident.

The fire safety manual needs to be reviewed annually, or whenever alterations are made to the building and should include the following:

- All plant and equipment interface controls, to ensure that all equipment is in working order and that maintenance procedures are being followed
- As-built drawings and specifications of the fire protection measures
- Any changes that create a need to review the risk assessment under the Regulatory Reform (Fire Safety) Order 2005 (and national equivalents)

14.9 Maintenance programmes

The ideal solution to unplanned breaches in fire-resisting elements or damage to passive fire protection is to plan and control every activity to include the restoration of the fire protection.

'Ownership' of the work needs to be clearly established and completion/close-out cannot be achieved until verified. All costs associated with the planning and repair is borne by the instigating activity or project.

However, it is recognised that such a level of proactive planning and control may be difficult or impractical to implement and sustain. In such circumstances, the use of maintenance/monitoring systems offers a reasonably practicable means of checking the integrity of the fire-resisting elements and effecting repairs as required. These systems can provide a level of verification in support of control systems (planning, permits etc.) or can stand alone as a means of identifying and repairing unplanned breaches. Such systems can never provide the level of control inherent in the proactive/planned methods but are effective in providing and verifying compliance at periodic intervals. Failure to provide such a system allows unplanned activity to continue and for the perpetrators of such activity to escape the consequences.

14.10 Monitoring

Regular inspection for potential breaches in passive fire protection must be carried out. This can produce beneficial information in respect of planned and unplanned activity, frequency, type, cost and other statistical data. It can demonstrate compliance in the control and management of the passive fire protection in the building.

The frequency of monitoring activity will be dictated by the building's risk profile. Buildings with hazardous contents, high occupancy levels or high rates of change are examples of a higher risk category. The period between monitoring activities should not, of course, be allowed to exceed any Statutory or Health and Safety Executive guidance minimum. It is important to ensure that all activities within the building that might affect the PFP are monitored and responded to where necessary.

14.11 Recording

Information as to identity, location, design, performance, installation, type, age, etc., is also highly beneficial in repairing and maintaining passive fire protection. The creation of maintenance records can range from simple identification tags to more elaborate databases of information tailored to both client and regulatory requirements. These records should be created and maintained in addition to the 'as built' records which form part of the building's Health and Safety File and Fire Safety Manual. Additionally, records of monitoring activities must be maintained in order to demonstrate compliance.

14.12 Other management implications

The successful deployment of planned activity, maintenance, monitoring and record-keeping has a number of effects.

- Life is protected - users, visitors and firefighters
- Capital assets are protected
- Business continuity can be optimised
- Unplanned and uncontrolled activity is reduced/eliminated
- Ownership of breaches is established
- Patterns of activity can be identified to aid future planning
- Risks to the business/enterprise are reduced/controlled
- High risk locations and types can be identified
- Trends can be detected (e.g. loss of control)
- Costs of unplanned breaches can be reduced
- Compliance can be demonstrated
- Non-compliance can be detected

Management need to be aware of the importance of PFP on a range of factors that affect the successful operation of the building.

14.13 Enforcers' inspections

It is recognised that, other than during construction, inspections by Fire and Rescue Services under the Regulatory Reform (Fire Safety) Order (and national equivalents) will be infrequent and relatively superficial. However, there is always the possibility that an inspector may probe further, or if significant defects in the PFP are found, a dedicated and thorough third party inspection may be undertaken. The potential is therefore present for an unforeseen loss of use of a building. Through the development or adoption of maintenance strategies for passive fire protection building owners and users can mitigate all manner of such tangible risks.

14.14 Audit trails and record keeping

It is essential that full records and an audit trail is provided for all the passive fire protection in the building. This information will be required for the CDM Safety File and under Regulation 38 (UK only).

