Intumescent Fire Seals Association

The Fire Risk Assessors Good Practice Guide No.2

Guidance in respect of the use of intumescent penetration seals

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Purpose of this Document

Compartmentation and the provision of protected corridors and stairways are fundamental concepts in the fire safety provisions embodied in regulations. These objectives are achieved by the incorporation of fire resisting barriers; walls and floors, within a building to provide areas of relative safety. Such barriers are particularly important in areas such as hospitals where the principle of horizontal evacuation is practiced.

Unfortunately modern buildings are full of services, cables, pipes, ductwork, etc, which need to pass through these fire resisting elements, each of which has the potential to compromise the protection that they are designed to provide.

The degree of compromise that these services cause is mitigated by the method used to seal around these services in order to maintain the fire resistance of the element being penetrated. Even when 'tested' materials are used, if the product has not been tested in a construction of the type being used, with a service similar to that which exists and in the same orientation then the fire protection can be seriously compromised. Equally the potential for some of the proprietary systems to produce dangerous levels of smoke production is often unknown. This Good Practice Guide is designed to assist any fire Risk Assessor to make an intelligent appraisal of any systems that he/she come across during their audit of a facility and to give them 'basic' guidance on the specification of any upgrading required.

Background to Risk Assessments

Since 1999, buildings that are used for the employment of persons had to be subject to a Fire Risk Assessment Audit performed under the legal duties imposed by The Fire Precautions (Workplace) Regulations (Amended 1999). This included buildings that were already the subject of a Fire Certificate issued under the Fire Precautions Act 1971.

In England & Wales*[(1)], 1st October 2006 saw the introduction of the Regulatory Reform Order (RRO) which repealed the Fire Precautions Act and replaced it with the need for the 'responsible person' to carry out, or have carried out, an ongoing Fire Risk Assessment of the premises for which he/she is responsible. This Risk Assessment automatically embodies the requirements of the 'Workplace' Regulations as employees are also persons 'in and around' the building, and so fire safety moves away from a prescriptive base to a totally risk base system. The Fire Services' role in this process is no longer that of the inspecting authority and changes to that of being the auditor of the Risk Assessment process. The responsible person, normally the premises owner (possibly the Chairman of the Board) does, from this date, take total legal responsibility for the safety of all building occupants in the event of a fire breaking out.

The objective of this Risk Assessment is to demonstrate that, in the event of fire, the health & safety of persons in and around the building is not at risk. This process extends much further than the audits that were performed to ensure that the Fire Certificate conditions were being satisfied, as were previously undertaken by the Fire Service under the Fire Precautions Act.

Intumescent materials and smoke seals play a major role in restricting fire spread, and hence reducing death and injury, and this Good Practice Guide is designed to provide Risk Assessment auditors with information that will assist them in their Fire Safety Audit.

[MV] In Scotland, the 'RRO' is known as the 'Fire (Scotland) Act 200, implemented on 1st October 2006.

Penetration Sealing Principles

The services that exist in a modern building are not only plentiful they can be extremely diverse. Some of the services will have the tendency to burn, or melt, e.g. large cables, or plastic pipes, whilst others will have the ability to conduct heat from the fire zone to the protected areas. Fire, therefore, has the capacity to exploit the apertures through which these services pass, particularly if the aperture size is increasing as a result of material burning away or melting. Guidance published in support of Regulations generally treat all such penetrations as 'fire

stopping'. There is no bespoke test called up in this Guidance and in the absence of there being a preferred configuration being available it is up to manufacturers to carry out tests, often of their own design, to demonstrate that their product can maintain the fire resistance of the element being penetrated. Only the purchaser has the responsibility to ensure whether the test undertaken was realistic and/or applicable, especially in the context of the penetrating service that is being sealed.

Most service penetration seals are tested by analogy with the fire resistance test procedure BS476: Part 20: 1987. The degree by which the test stresses the sealing system is normally governed by the attitude of the product manufacturer who can opt for a demanding test or an 'easy ride'. The lack of a bespoke test causes Regulatory Guidance to be very generic in its approach and permits fire stopping to be carried out by the application of a variety of cementicious materials, or mineral 'wool' products, which may be used as an alternative to proprietary seals. As a consequence, whilst the test method chosen by the manufacturer may not be overly demanding many of the seals that will appear in a fire safety audit may never have been tested at all. Many of them will be applied solely on the basis of being listed as suitable in the Guidance.

