The use of intumescent products in historic buildings

An English Heritage guidance note

1 Introduction

Intumescent materials are frequently specified to solve numerous fire protection problems, to the point that they are often considered commodity products. This has led many to believe that all intumescent materials are the same - this is not only untrue but potentially dangerous because the wrong product may not fulfil its function in the event of a fire.

To intumesce is to swell in volume as a result of a chemical reaction, often triggered by high temperatures (eg 100-200°C). However

- some intumescent materials can expand up to 50 times their original volume; others hardly expand at all
- some exert sufficient pressure when activated to crush various materials; others become very fluid

Intumescent mastic being applied to edges of upgraded door panels

English Heritage policy

English Heritage seeks to ensure that any works to a historic building do not unnecessarily disturb or destroy historic fabric. In deciding how best to achieve a fire safety strategy to protect users and historic fabric against hazards caused by fire, the principles of minimum intervention and reversibility should be adopted wherever and whenever possible.

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- some are easily blown away when exposed by hot turbulent gases, others are more cohesive

These different characteristics have been harnessed by manufacturers to create products suited to meeting a wide range of fire protection requirements. As with all areas of specification the choices can seem a little bewildering at first. Once the purpose of each product is understood owners or managers of historic properties can select products both capable of solving fire protection problems and best suited to conserving the original building fabric. There no longer need be a conflict between meeting the fire protection requirements and conserving the fabric - both problems can be addressed at the same time.
For example

- thin intumescent membranes have been and are being developed to improve the fire resistance of timber panels and lath and plaster ceilings - allowing the original materials and details to be kept intact
- it is not always necessary to cover attractive iron columns and beams with fire resistant board in order to improve the structural fire protection - intumescent paint technology can provide this function too
- surface mounted, non-intrusive intumescent door edge seals have been developed to seal the gap between the door and frame edge to form a fire resisting doorset - removing the need to machine grooves into the edges of historic doors.

Many of the problems which are commonly encountered and some of the methods for solving them are discussed in this document. Other solutions may be available, particularly as new products are developed. Whether the methods suggested or others are used, it is always necessary to check that they have been adequately tested. Further details of available products can be obtained by contacting the Intumescent Fire Seals Association (IFSA).

Historic buildings form an integral part of our heritage - once lost in a fire they can never be truly replaced. Although no historic building was constructed with modern day fire safety principles in mind, correctly used intumescent material technology can greatly assist in upgrading the existing fabric to provide a similar degree of fire protection. The key is understanding the problems which exist and the intumescent based products which have been developed to solve them.

2 Major uses of intumescent products

There are three main areas in which the benefits of intumescent material technology have enabled fire safety engineered solutions to be developed.

One of the major principles adopted by current fire safety legislation is to provide fire resistant separating elements within buildings to enable building users to escape safely. The walls and floors along escape routes, for example, are often required to provide 30 minutes' fire resistance. These elements are often breached by door openings and service penetrations which incorporate gaps either around or within the installed product. These gaps tend to compromise the fire resistance performance of the separating element unless they are satisfactorily sealed. Intumescent products have been developed to provide a wide range of solutions for sealing gaps.

Intumescent products can be used to provide an insulating layer which reduces the rate at which the layer of material beneath increases in temperature, and/or chars. This technology is widely used in modern construction, for example to delay the reduction in the structural strength of steel columns and beams when exposed to fire, and therefore prevent parts of the building from collapsing.

The growth of a fire is partly affected by the rate at which flames can spread along wall and ceiling linings. Wall panelling constructed to traditional details using timber may allow fire to spread at a faster rate than is permitted by many regulations. Intumescent coatings have been developed as one way of improving the performance of timber linings in this respect by forming an insulating layer of carbonaceous char on the surface.

3 Performance testing

It is important that any installed product fulfils the end user's requirements. The most important function of intumescent products is to perform satisfactorily in the event of a fire (see Section 4). There are, however, other related functions which need to be considered.

- All buildings experience movement to a greater or lesser extent and therefore products need to be able to accommodate any likely structural movement.
- Areas requiring intumescent products are often difficult to reach. Certain products may be easier to install than others in these situations.
- Future modifications to a building can often inadvertently reduce the degree of fire protection provided by upgrading works. When upgrading, it is advisable to plan for any future work, eg by devising methods which allow new service cables to be passed easily through a fire resistant wall.
- Although many of the products require little in the way of maintenance, some will experience wear and tear. Maintenance requirements should, therefore, be considered at the outset.
- It is sometimes necessary to ensure that air movement within a room or building is maintained to prevent damp problems, eg dry rot, occurring.
- In historic buildings it is usually important to ensure that upgrading works are visually acceptable, and can be installed and removed with minimal damage to historic fabric.
- The visual effect of any applied finish needs to be tested, both initially, and over time. Methods of preparation and removal of any applied finish without damage to historic fabric need to be assessed.

Table 1 Summary of appropriate test standards against which the performance of intumescent based products should be tested.

Product type	Appropriate Part of BS 476 Test method	Comments
Door edge seals	Part 22 and/or 23	Door edge seals can be tested either to Part 22 as part of doorset assemblies or independently to Part 23. The results obtained from testing to Part 23 are applicable for use on proven single acting, single leaf, latched timber door assemblies of sizes up to that tested but not greater than 2000 x 926mm at a thickness equal to that of the tested specimen.
Intumescent sheets for door hardware protection	Part 22	Intumescent sheets for this purpose should be tested as part of a doorset assembly.
Intumescent seals used in fire resistant glazing	Part 22	Seals for this purpose should have been tested as part of a glazing detail within a doorset, partition or screen.
Intumescent mastic for fire stopping application	Part 20	Suitable specimens should have been tested to the general requirements of Part 20 to demonstrate, eg the performance in various applications incorporating different materials and gap sizes.
Intumescent pillows for cavity barriers	Part 20	As for intumescent mastic
Intumescent coated mineral wool slabs for cavity barriers	Part 20	As for intumescent mastic
Intumescent membranes– door panel upgrading products	Part 22	Products of this nature should have been tested to Part 22 as part of a doorset assembly.
Intumescent membranes– ceiling upgrading products	Part 21	Representative ceiling details should have been tested with a defined load applied during the test.
Pipe wraps and collars	Part 20	As for intumescent mastic
Intumescent coated foam	Part 20	As for intumescent mastic
RTV foam	Part 20	As for intumescent mastic
Intumescent air transfer grilles	Part 22	Intumescent air transfer grilles should have been tested as part of a doorset or partition assembly.
Structural beam and column protection	Part 21	The results from any test conducted to Part 21 need to be interpreted for a given situation by a qualified fire safety engineer using accepted structural calculations.
Intumescent paints and varnishes for improving surface spread of flame	Part 7	Where intumescent based coating systems claim to improve the surface spread of flame performance to Class 1, the performance should have been tested successfully to Part 7. Where the system claims to achieve Class O performance (as defined in Approved Document B to the England and Wales Building Regulations), it should also have been tested successfully to Parts 6 and 7.