Summary Recommendations

- *The provision and maintenance of the PFP within the building should form part of the risk assessment carried for the building. Where PFP systems have to be removed or have become damaged for other purposes, they must be made-good as soon as possible.*
- *It is essential for those elements of PFP that need regular inspection and maintenance e.g. fire and smoke dampers, that provision is made for this in the maintenance programme.*
- *Planning of breaches in compartment walls/floors and their repair are of prime importance in controlling the risk of fire and smoke spread.*
- *Care must be taken in selecting an appropriately rated penetration repair solution, compatible with the original installation and substrate and suited to the type, configuration and number of penetrating services. This care should be extended to the delivery and verification of the solution by a third party certificated specialist.*
- *Where it is impractical to plan and control such work through conventional methods, consideration should be given to the operation of 'cold work' procedures and permit systems to control and record access to, and activity within, areas of a building.*
- *Facilities managers have a key role to play in the management of breaches in passive fire protection. They are often empowered to plan and supervise the installation of new services on behalf of building owners and occupiers and yet also to fulfil duties in respect of fire safety compliance. The facilities manager must use care in the planning and control of new works in order to have minimal impact on the passive fire protection measures in the building.*
- *It is strongly recommended that a 'fire safety manager' be appointed for all large or complex buildings. The fire safety manager who may be the facilities manager should have overall responsibility (and powers and resources) for all issues relating to fire safety, and liaise with the other engineering professionals looking after the building.*
- *The fire safety manual needs to be reviewed annually, or whenever alterations are made to the building and should include the following:*
    - *All plant and equipment interface controls, to ensure that all equipment is in working order and that maintenance procedures are being followed*
    - *As-built drawings and specifications of the fire protection measures*
    - *Any changes that create a need to review the risk assessment under the Regulatory Reform (Fire Safety) Order 2005 (and national equivalents)*

- *Regular inspection for potential breaches in passive fire protection must be carried out. This can produce beneficial information in respect of planned and unplanned activity, frequency, type, cost and other statistical data. It can demonstrate compliance in the control and management of the passive fire protection in the building.*
- *Information as to identity, location, design, performance, installation, type, age, etc., is also highly beneficial in repairing and maintaining passive fire protection. The creation of maintenance records can range from simple identification tags to more elaborate databases of information tailored to both client and regulatory requirements. These maintenance records should be created and maintained in addition to the 'as built' records which form part of the building's Health and Safety File and Fire Safety Manual. Additionally, records of monitoring activities must be maintained in order to demonstrate compliance.*
- *It is essential that full records and an audit trail is provided for all the passive fire protection in the building. This information will be required for the CDM Safety File and under Regulation 38 (UK only).*

THIRD PARTY CERTIFICATION

Third party certification is a guarantee of the quality of the PFP product or installation that is independent of the manufacturer or contractor. It provides confidence to all stakeholders that the PFP as installed will work as intended.

15 THIRD PARTY CERTIFICATION

Frequent reference has been made previously to third party product certification and certificated installers and this process is summarised here. Suitable UKAS accredited schemes are run by certification bodies listed in 18.3.3.

Third party certification for products varies according to the terms of individual schemes, but essentially includes verification of the test evidence and scope of application or use of the product, and a regular audit of the factory QA system to ensure that the product as supplied to the contractor is to the same design or formulation as the original test samples.

Third party certification for installers is a process whereby the contracting company is seen to employ appropriately trained staff to design and/or install the required PFP system. Their work is independently audited by site inspections from the third party organisation and a full record system is required as part of the scheme. The use of such certification is recognised in Approved Document B (Use of Guidance; Independent certification schemes) and in the national equivalents. The use of certificated installers will reduce the incidence of PFP being installed by unskilled or inappropriate contractors and/or the use of unsuitable materials and reduce essential work and re-work considerably. Upon completion, a Certificate of Conformity is issued to the main contractor for each contract. These autonomous schemes raise the profile of the supply and installation chain and provide the client with an enhanced level of confidence regarding the quality of installed PFP.

Where the designer has elected to use fire safety engineering techniques for all or part of the works, quality of installation may be more important, because prescriptive requirements tend to be all encompassing and conservative, whereas fire safety engineering calculations or recommendations may be more exact in their requirements, and any deficiency then becomes much more important. Some clients will no longer accept the use of non-certificated installers.

In July 2001, the ASFP required all contractor/installer members to be third party certificated as a condition for membership of the Association, in order that manufacturing members can rely on fair use and representation of their products as intended. In 2012, the ASFP required that all passive fire protection products listed in its publications either be third party certificated or CE marked, as appropriate, by July 2013.

16 RIBA PLAN OF WORK

Most building designs are developed in line with the Royal Institute of British Architects (RIBA) Plan of Work 2013, a process protocol which describes the activities from appraising client requirements through to post construction (see table 4 overleaf). All the design professionals will usually adopt this process, although they may not all be appointed at the outset.

In the past, it might have been said that the architect may be the only designer to be employed before the end of Stage 2. However, increasingly that is no longer the situation. Initiatives such as Soft Landings – a sequence of activities designed to improve the performance of buildings and to dovetail with the procurement process – is leading to a culture of improved briefing, realistic performance benchmarking, reality checking of design and procurement decisions, a graduated handover process and a period of aftercare by the project team.