With these generic materials there is no guidance as to installation, nor any recognition that they can be rendered ineffective by movement in the service during exposure to high temperature. It is inevitable that services will sag, bow and twist when heated at high temperatures, all of which will have a profound influence on the ability of the seal to provide safe conditions on the protected face. It must also be recognised that the barrier should prevent the passage of cold smoke, hot smoke and products of combustion as well as fire and flame if life safety is to be assured, and yet, the materials listed may only satisfy the smoke tightness aspect if installed perfectly and designed to accommodate the anticipated movement in the actual service being sealed when it is hot. Rammed-in, loose fill mineral rock fibre may not have the capability of containing any of the listed hazards and yet this will probably be one of the most common systems found in any penetration sealing audit, especially in older buildings.

Any Fire Risk Assessment auditor must be convinced that the penetration sealing system is matched to the services penetrating the element, and indeed, be able to provide the fire separation within a wall or floor of that type and be retained in position during the periods of high thermal movement in either the services or the element.

Intumescent based penetration sealing systems do have an increased ability over cementicious or fibrous seals, to respond to changes of shape or size of the aperture as a result of movement in the services, and similarly, be able to resist the penetration by cold smoke in their non-activated state and, at the same time, provide a 'hot smoke' seal when activated. Any audit or remedial specification should recognise these attributes.

When auditing plastic pipes it is important to recognise that guidance to Regulations permits 40mm diameter plastic pipe to pass though a fire separating wall without the need for a heat activated sealing system solely to be fire stopped to the structure. The Risk Assessing Auditor must again feel confident that the development of a hole of that size, which will happen quickly as the plastic melts out, will not jeopardise the life safety conditions on the protected side of such a barrier. Similarly, whilst it is easy to recognise that a pipe closing device exists, it is not sufficient to assume that the type fitted are able to seal the actual pipe that is installed in the building being audited. There are a variety of materials from which plastic pipes are manufactured, some of which are more difficult to seal than others. Equally, the selected device must be able to demonstrate its ability to close off pipes, not only of the material, but also of the diameter and wall thickness in use. Evidence of its ability to work should always be sought.

It is vital that pipe closers are physically fixed back to the construction, into solid material using fixings that do not melt. They cannot be retained by skim coats of plaster, or by mastics and adhesives, only by fixing that are not compromised by heating and that extend into the non-fire damaged material.

Further Guidance on the selection of penetration sealing systems is to be found in the IFSA Code of Practice for the 'Sealing Apertures and Service Penetrations to Maintain Fire Resistance' obtainable from the secretariat. However, this may not completely answer all of the questions in respect of suitability, and as a consequence, liaison with the potential providers of the seals system should be undertaken for any proposed remedial solution.

Conclusion

To conclude, therefore, cementicious rigid materials are unlikely to maintain the fire resistance when the services expand, distort or bow, or the element distorts significantly. Unsealed fibrous materials are unlikely to provide the smoke tightness embodied in the Regulatory requirements and enshrined in the life safety codes. A system that can be shown to satisfy an audit will be supported by test evidence which relates to both the active service, the substrate being penetrated (i.e. the wall or floor) and the orientation of the seal relative to the element, e.g. vertical element/horizontal service. If the audited, installed seal cannot be supported by test evidence for the particular application it should be replaced by a system that can be certificated.

Checklist of possible actions as a result of an audit

ALL SERVICE PENETRATIONS

Is it possible to see light through the wall/floor where the services pass through?

Yes - Seal the hole(s) in the element with a proprietary sealing system that has the requisite period of fire resistance, i.e. the same as the element being penetrated, in the orientation and in conjunction with an associated construction and service mix similar, if not identical, to that used in the building.

No - Consider whether the sealing system will also meet the following criteria.

Will the sealing system that is being installed, or is already installed, remain impermeable to smoke during the fire?

No - Consider whether any existing seal can be made less permeable by the application of an impermeable and preferably flexible coating, preferably intumescent in nature, that will further inhibit the flow of smoke and not compromise the fire resistance, and upgrade the seal accordingly.

Yes - Consider whether the sealing system will also meet the following criteria

All walls will bow and all floors will deflect when heated on one face, or from the underside to temperatures between 800 and 1000^{o} in the fire. Will the sealing system become dislodged, or possibly crack and fissure under this thermally induced movement?

Yes - Replace with, or use, a sealing system that is able to accommodate or resist the anticipated level of movement *(1) in the construction being sealed, as a consequence of the nature of the materials and/or the method of installation. Intumescent based seals generally have the capacity to re-seal any movement induced gap.

No - Consider whether the sealing system will meet the following criteria.

*(1) *A 6m floor slab is able to deflect 300mm at mid-span and still be certified as being fire resistant. Deflection will decrease towards the supports.*

Is it possible for the sealing system to be damaged by the thermal expansion of metal pipes, cable trays/ladder and trunking or by the bowing and 'sagging' of inadequately supported services when they are exposed to high temperatures?