4 Fire resistance performance

A variety of standard test methods have been developed to quantify the different aspects of behaviour of building components in the event of a fire. If intumescent based products are to perform as required, it is important to ensure that

- they have been tested according to appropriate test method(s)
- they performed satisfactorily when tested
- the application in which the specimen was tested is appropriate for proving the performance in the intended situation
- the products are correctly installed in accordance with the manufacturer's or supplier's instructions

Recommended performance criteria against standard test methods are given in the Fire Precautions Acts and in Approved Document B to the England and Wales Building Regulations. The recommendations given are with the aim of ensuring life safety in the event of fire. At the same time they will also provide some degree of protection to property itself, although this is not a principal objective of the legislation. The performance requirements given in the legislation are considered minimum rather than maximum standards for life safety protection. Achieving standards in excess of the minimum will be even more important where property protection is an issue.

The British Standard Test series BS 476 (*Fire tests on building materials and structures*) provides a selection of tests which quantify the performance of materials or components with respect to the various stages of a fire. All the product types described in this guidance note should have been tested to at least one of the Standards in this series, although this situation will change as European and International Standards are agreed. Testing to the Standards in Table 1 is not enough in itself. Every product has performance limitations whether it be with respect to fire or any other criteria. It is important therefore that the manufacturer or supplier clearly understands and demonstrates the limits of applicability of their product(s).

Typical limitations include

- maximum fire resistance provided
- permissible types, sizes and condition of supporting structures or substrate
- ability to accommodate movement
- maximum height above floor level

Where products claim to improve the fire resistance performance of an existing building element, it is important that a fire safety expert establishes the performance of the element both before and after the upgrading solution has been applied. For instance, a claim that a ceiling upgraded with product *x* will provide 30 minutes' fire resistance is of little value unless the performance of the ceiling without product *x* is known.

5 Available solutions

5.1 Improving the fire resistance performance of timber panelled doors and frames

Doorways are obviously intended to allow people to move freely between rooms - unfortunately they also allow the relatively quick spread of fire unless they offer an adequate level of fire resistance. If it is to provide a specified period of fire resistance, many aspects of a doorset need to be considered. Some aspects are discussed in detail in the English Heritage technical guidance note *Timber panelled doors and fire: upgrading the fire resistance performance of timber panelled doors and frames*.

Many of the intumescent products which have been developed are useful for upgrading or constructing fire resistant doorsets.

The major areas for which they can be used include

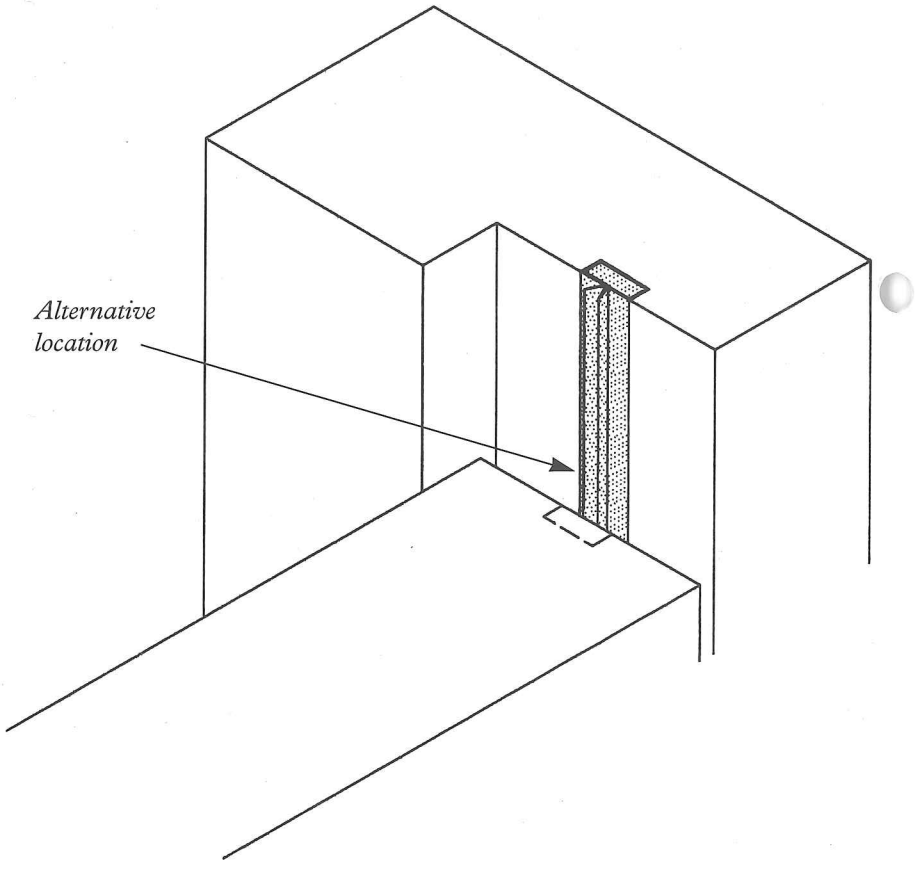


Fig 1 Combined smoke and intumescent seal in PVC carrier set into groove central to frame rebate

- sealing the gap between the door and frame edge
- sealing the gap between the back of the frame and supporting construction
- protecting weak areas around items of door hardware
- improving the performance of timber panels
- providing methods of installing fire resistant glass
- fitting fire resistant air transfer grilles

Many of these applications are also suitable for partitions and screens.

5.1.1 Door edge seals

The gap between the door and frame edge, although necessary to allow the door to open and close freely, is an obvious weak point in the overall assembly. Hot gases are drawn through the gap, increasing the rate at which the materials of the door and frame combust. This leads quickly to flaming on the other side of the door. It is vital that the gap is sealed so that the rate of combustion is reduced and the passage of flames and hot smoke is resisted for the required period of time.

Some intumescent material types for this application assist in clamping the door into position within the frame as well as filling the gap with a non-combustible material. Sodium silicate and graphite based intumescent materials achieve this by exerting pressure between the door edge and frame. Clamping the door into position is beneficial because timber doors tend to bow towards a heat source applied to one side of the door only. This distortion forces the door to move out of the frame rebate, allowing the passage of flames at the door edge.

Intumescent seals for the door gap are available in a wide range of designs, sizes and finishes, including grained timber. Some of the most common designs are shown in Figures 1 and 2. The seal types shown in Figure 1, which are commonly used on modern fire resistant doorsets, usually need to be inserted into a groove, central to either the door or frame edge.