It also promotes an open and collaborative working culture. This will be mandatory on the Government estate from 2016. The increasing use of Building Information Modelling (BIM) will also accelerate this process

With the more thorough objective and brief setting required and delivered through these changing initiatives, the opportunities for improved specification, installation and checking of fire precautions in buildings, and the opportunities for effective fire engineering will be increased.

Table 4: RIBA Plan of work

Stage	Core Objectives
0	Identify client's business case and strategic brief and other core project requirements.
1	Develop project objectives, including quality objectives and project outcomes, sustainability aspirations, project budget, other parameters or constraints and develop initial project brief. undertake feasibility studies and review of site information.
2	Prepare concept design, including outline proposals for structural design, building services systems, outline specifications and preliminary cost information along with relevant project strategies in accordance with design programme. agree alterations to brief and issue final project brief.
3	Prepare developed design, including coordinated and updated proposals for structural design, building services systems, outline specifications, cost information and project strategies in accordance with design programme.
4	Prepare technical design in accordance with design responsibility matrix and project strategies to include all architectural, structural and building services information, specialist subcontractor design and specifications, in accordance with design programme.
5	Offsite manufacturing and onsite construction in accordance with construction programme and resolution of design queries from site as they arise.
6	Handover of building and conclusion of building contract
7	Undertake in use services in accordance with schedule of services.

17 OUTLINE TO THE BUILDING REGULATIONS AND STRUCTURAL FIRE RESISTANCE

17.1 England and Wales

Provision for structural fire resistance of buildings is embodied in Part B of Schedule 1 of the Building Regulations as follows:

> *"The building shall be designed and constructed so that, in the event of fire, its stability will be maintained for a reasonable period."*

Approved Document B interprets the requirements of the Building Regulations and states that the stability criterion will be satisfied if

> *"the load bearing elements of the structure of the building are capable of withstanding the effects of fire for an appropriate period without loss of stability."*

The Approved Document contains detailed provisions for the maintenance of structural stability in fire. These are intended to provide guidance for some of the most common building situations. Guidance on appropriate periods for different building occupancies are given. However, these fire resistance periods are not mandatory.

The Approved Document also states that:

> *"There is no obligation to adopt any particular solution contained in an Approved Document if you prefer to meet the relevant requirement in some other way. However, should a contravention of a requirement be alleged then, if you have followed the guidance in the relevant Approved Documents that will be evidence tending to show that you have complied with the regulations. If you have notfollowed the guidance then that will be evidence tending to show that you have not complied. It will then be for you to demonstrate by other means that you have satisfied the requirement."*

The Approved Document goes on to suggest other means to demonstrate compliance by stating that:

> *"A fire safety engineering approach that takes into account the total fire safety package can provide an alternative approach to fire safety. It may be the only viable way to achieve a satisfactory standard of fire safety in some large and complex buildings."*

The Approved Document lists the parameters that should be included in such a fire safety study.

17.2 Scotland

In Scotland, the Building (Scotland) Regulations 2006 regulate new buildings or alterations. The Fire (Scotland) Act 2005 regulates fire safety of buildings in use. Guidance is contained in the Scottish Technical Handbooks which can be downloaded from: http://is.gd/yqAWnt. Further information is available at www.infoscotland.com/firelaw

In Scotland, approval must be gained before building and compliance is required with the Technical Standards of the Building Regulations; one cannot build at risk.

Fire resistance requirements are contained in Regulation 12 to the Building Standard (Scotland) Regulations which state that

> *every building shall be so constructed that, for a reasonable period, in the event of a fire, its stability is maintained.*

The measures which should be followed to ensure that this regulation is met are contained in Part 2 of the Technical Standards: *Structural Fire Precautions*. Many of the provisions outlined in Part 2 are designated as functional standards, which contain references to deemed to satisfy standards. These may be descriptive or refer to documents such as British Standards. Alternative design strategies can be adopted.

The introduction to the Technical Standards contains the following statement:

> *Compliance with the Regulations: Regulation 9 sets out three ways by which the requirements of the Regulations can be satisfied:*
>
> - *by compliance with the relevant standards set out in the supporting Technical Standards; or*
> - *by conforming with provisions which are stated in the Technical Standards to be deemed to satisfy the relevant standards; or*
> - *by any other means which can be shown to satisfy the relevant standards.*

The third of these statements is taken to mean that it is not necessary to follow the requirements of the technical standard if it can be proven that an alternative method meets the provision of the functional standard.
A relaxation of the requirements given in Technical Standard D is possible where alternative methods of fire protection can be shown to give equivalent levels of safety to those required in the standard. In such situations, the local Building Control Officer, often assisted by the Scottish Development Office, may request compensatory features.

17.3 Northern Ireland

In Northern Ireland, the Building Regulations (Northern Ireland) 2000 regulate new building work or material alterations to existing buildings. Guidance on achieving these requirements is contained in Technical Booklet E. Further information is available at http://is.gd/qMnjgP and www.dfpni.gov.uk

Technical Booklet E for Northern Ireland closely follows Approved Document B http://is.gd/zK3HNM.

The fire safety requirements for these regulations are supported by Technical Booklet E which contains provisions regarding structural fire resistance, compartmentation, etc., similar to those in the Approved Document for England and Wales.

Unlike the provisions of the Approved Document which are for guidance, the use of which is regarded as evidence tending to show that the requirements of the Building Regulations have been met, the provisions of Technical Booklet E are deemed to satisfy those requirements. Where the provisions of the Technical Booklet are not followed then the onus falls on the designer to show that the requirements of the regulations can be met by other means.

17.4 Republic of Ireland

The building control system is centred on the parent Act, the Building Control Act, 1990, which:

- Provides for the making of Building Regulations and deals with issues such as building standards, workmanship, conservation of fuel and energy and access for the disabled
- Provides for the making of Building Control Regulations - Commencement Notices, Fire Safety Certificates and Fees - Administration by Building Control Authorities.
- Gives powers of enforcement and inspection.

Building Control Act 2007 (Ireland): The Building Control Act 2007 strengthens the Enforcement Powers of Local Building Control Authorities by introducing revised procedures for issue of Fire Safety Certificate by local Building Control Authority.

Building Control (Amendment) Regulations 2014 (Ireland S.I. 09): The Building Control (Amendment) Regulations 2014 came into operation on the 1 March 2014. This follows two rounds of stakeholder consultations and the final Department of the Environment, Communities and Local Government (DECLG) *Code of Practice for Inspecting and Certifying Buildings and Works* was published in February 2014 http://is.gd/Awz2Je

The responsibilities of designers, design certifiers and assigned certifiers are established in the Code of Practice. There are three types of certifier:

- Assigned certifier – prepares and actions an inspection plan and signs the certificate of compliance; is the competent registered professional service signed in accordance with the building regulations
- Ancillary certifier – issues ancillary certificate to confirm compliance with particular elements of a building
- Design certifier – signs the certification of compliance for the design

Prior to project commencement the design certifier must formally identify companies and individuals that will be required to act as ancillary certifiers and state what certification will be required from them. Manufacturers, distributors, specifiers, installers and inspectors of passive fire protection systems will all have a role in the ancillary certification process and will need to demonstrate relevant competence.

Building Control Regulations 1997 – 2014 (Ireland): These apply to all new buildings. Their purpose is to promote observance of the Regulations by supplementing the basic powers of inspection and enforcement given to Building Control Authorities by different sections of the Building Control Act, 1990. They do this by requiring a Fire Safety Certificate for most buildings, with the exception of houses and individual apartments. The construction of an apartment block is subject to the requirement - to ensure safety of persons in the building.

Building Regulations 1997 – 2014 (Ireland): The primary purpose of the Building Regulations is to provide for the health, safety and welfare of people in and around buildings. In general, the Building Regulations 1997 – 2014 apply to the construction of new buildings and to extensions and material alterations to existing buildings and to certain changes of use of existing buildings. They are couched in broad functional requirements similar to the UK Building Regulations. More information can be found at: http://is.gd/QBvTGc or www.environ.ie

Health and Safety legislation: The Safety, Health and Welfare at Work Act 2005 requires under section 19 for employers to carry out a risk assessment for all Health and Safety issues including emergency egress and for these to be recorded.

The Safety, Health and Welfare at Work (General Application) Regulations 2007 transpose both the EU Framework Directive (89/391/EC) and the Workplace Directive (89/654/EC). These directives resulted in the UK Regulatory Reform (Fire Safety) Order 2005 and much of the guidance written on this is relevant in Ireland.

The latest version of the Safety, Health and Welfare at Work (Construction) Regulations 2013 (S.I. No. 291) can be downloaded here http://is.gd/p2oUeu with an explanatory note here http://is.gd/9r9WOJ.