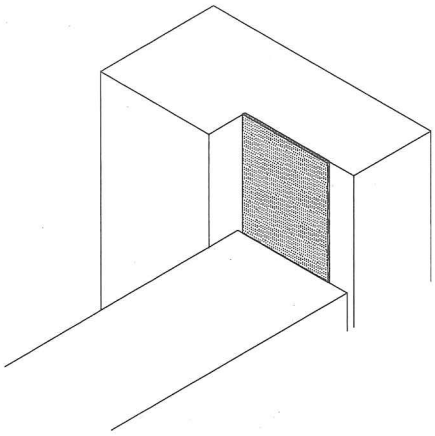


Fig 2 Surface mounted intumescent seal bonded to frame rebate

Seals of this type have the advantages of being sold as combined intumescent and smoke seals and being easy to replace if worn or damaged. Locating the seal into a groove improves its durability, although machining a groove may not be acceptable on conservation grounds. In this case and where reversibility is important, surface mounted intumescent seals which can be overpainted may be preferable (see Figure 2). The size of the seal(s) which should be fitted depends on the type of seal, the fire resistance performance required, and the nature of the doorset. It is important to seek guidance from the intumescent seal supplier, from the Intumescent Fire Seals Association (IFSA), or from a fire safety engineer expert in these matters.

All intumescent seals designed to seal the door edge gap are prone to some wear and tear because of their location. It is essential, therefore, to inspect their condition regularly and replace them where necessary.

5.1.2 Sealing between the door frame and supporting construction

A gap between the back of a door frame and the supporting partition or brick wall can easily be exploited by fire. The architraves which cover the gaps are often the only barriers which initially prevent the fire spreading from one side of the door to the other. BS 8214 (*Code of practice for fire door assemblies with non-metallic leaves*) gives detailed guidance on this matter for a range of situations: for 30 minute applications it recommends that sufficiently large and well fitting architraves can be adequate. If there is any doubt, it is worth fire-stopping the gap by either inserting mineral wool or applying intumescent mastic (see Figure 3). Where the gap is wider than 10mm it is advisable to insert a mineral wool backing before applying the intumescent mastic.

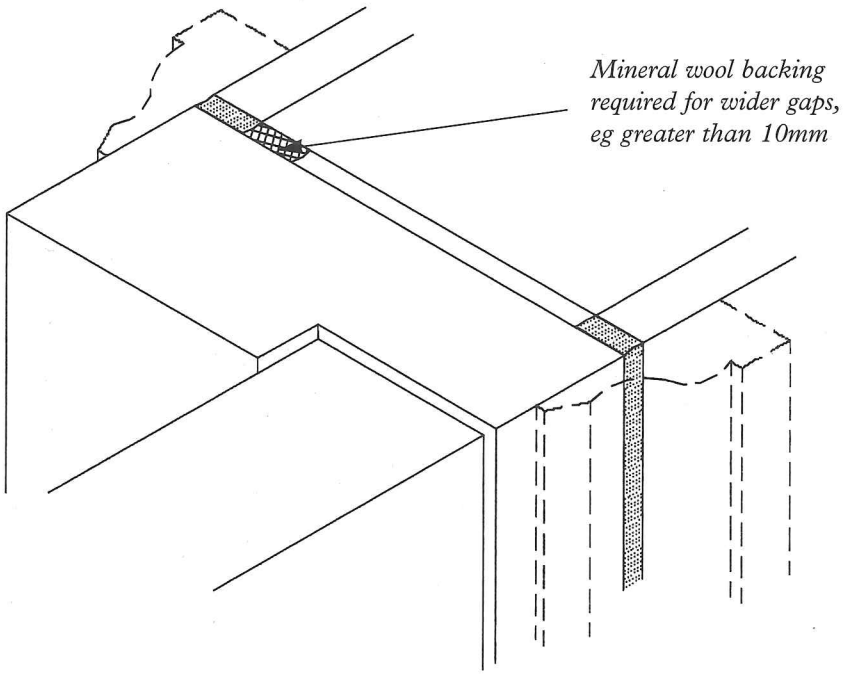


Fig 3 Beads of intumescent mastic applied between the frame and supporting structure

5.1.3 Protecting weak areas around items of hardware

Items of metal hardware conduct heat to the non-fire side of a fire resistant doorset more quickly than timber, and thereby sometimes present vulnerable areas which can cause failure of the doorset. In addition the structural integrity of the door or frame is weakened by the removal of large sections of timber. This matter is discussed in some detail in the English Heritage leaflet cited above (*Timber panelled doors and fire*).

A number of intumescent sheet material products, which are approximately 1-2mm thick, have been developed to address the problems caused by morticed or recessed items of hardware such as hinges, locks, latches, lever action flush bolts, and concealed overhead door closers. The material needs to swell to several times its original volume without exerting excessive pressure, which could cause sections of timber to break off. Ammonium phosphate based materials, for example, are suited to this application. The expanded material assists by filling voids and thermally insulating items of metal hardware.

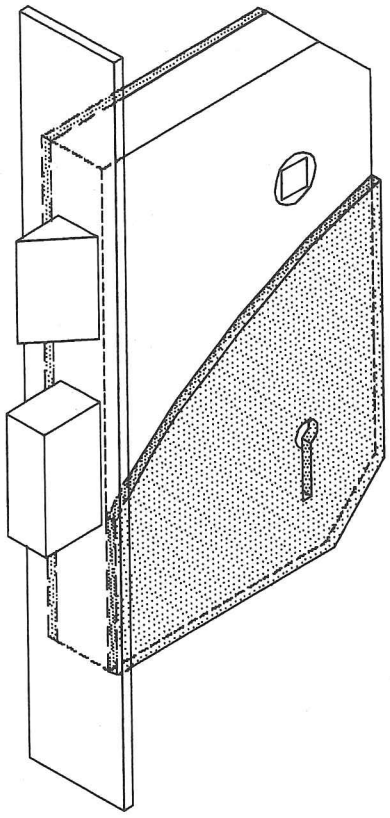


Fig 4 Intumescent sheet fixed to two faces of a lock case

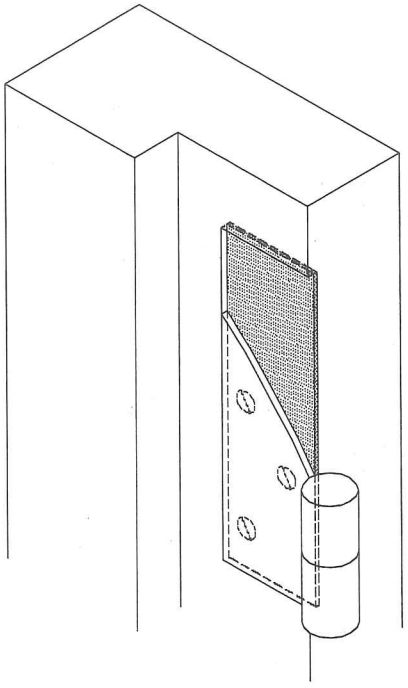


Fig 5 Intumescent sheet fixed behind a butt hinge blade

Figures 4 and 5 show examples of methods of protecting a morticed latch/lock assembly and a butt hinge. Bonding the material to the lock, for example, helps to make sure that it is correctly located. Intumescent mastic is not generally recommended for protecting hardware in this way because it is difficult to apply the mastic to the required area and also because it may interfere with the mechanism.