The Health and Safety Executive has also published HSG 168, *Fire Safety in Construction;* http://is.gd/tl78fK or www.hse.gov.uk

17.5 Supporting documents/legislation

DfES Building Bulletin 100 – *Designing & managing against the risk of fire in schools:* http://is.gd/7W2nDM
Department of Health HTM 05 Series, including:

i. *HTM 05-01 Managing Healthcare fire safety*
ii. *HTM 05-02A Guidance in support of functional requirements*
iii. *HTM 05-02B Fire engineering provisions*
iv. *HTM 05-03 Operational provisions*

Local Government Group - *Fire safety in purpose-built blocks of flats;* http://is.gd/PbY0vz

Construction Design and Management Regulations (CDM) 2007: The Construction Design and Management Regulations (CDM) require all concerned in the process from design inception to completion of the building to prepare a file (the CDM file) containing details of all the work undertaken and materials used where safety is concerned. The CDM file can be an invaluable source of information on all aspects of fire safety work in the construction of the building that may be used by the occupant when preparing maintenance plans, modifications to the building or fire risk assessments.

Details are contained in a *Code of Practice L144: Managing health and safety in construction;* http://is.gd/BMKhP2 or www.hse.gov.uk

18 REFERENCES, STANDARDS AND BIBLIOGRAPHY

Note: The compilers of this document make no claim for the validity or accuracy of the various guidance documents referenced herein. All website links were checked at publication but may change due to the volatility of the internet. The publishers accept no liability for links that are not functioning after publication.

18.1 ASFP documents

18.1.1 ASFP Guide to Passive Fire Protection for Fire Risk Assessors http://is.gd/eUAABM

This document is aimed at all those persons undertaking fire risk assessments under the Regulatory Reform (Fire Safety) Order 2005 and national equivalents in Scotland, Northern Ireland and the Republic of Ireland. It gives comprehensive guidance on what to check for all types of passive fire protection to be able to undertake a suitable and sufficient assessment under the relevant legislation. It also contains a checklist and annexes on each type of passive fire protection with further information available from the relevant trade association.

18.1.2 ASFP Colour books http://is.gd/IZRRLz

Coloured books are comprehensive documents on the use and evaluation of passive fire protection products in buildings. Many contain lists of products which have had their performance verified by third party certification. They do not cover installation.

ASFP Yellow Book - *Fire Protection for Structural Steel n Buildings:* provides comprehensive information on fireprotection products for structural steelwork (including cellular beams) to comply with building regulations. Most products are required to be third party certificated before they can be listed in the book. It is being revised to take rectangular openings in cell beams and developments in fire testing and assessment methods in Europe. The fifth revision will be published in 2014.

ASFP Red Book - *Fire Stopping and Penetration Seals for the Construction Industry:* provides comprehensive information on fire stopping and sealing products to comply with building regulations. All products are required to be third party certificated before they can be listed in the book.

ASFP Blue Book (BS) - *Fire Resisting Ductwork:* is an industry guide for those involved in the specification, installation, inspection and verification of fire-rated ductwork. It provides comprehensive information on fire resisting ductwork and includes diagrams of types and functions of various systems. All products have to be third party certificated before they can be listed in the book.

ASFP Blue Book (EN) - *Fire Resisting Ductwork:* is a new version of Blue Book for products evaluated using BS EN test methods. All products are required to be third party certificated before they can be listed in the book.

ASFP Grey Book - *Fire and Smoke Resisting Dampers:* provides practical advice for system designers, manufacturers and installers to consider the appropriate issues and at the design stage, to ensure that dampers will function as intended by current regulations. All products have to be third party certificated before they can be listed in the book.

ASFP Purple Book - *Fire Resisting Non Load-Bearing Partitions*: provides comprehensive guidance on the materials and systems used to make fire-rated partitions.

ASFP Orange Book - *Fire Retardant Coating Systems*: provides guidance on the use of proprietary fire retardant coating systems to enhance the fire performance of commonly used substrates in the UK's construction industry.

18.1.3 Technical guidance documents http://is.gd/FCjaV1

TGD 2 *Code of practice for use of sprayed mineral coatings for fire protection of steel*
TGD 5 *Guide to Class 0 and Class 1:* 2nd edition
TGD 8 *Code of practice for junctions between different fire protection systems (structural steel elements)*
TGD10 *Code of practice for refurbishment and upgrading of fire protection of structural steelwork*
TGD11 *Code of practice for specification and on-site use of intumescent coatings for fire protection of structural steelwork*
TGD13 *Over-cladding of reactive coatings when used as fire protection to steel structure*
TGD14 *Code of practice for the installation/inspection of board systems for the fire protection of structural steelwork.*
TGD15 *Code of practice for the installation/inspection of sprayed non-reactive coatings for fire protection of structural steelwork*
TGD16 *Code of practice for off-site applied intumescent coatings*
TGD17 *Code of practice for the installation and inspection of fire stopping systems in buildings: Linear joint seals, penetration seals, small cavity barriers*
TGD18 *Code of practice for the installation and inspection of fire resisting duct systems*

18.1.4 Advisory notes http://is.gd/I31BOH

These are short (1 to 2 page) documents and may be technical e.g. providing guidance on the installation of specific products, or may be more general e.g.

ASFP Advisory Note on indicative or ad-hoc testing. This warns end-users on the limitation of the applicability of any results from fire tests carried out to indicative or ad-hoc methods.

18.2 Other guidance documents

BRE Digest 474 Advice on building handover 'HOBO protocol; Handover of Office Building Operations, BRE Watford WD25 9XX. http://is.gd/RQPW5E

ASFP Guide to Passive Fire Protection for Fire Risk Assessors http://is.gd/eUAABM

Competency Criteria for Fire Risk Assessors http://is.gd/vBTqzG

A Guide to Choosing a Competent Fire Risk Assessor http://is.gd/vBTqzG

18.3 Where to get further advice

18.3.1 Trade associations

Association of Interior Specialists
Olton Bridge, 245 Warwick Road, Solihull, West Midlands B91 3DX
Tel: 0121 707 0077 Email: info@ais-interiors.org.uk Web: www.ais-interiors.org.uk

Architectural and Specialist Door Manufacturers Association
Burnside House, 3 Coates Lane, High Wycombe, Buckinghamshire HP13 5EY
Tel: 01494 447370 Fax: 01494 462094 Email: info@asdma.com Web: www.asdma.com

Association for Specialist Fire Protection
Kingsley House, Ganders Business Park, Kingsley, Bordon, Hampshire GU35 9LU
Tel: 01420 471612 Email: info@asfp.org.uk Web: www.asfp.org.uk

British Woodworking Federation
The Building Centre, 26 Store Street, London, WC1E 7BT
Tel: 0844 209 2610 Fax 0844 209 2611 Email: bwf@bwf.org.uk Web: www.bwf.org.uk

Door and Hardware Federation
42 Heath Street, Tamworth, Staffordshire B79 7JH
Tel: 01827 52337 Fax: 01827 310827 Email: info@dhfonline.org.uk Web: http://www.dhfonline.org.uk/home.aspx

Glass and Glazing Federation
54 Ayres Street, London, SE1 1EU
Tel: 0207 939 9101 Email: info@ggf.org.uk Web: www.ggf.org.uk

Guild of Architectural Ironmongers
BPF House, 6 Bath Place, Rivington Street, London EC2A 3JE
Tel: 020 7033 2480 Fax: 020 7033 2486 Email: info@gai.org.uk Web: www.gai.org.uk

Gypsum Products Development Association
PO Box 35084 London NW1 4XE
Tel: 020 7935 8532 Email: admin@gpda.com Web: www.gpda.com

Intumescent Fire Seals Association
20 Park Street, Princes Risborough, Bucks HP27 9AH
Tel: 01844 276928 Fax: 01844 274002 Email: ifsa@intfire.com Web: http://www.ifsa.org.uk/index.html

18.3.2 Product testing & research organisations

BM TRADA
Chiltern House, Stocking Lane, Hughenden Valley, High Wycombe, Buckinghamshire, HP14 4ND
Tel: 01494 569750 Email: info@bmtrada.com Web: http://www.bmtrada.co.uk/

BRE Global
Bucknalls Lane, Watford, WD25 9XX UK
Tel: 0333 321 88 11 Email: enquiries@bre.co.uk Web: http://www.bre.co.uk

Building Test Centre
British Gypsum, East Leake, Loughborough, Leics, LE12 6NP
Tel: 0115 945 1564 Email: btc.testing@saint-gobain.com Web: www.btconline.co.uk

Cambridge Fire Research
Brewery Road, Pampisford, Cambridge, CB22 3HG
Tel: 01223 834752 Email: testing@cambridge-fire.co.uk Web: http://cambridge-fire.co.uk/index.php

Darchem Flare
Stillington, Stockton-on-Tees, TS21 1LB
Tel: 01740 630461 Web: http://www.esterline.com/

Exova Warringtonfire
Holmesfield Road, Warrington, Cheshire, WA1 2DS
Tel: 01925 655116 Email: Europe@Exova.com Web: http://www.exova.com/sectors/fire-safety/

18.3.3 Certification bodies

BM TRADA Ltd
Chiltern House, Stocking Lane, Hughenden Valley, High Wycombe, Buckinghamshire, HP14 4ND
Tel: 01494 569700 Email: certification@bmtrada.com Web: http://www.bmtrada.co.uk/