Sheets of intumescent material of a different type can also be used to seal the gap formed by a letter-plate opening. The material needs to expand forcefully and voluminously in order to seal the gap. There are restrictions on the size of opening which can be sealed and the type of letter plate assembly which is required to be used in conjunction with the intumescent material. Although intumescent material used in this application will experience some wear and tear, many of the other situations described will not.

5.1.4 Intumescent materials used to provide fire resistant glazing

Intumescent materials have allowed details to be successfully developed for fitting one of the many types of fire resistant glass into timber doors and screens. The method of fitting is just as important as the glass type itself in terms of performing in a fire. The wrong method of glazing can make the difference between 5 minutes' and 60 minutes' effectiveness in a fire resistance test. Therefore replacement or secondary fire resistant glazing details should be designed by a conservation architect, in conjunction with a fire safety expert.

5.1.5 Upgrading the fire resistance performance of flat timber panels

For many years a solution has been sought to the problem of upgrading the fire resistance performance of flat panels in doors and partitions while retaining the original aesthetic appearance. Intumescent 'membrane' products which are bonded to the face of the panel have been developed for this purpose (Figure 6). Products are available which are approximately 2-3mm thick, including a more durable thin plywood facing which can be over-painted, veneered or varnished. This and a variety of other methods of upgrading panels are discussed more fully in *Timber panelled doors and fire*.

5.2 Sealing around service penetrations through walls, partitions and ceilings/floors

Electric cables, heating pipes, air handling ductwork and a multitude of other services frequently pass through walls and ceilings which are

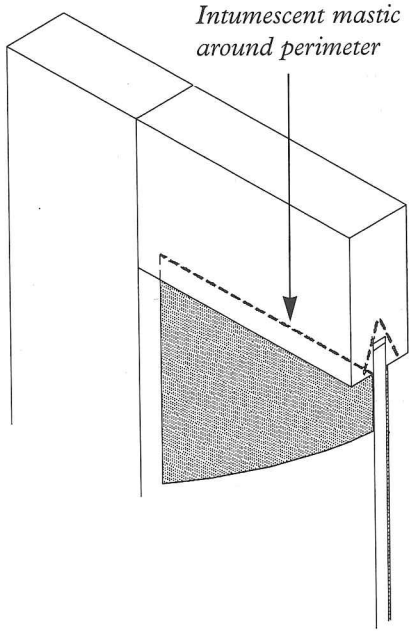


Fig 6 Intumescent membrane bonded to the faces of a timber panel

required to be fire resisting. A variety of intumescent based solutions have been developed to ensure that service penetrations do not compromise the fire resistance performance of walls or ceilings.

5.2.1 Sealing around large quantities of electric cables and metal pipes

Permanent and temporary intumescent based solutions have been developed to address the common problem caused by cable trays or large numbers of cables and metal pipes passing through fire resistant walls or ceilings. It is important that the metals used to construct the pipes have melting points in excess of 1000°C for the following methods to be appropriate.

Semi-rigid mineral wool slabs coated with intumescent material offer one method of permanent fire-stopping around service penetrations of this type (Figure 7). The mineral wool slab is typically cut slightly undersize and the remaining gaps around the perimeter and penetrations are filled using intumescent coated foam and/or intumescent mastic as part of a proven system. Intumescent mastics used should be capable of expanding voluminously to accommodate any small residual gaps between the penetrations after installation. Graphite and ammonium phosphate mastics are best suited to these situations. This method can also be used through a partition or ceiling provided that the aperture comprises a timber frame of noggings, studs or joists. It is vital at all times that any services or cable trays are independently supported from the mineral slabs, for example, by the use of wire hangers. It is often possible to install future services using the same system and sealing techniques. To avoid accidental damage, it may be worthwhile fitting a protective covering of plywood over the slabs in areas which are frequently used. Mineral wool slab systems of this nature are best installed by specialist contractors who are familiar with the installation instructions. The slabs require little maintenance but should be checked regularly in case of damage or tampering.