BRE Certification (Incorporating the Loss Prevention Council (LPC) for LPCB Certification)
Bucknalls Lane, Watford, WD25 9XX UK
Tel: 0333 321 88 11 Email: enquiries@bre.co.uk Web: http://www.bre.co.uk

FM Approvals Ltd
1 Windsor Dials Windsor Berkshire SL4 1RS
Tel: 01753 750000 Web: www.fmapprovals.com

IFC Certification Ltd
20 Park Street, Princes Risborough, Buckinghamshire, HP27 9AH
Tel: 01844 275500 Email: info@ifccertification.com Web: www.ifccertification.com

Warrington Certification Ltd
Holmesfield Road, Warrington, Cheshire, WA1 2DS
Tel: 01925 646669 Email: WCL@Warringtonfire.net Web: http://www.warringtoncertification.com

Underwriters Laboratories
220 Cygnet Court, Centre Park, Warrington, UK. WA1 1PP
Tel: 01483.302.130 Email: customerservice.uk@uk.ul.com Web: http://www.ul.com/uk/eng/pages/

18.3.4 Other useful contacts:

Fire Protection Association
London Road, Moreton in Marsh, Gloucestershire, GL56 0RH
Tel: 01608 812 500 Email: fpa@thefpa.co.uk Web: https://www.thefpa.co.uk/fpa_home/

Passive Fire Protection Federation
Kingsley House Ganders Business Park Kingsley Bordon Hampshire GU35 9LU
Tel: 01420 471612 Email: admin@pfpf.org Web: www.pfpf.org.uk

Some of the organisations listed above have a number of interests. This listing is only a guide and full details can be found on the appropriate website.

ASFP is publisher of this document. Electronic versions of this document are available on the ASFP website.

19. GLOSSARY

Air transfer grille: A device which allows the passage of ventilation air in normal conditions through a fire door, wall or partition; but, closes automatically to prevent the passage of fire in a fire condition for a stipulated time period.

Automatic fire and smoke damper: A device which allows the passage of ventilation air in normal conditions through a duct, fire wall or partition; but closes automatically to prevent the passage of smoke and fire in a fire condition for a stipulated period of time. Response to smoke is typically achieved by linking to the automatic fire detection system.

Building hardware (ironmongery): Fittings designed for incorporation in a fire-resisting doorset and which contribute to ensure that the fire-resisting door (when closed) resists the passage of fire and/or gaseous products of combustion. Such fittings include hinges, pivots, door closing devices, latches, locks, and door furniture (lever handles, knobs).

Building Information Modelling (BIM): a process involving the generation and management of digital representations of physical and functional characteristics of places.

Cavity barrier: A construction provided to close a concealed space against the penetration of smoke and flame or to restrict the movement of smoke or flame within such a space, for a stipulated time period.

CE marking: Marking of a construction product under the Construction Products Regulation. If the performance of the product is defined by a harmonised European product standard (hEN), then CE marking is mandatory. If it is defined by a European Assessment Documents then it is voluntary.

Combustibility: This assesses whether a material has the propensity to burn. Non-combustible materials are usually highly inert.

Compartment (fire): A building or part of a building, comprising one or more rooms, spaces or storeys, constructed to prevent the spread of fire to or from another part of the same building, or an adjoining building. The basis of compartmentation is to subdivide buildings into areas of manageable risk, to provide adequate means of escape, and to provide fire separation for adjoining buildings.

Drywall: A generic term used to describe a range of metal and timber framed assemblies clad with gypsum plaster-board and other board materials for standard dry lining, partitions and ceilings which involve little or no wet operations.

European Technical Approval (ETA): Favourable technical assessment of the fitness for use of a product for an intended use, based on the fulfilment of the Essential Requirements for building works for which the product is used. An ETA can be issued on the basis of a European Assessment Document (EAD).

European Assessment Document (EAD): Document used as the basis for preparing ETAs, which contains specific requirements for the products within the meaning of the Basic Works Requirements, the test procedures, the methods of assessing and judging the results of the tests, the inspection and conformity procedures, written by EOTA (the European Organisation for Technical Approvals) on the basis of a mandate received from the Commission.

Fire damper: A device which allows the passage of ventilation air in normal conditions through a duct, wall or partition; but, closes automatically to prevent the passage of fire in a fire condition for a stipulated time period.