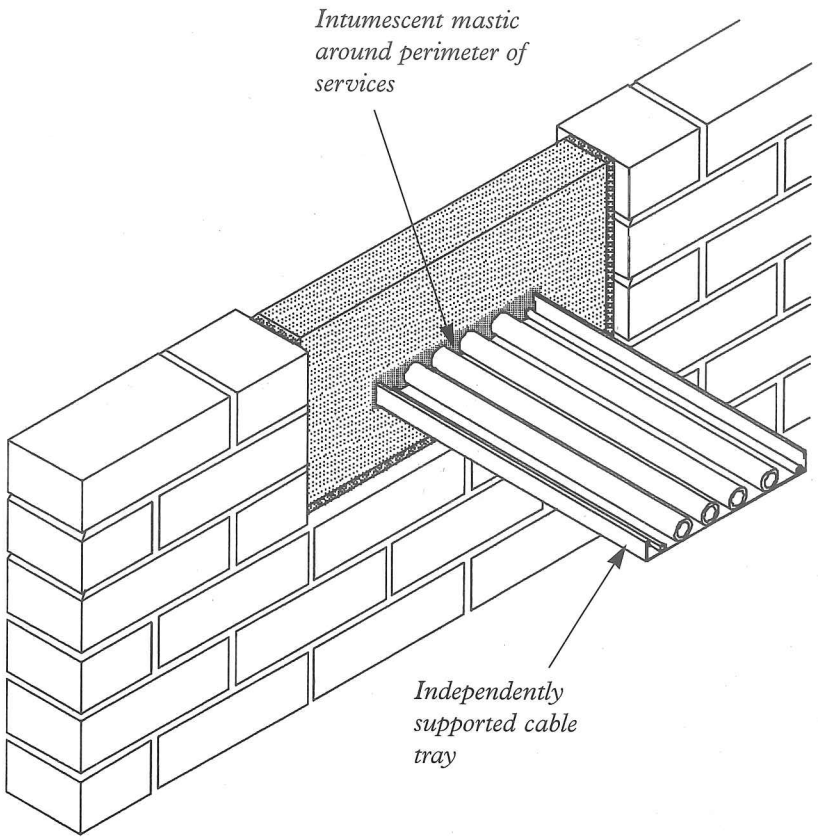


Fig 7 Semi-rigid mineral wool slab fire stopping around cable tray arrangement

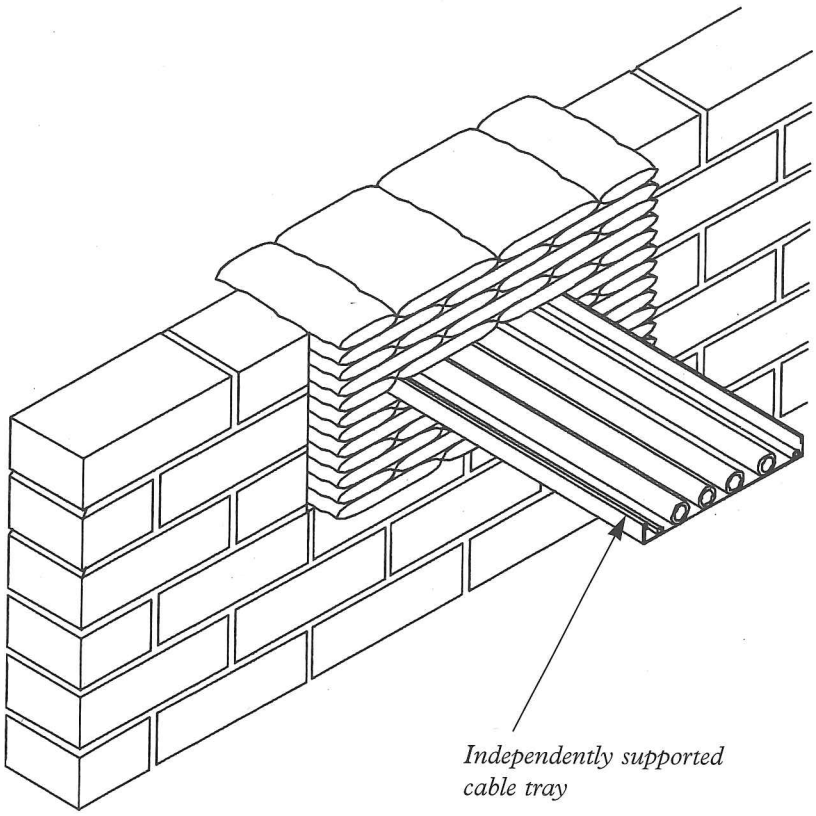


Fig 8 Intumescent pillows used as temporary fire stopping around a cable tray arrangement

Another method of permanently fire-stopping around similar penetrations is to use RTV (Room Temperature Vulcanising) Foam. This is a two-part fire retardant silicone which expands to approximately 2-3 times its original volume when mixed and applied at room temperature. It may be necessary to use a temporary backing when applying this product. The foam is suitable for situations which need to allow for structural or service movement. RTV foam is particularly useful in historic properties for filling, as necessary, awkward corners or crevices. Once cured, the foam can be cut to allow new or additional services to pass through and can then be sealed by applying fresh RTV foam.

5.2.2 Sealing around small cable and pipe penetrations

Intumescent mastics can be used to seal around minor service penetrations. Acrylic based products are suited to many applications, including penetrations through plasterboard stud partitions.

5.2.3 Temporary sealing around cable and pipe penetrations

Intumescent pillows offer an effective temporary means of sealing around service penetrations (Figure 8). The pillows can be installed and removed very quickly, and they leave no debris - this is particularly helpful where delicate fabrics or artefacts are present. The pillows can easily accommodate additional services or indeed be reused in other locations.

The material within the casing expands when heated to fill the surrounding void and so it is not vital that the intumescent pillows are in close contact with each other or with the surrounding structure. This is beneficial where it is necessary to allow air to pass from one side of a wall to the other. They are also effective in filling voids which are difficult to reach. It is important to make sure that the supporting structure will remain in place for the required fire resistance duration because otherwise the expanding material is liable to fall away from the void it is intended to fill. In the case of ceilings it is necessary to support the intumescent pillows independently using a fire resistant construction.

5.2.4 Sealing the voids within PVC service pipes

Pipes constructed from PVC and other low melting point materials pose a particular problem - fires can easily melt the material and pass through a wall or floor. Placing an intumescent based material within the pipe is generally not acceptable or practicable because it interferes with the flow of fluids through the pipe.

Manufacturers have harnessed the characteristics of intumescent materials which exert high pressures and swell voluminously to form intumescent pipe collars and pipe wraps (see Figures 9 and 10 respectively). The intumescent material is located around the pipe and functions by rapidly compressing the melting plastic and completely filling the gap within. Pipe wraps are installed within the wall and can therefore be concealed, using mortar. Pipe collars, on the other hand, are clipped around the pipe and securely fixed to the face of the structure, which is more suitable for retrofit situations. When pipe collars are being fitted in partitions, studs and noggings need to be located in the positions shown in Figure 10 so that they are securely fixed to the partitions.

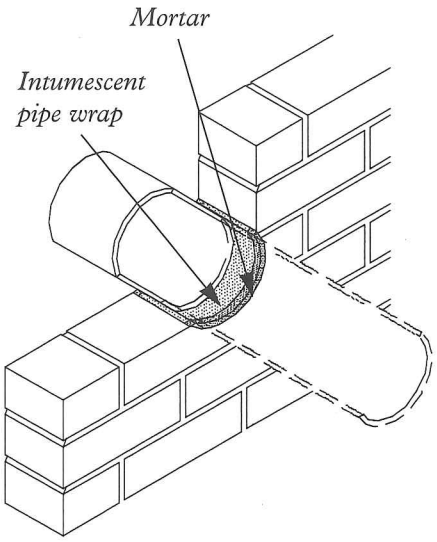


Fig 9 Intumescent pipe wrap fitted around a PVC pipe and within the wall

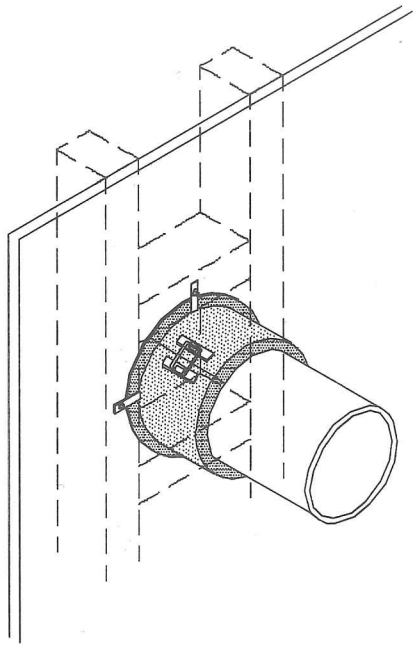


Fig 10 Intumescent pipe collar fitted around a PVC pipe and to the surface of the wall

5.2.5 Allowing air to move freely

Air transfer grilles and air handling ductwork are frequently installed in walls or floors to allow free or mechanically driven movement of air around the building.

To prevent rot in timber, free movement of air is important through fire barriers constructed in roof spaces of older properties. Intumescent air transfer grilles have been developed to allow this to

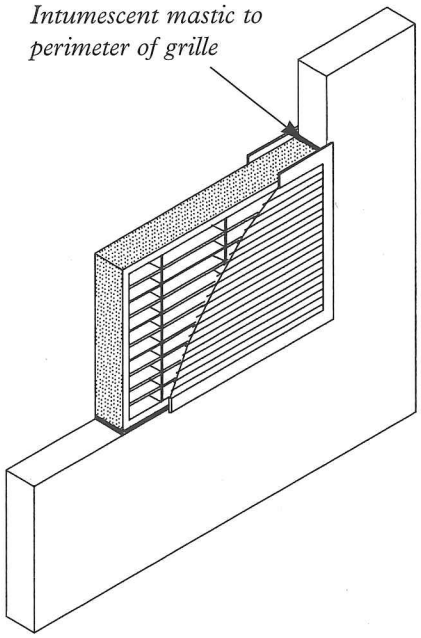


Fig 11 Intumescent air transfer grille in door/wall

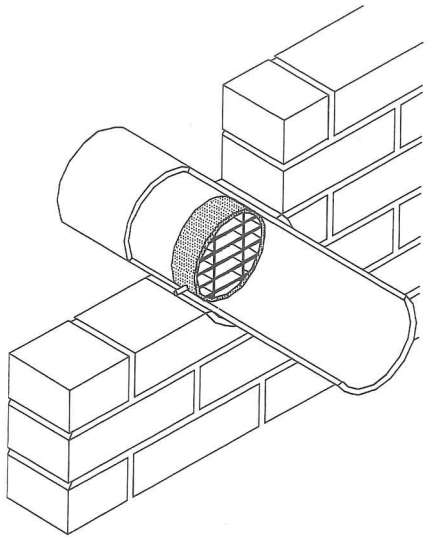


Fig 12 Intumescent air transfer grille within air handling ductwork

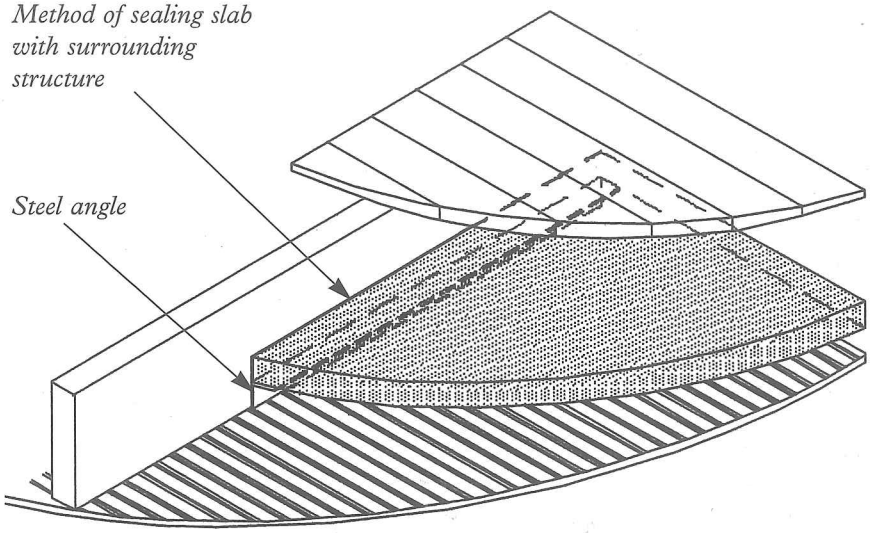


Fig 13 Intumescent coated mineral wool slabs used to upgrade a floor/ceiling

happen without compromising the fire resistance performance of the partition, wall, door or ceiling into which the grille has been installed (Figure 11).

The grille typically comprises a series of thin vertical and horizontal members, between which the air passes. In a fire, the members themselves intumesce to close up each gap to form an impermeable fire resistant barrier. As with all intumescent products, the grilles will prevent the passage of smoke only when they have fully activated. This process typically takes 5 minutes or longer when tested to BS 476: Part 22: 1987. Because of the large area through which the smoke can pass it may be considered necessary to fit additional smoke dampers which are linked to the automatic fire detection system, to limit spread of cold smoke away from the seat of the fire.

Different grilles will have varying propensities to collect dust and dirt. This in turn affects the performance in terms of air movement and the frequency with which they need to be cleaned.

Similar technology has been used to develop intumescent grilles for use in air-handling ductwork. The grille shown in Figure 12 is fully accommodated within the standard diameter of duct and therefore the air flow rate is reduced. This can be partially overcome by setting the grille into a rebated section of duct.

5.3 Upgrading the fire resistance performance of partitions and ceilings/floors

Intumescent coated mineral wool slabs can be used to upgrade the fire resistance performance of existing floors or partitions (Figures 13 and 14). The semi-rigid slabs are installed between the studs or joists, using cleats. It is necessary to gain access to the studs or joists, from one of the two sides which, in the case of partitions, involves removing the facing to one side; in some circumstances it might be preferable to overboard to leave the historic construction intact. In the case of floors, access is usually most easily achieved by lifting floorboards, but where historic ceilings have already been lost it may be better to carry out works from below. Care is required to lift floorboards without damage, particularly if original fixings are still intact. A complex arrangement of service cables and pipes between the joists can make it difficult to lay the material in the required way.

Intumescent membranes have been and are being developed to improve the fire resistance performance of lath and plaster ceilings. Membranes are available as thin as 2mm which are bonded to the underside of the existing plaster using specially formulated adhesive, allowing cornice details to remain true to their original appearance (Figure 15).