Fire door (assembly): A door or shutter, provided for the passage of persons, air or objects, which together with its frame and furniture as installed in a building, is intended, when closed, to resist the passage of fire and/or gaseous products of combustion, and is capable of meeting specified performance criteria to those ends. (AD-B)

Fire-resisting (fire resistance): The ability of a component or construction of a building to satisfy for a stated period of time some or all of the appropriate criteria specified in the relevant part of BS 476 (AD-B)

Fire-resisting composite panel: A fully bonded steel faced panel with mineral fibre or other non-combustible core which is used for cladding external walls of steel building structures to form a separating element from one building to another; and, for high risk areas within buildings to form a separating element. It is designed to restrict the spread of fire from the compartment or building of origin for a stipulated period of time.

Fire-resisting doorset: A complete installed door assembly comprising door frame, door leaves, other panels, building hardware, seals and any glazing that, when closed, is intended to resist the passage of fire and smoke in accordance with specified performance criteria. (ASDMA guide).

Fire-resisting ductwork: Ventilation or extraction ductwork designed to contain fire and the products of combustion in a manner that does not allow passage to other parts of the building from the compartment of origin for a stipulated time period.

Fire-resisting glass: A glass that demonstrates its ability to meet the defined heating and pressure conditions specified in EN 1363-1 fire resistance test (or any other national or international fire resistance test method). Typically, the glass will be clear, textured, toughened, laminated or wired and may incorporate special features such as coatings or laminations that enable the glass to achieve a particular fire performance in terms of integrity and insulation.

Fire-resisting glazed screen: Glazed structure or window incorporating fire-resisting glass and designed to resist the spread of fire and the gaseous products of combustion for a stipulated period of time.

Fire-resisting partition: An internal non load bearing vertical dividing structure designed to resist the spread of fire, heat, and the products of combustion for a stipulated period of time. Such a partition can include a glazed section or a fire door.

Fire-resisting suspended ceiling: A suspended ceiling designed to contribute to the overall fire resistance of a floor assembly or to prevent the collapse of steel beams supporting a floor or roof, for a stipulated period of time. It may also provide fire resistance as a membrane in the same way as a partition.

Fire safety engineering: The application of scientific and engineering principles, rules (codes), and expert judgement, based on an understanding of the phenomena and effects of fire and of the reaction and behaviour of people to fire, to protect people, property and the environment from the destructive effects of fire.

Fire separating element: A compartment wall, compartment floor, cavity barrier and construction enclosing a protected escape route and/or a place of special fire hazard. (AD-B).

Fire shutters: These can be collectively defined with fire-resisting doors as a door, or shutter, provided for the passage of persons, air or objects, which together with its frame and furniture as installed in a building, is intended (when closed) to resist the passage of fire and/or gaseous products of combustion, and is capable of meeting specified performance criteria to those ends.

Fire stopping: Sealing products that take up imperfections of fit or design tolerance between the fire-resisting fixed elements of a building to restrict the passage of fire and smoke. They continue to take up the imperfections of fit at all times and have the same fire rating as the fixed elements of which they form a part. In reaction to a fire condition they swell, spread or deform to achieve their performance.

Fusible link: Device installed local to the door or shutter which will fracture at a specified temperature to release a door closing mechanism.

Penetration seal: Products that maintain the integrity and insulation (if required) of fire-resisting separating elements where services pass through the element. They are designed to allow for any movement and to close any opening that may be expected to occur in a fire situation. For the purpose of this document penetration seals have been included under fire stopping products.

Protected shaft: A shaft which enables persons, air or objects to pass from one compartment to another, and which is enclosed in fire-resisting construction.

Reaction to fire: This is the extent to which a product burns and contributes to the development of a fire. Reaction to fire tests evaluate properties including: ignitability, flame spread, rate of heat release, production of smoke and toxic gases.

Resistance to fire: The ability of a product to prevent the spread of flame and/or smoke, and, where relevant to maintain mechanical stability. Resistance to fire tests to assess the ability of a product when used in specific circumstances to perform in a particular manner are defined in BS 476 parts 20 to 24.

Responsible person: is the employer, where there is one, and where there is not it will be the person responsible for the activity undertaken on the premises which might give rise to a risk to those present. It includes;

a) the employer in relation to any workplace which is to any extent under his control;
b) in relation to any premises where there is no employer
    i) the person (whether the occupier or owner of the premises or not) who has the overall management of the premises; or
    ii) where there is no one with overall management responsibility, the occupier of the premises; or
    iii) where neither (i) or (ii) apply, the owner of the premises

Structural fire protection: Products used to insulate the structural frame of a building or other construction to allow it to retain its required load bearing strength or limit the core temperature for a stipulated period of time.

www.asfp.org.uk

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Price £25

ISBN 978-1-870409-36-0