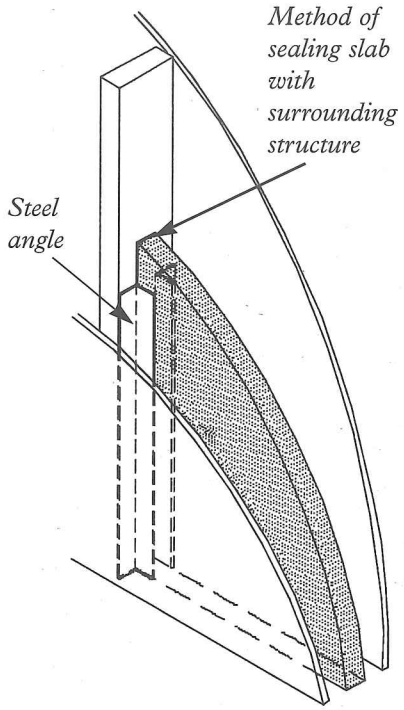


Fig 14 (above) Intumescent coated mineral wool slabs used to upgrade a partition

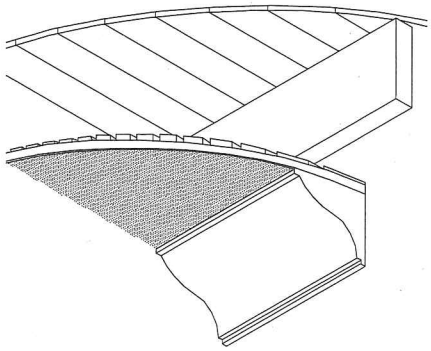


Fig 15 Intumescent membrane bonded to the underside of a traditional lath and plaster ceiling

Intumescent coated foam strips have been developed principally to bridge linear expansion gaps. They can, however, be used for various other applications, including sealing between a floor joist and brick wall (Figure 16). Their flexible nature and intumescent coatings allow them to accommodate and fill irregularities which are likely to occur in the gaps - it is not always necessary, therefore, to ensure intimate contact with the neighbouring components.

Intumescent sheets are being developed for upgrading floors by overlaying in situ boards. This can be a useful method where floors are to be fully carpeted, although it may involve works to skirtings.

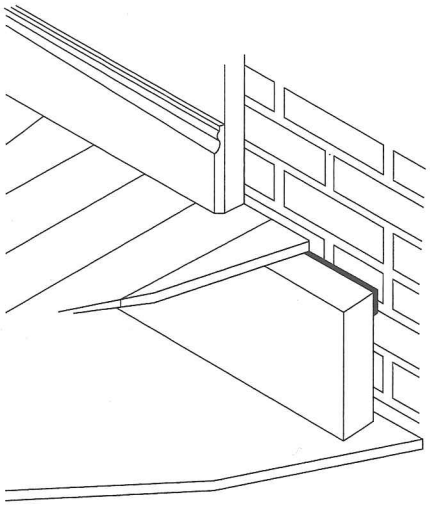


Fig 16 Intumescent coated foam strip used to seal between a floor joist and a brick wall

5.4 Protecting the structural strength of columns and beams in a fire

Steel beams and columns are often used to provide the structural support to modern buildings. Safety factors are built in when calculating the required section size of beams and columns to support the design load. The structural strength of steel and other metals reduces as temperatures increase. In a fire, a temperature may be reached, therefore, at which a beam or column is no longer able to support its design load. If a beam or column is to support its load for a given period of time during a fire the temperature rise must be controlled. Methods of insulating structural members have been developed to prolong the duration within which they are able to support their load.

One such method involves using intumescent paint, which preserves the surface appearance of structural members. When heated, the paint swells to form a layer of carbonaceous char which insulates the metal below. The thickness of coating required depends on a number of factors

- design load
- safety factor added to the design load
- section size and design of the structural member
- the period of fire resistance required

For modern constructions this can generally be calculated using tables produced by the Association of Specialist Fire Protection Contractors and Manufacturers (ASFPCM). The paint system often comprises three coatings which can be either sprayed or brushed on. The three coatings usually consist of an anti-corrosive primer, and an intumescent layer, followed by a top coat which can be made up to any standard BS appearance specification. The primer needs to be painted on to bare material - unless tests are carried out to prove otherwise. (If applying the primer does require removal of historic paint layers, samples should be taken as an historic record.)

The same principle can be applied to cast iron members, commonly used in historic buildings. The thickness required would need to be calculated from first principles by a fire safety engineer, particularly as test evidence on structural cast iron members is unlikely to be available. However, very thick paint layers can result in the loss of architectural detail.

(The first volume [forthcoming] of English Heritage's *Research Transactions* will include an article on fire performance of cast iron columns.)

5.5 Intumescent based paints and varnishes

The ability of flames to spread laterally across a wall or ceiling lining is important because it has an effect on the rate at which a fire grows. Walls and ceilings to corridors and other areas which form escape routes are particularly important.

Approved Document B to the England and Wales Building Regulations, and the Fire Precautions Acts recognise this fact, and give recommended measures for controlling it. Linings to walls and ceilings along means of escape, for example, are sometimes required to achieve Class 0 spread of flame characteristics, which represents the highest classification of performance: assessment of fire risk may also be required. Existing timber panelling coated with traditional waxes, paints or lacquers is unable to meet these requirements.

Intumescent based paints and varnishes have been developed as one method of improving performance. They achieve this by forming a layer of carbonaceous char over the surface of the timber. This insulates the timber for a time and assists in preventing the release of gases which allow combustion to continue. Some intumescent paints have been successfully tested to the appropriate standards when applied over existing paint finishes. Intumescent varnishes, however, are generally incompatible with existing wax, polish or varnish systems, and it is generally necessary, therefore, to remove any existing finishes. Panels treated with intumescent paint can be treated with further coats in the future, although advice on this point should be sought from the supplier. This is more difficult with intumescent varnish, which cannot easily accept further coats.

There is a wide variation in the appearance and durability of the intumescent varnish systems. Some products are not as clear as standard polishes or varnishes, and it may be difficult to achieve a visually satisfactory result. They may also not be as durable as standard varnishes, and are therefore not recommended for use on items

which may be frequently touched. Adjustments in mix and application to achieve acceptable visual results may alter the properties of the product. It is important therefore to obtain representative samples to be assured that the end product will be suitable for the intended purpose.

Improving the fire resistance performance of panels on doors using these coatings is a separate issue which involves very different testing methods. English Heritage will be investigating and reporting on this matter at a later date.

Bibliography

British Standards Institution publications

BS 476:— *Fire tests on building materials and structures*
—: Part 6: 1989 *Method of test for fire propagation for products*
—: Part 7: 1987 (1993) *Method for classification of the surface spread of flame of products*
—: Part 20: 1987 *Method for determination of the fire resistance of elements of construction (general principles)*
—: Part 21: 1987 *Methods for determination of the fire resistance of loadbearing elements of construction*
—: Part 22: 1987 *Method for determination of the fire resistance of non-loadbearing elements of construction*
—: Part 23: 1987 *Methods for the determination of the contribution of components to the fire resistance of a structure*
BS 8214:— *Code of practice for fire door assemblies with non-metallic leaves*

Relevant legislation and regulations

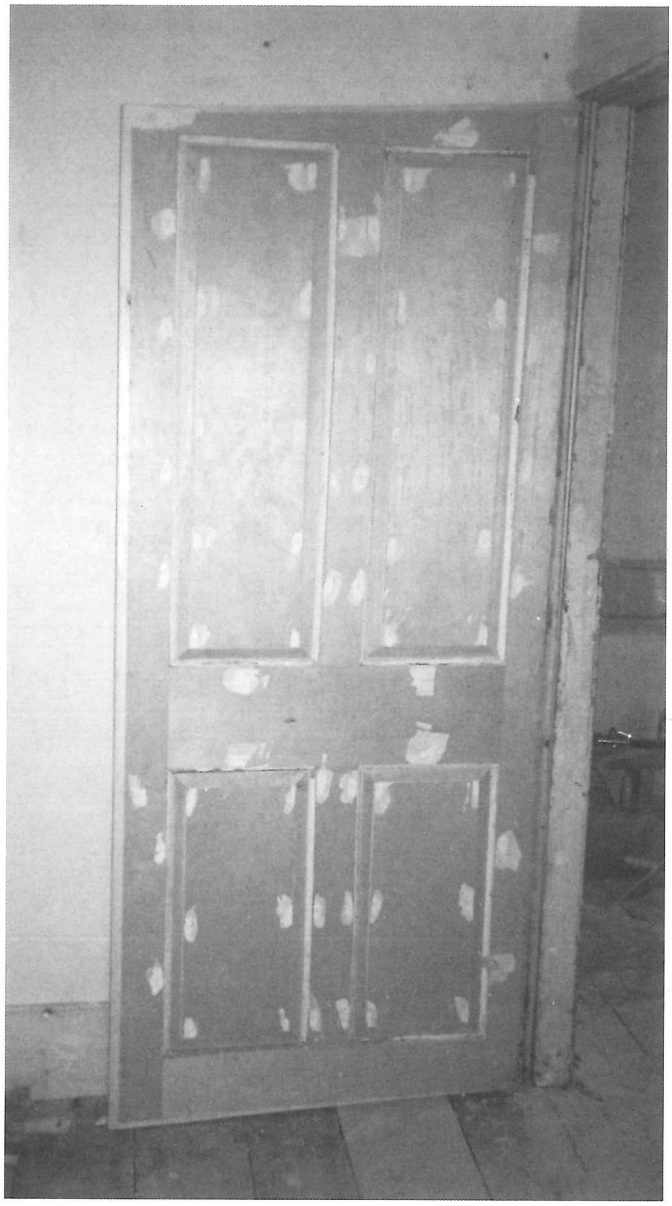
Fire Precautions Act, 1971 (as amended by the Fire Safety and Safety of Places of Sport Act, 1987)
Fire Precautions (Workplace) Regulations (forthcoming)
England and Wales Building Regulations, Approved Document B

Useful addresses

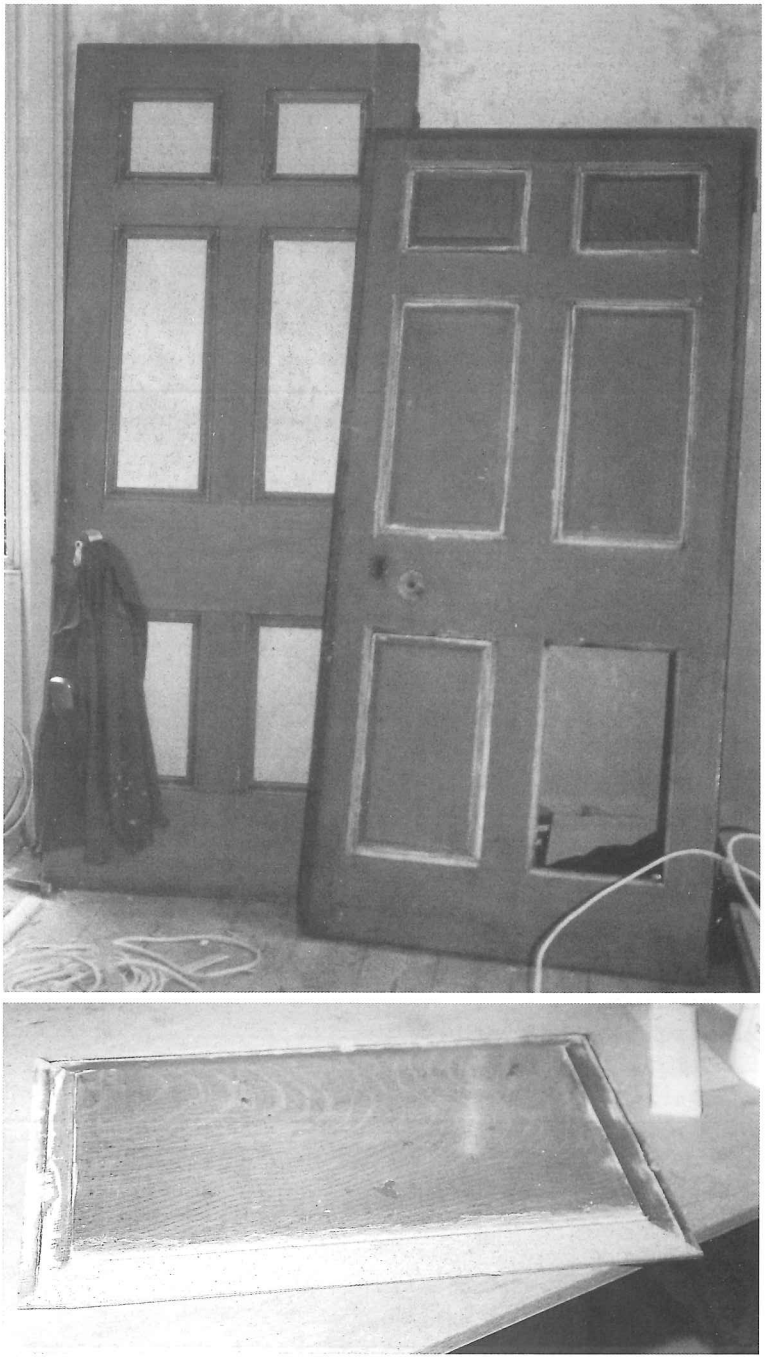
Association of Specialist Fire Protection Contractors and Manufacturers (ASFPCM)
235 Ash Road,
Aldershot,
Hants GU12 4DD Tel: 01252 336318

Fire Resistant Glass and Glazed Systems Association,
20 Park Street,
Princes Risborough,
Bucks, HP27 9AH Tel: 01844 275500

Intumescent Fire Seals Association (IFSA)
20 Park Street,
Princes Risborough,
Bucks, HP27 9AH Tel: 01844 275500



Whole door face upgraded with wood faced intumescent membrane. (Note intumescent mastic applied to staple hole fixings.)



Panelled door in course of upgrading with intumescent membrane. The lower image shows a removed panel with intumescent membrane applied to the front edge only.

This leaflet was prepared by International Fire Consultants Ltd and the Professional Services Team at English Heritage

ENGLISH HERITAGE

English Heritage, 23 Savile Row, London W1X 1AB 0171 973 3434

 Product code XH20055 May 1997