Yes - Ensure that all supports are adequate in number and fixed back to the primary structure with 'all-metal' fixings (not plastic plugs) or replace/use a seal system that has an intumescent interface between the service and the structure, including a 'bulkhead' sealing slab, which can accommodate hot movement.

No - Consider whether the sealing system will also meet the following criteria.

Is the sealing system fixed to the face of the construction, or in the plane of the surface of the element, such that it will be compromised by spalling (concrete), charring away (timber), erosion (plaster/fire protection board) or the loss of layers of protection (plasterboard/calcium silicate)?

Yes - Use a sealing system where the interface with the surface of the element incorporates a material that will expand and maintain a seal between the service and the deteriorating edge, normally intumescent in nature.

No - Consider whether the seal satisfies the other criteria listed.

METAL PIPES AND SERVICE SUPPORTS

The need for any metal pipe to satisfy the insulation criteria on the non-exposed face of a fire resisting wall or floor is not explicitly expressed. As a consequence most metal pipes will not be insulated, either side of a fire separating element. Any Risk Assessment carried out should consider whether the lack of any insulation or that pipe could result in a remote fire initiation or an injury to persons in, or around the building.

Does the pipe, on the protected face (or either) come into contact with any combustible materials, including dust and general waste products, within 500mm of the unexposed face?

No - Leave unprotected

Yes - Wrap or coat the pipe, or service support, with an intumescent based sheet material, paste or generous coating of intumescent paint for a distance of 0.5m, preferably using a material with test evidence to support its use.

CABLES

Because cables are clad with an electrical insulator there is a potential for the insulator to ignite, smoulder and/or smoke on the protected side of the fire wall or floor due to the conduction of heat down the electrical conductor, especially if the cables are also in contact with a metal cable tray or ladder. This can compromise the tenability of the space being protected. Whilst the insulation may be formulated to suppress ignition this could potentially increase the generation of smoke.

Will the ignition of a cable in the protected area, as a result of thermal transmission of heat down the conductor, from a fully developed fire, have the potential to spread fire?

No - Leave the cables unprotected.

Yes - Wrap or coat the cable, including any cable tray or cable ladder with an intumescent based sheet material, paste or generous coating of intumescent paint for a distance of 0.5m, preferably using a material with test evidence to support its use. (Note: the influence of this additional protection on the rating of the cable must be taken into account).

Would the generation of smoke from smouldering cables cause a potential problem to persons, goods, or equipment within the protected space?

No - Leave the cable unprotected.

Yes - Wrap or coat the cable, including any cable trays or cable ladders with an intumescent sheet material, paste or generous coating of intumescent paint, for a distance of 0.5m from both sides of the element.

PLASTIC PIPES

Plastic pipes soften before burning and where the pipe runs vertically it will lose its stiffness and possibly collapse so that it could pull out from any closing device. Early activation is vital. Where the pipe is horizontal the softening influence may cause the pipe to fold over just outside of the zone of the collar. This will possibly provide an initial seal to the pipe, but it is important that the device closes the pipe once the exposed section starts to melt out.

Is the plastic pipe fitted with a correctly installed intumescent collar or pipe wrap in place?

Yes - Ensure that it is a pipe closing device that is approved for the type of plastic, pipe size and orientation to be sealed.

No - Obtain and fit a suitable pipe closing device that has evidence of performance relative to the application.

Is there a 40mm diameter plastic pipe and, if there is, is the performance assessment solely to demonstrate regulatory compliance?

Yes - No need to fit a closing device.

No - Fit a pipe closing device that will seal the pipe against the flow of smoke and/or hot gases.

Finally, reduce any further risks by recommending that any upgrading is undertaken using quality products supplied by a member of the Intumescent Fire Seals Association; companies that have always put evidence of performance at the top of their list. See the website (www.ifsa.org.uk) or contact the Secretariat for a list of companies.

The information in this document is based on the current knowledge and collective experience of the Association's membership. Whilst every effort has been made to ensure the accuracy of the guidance given, the Association cannot accept liability for loss or damage arising from the use of the information.

INFORMATION ABOUT IFSA

The Intumescent Fire Seals Association (IFSA) is a trade association established in 1982 with the following objectives:

- To promote the life safety benefit associated with the use of intumescent and smoke seals
- To promote research and development into extending the areas where these benefits can be utilised
- To participate in the development of test procedures for fire protection products in BSI, CEN and ISO which are fair, repeatable and reproducible.

IFSA maintains close links with the fire community. The Secretariat is based at International Fire Consultants and receives technical advice from its Principal Consultant, Peter Jackman.

At the time of its formation, IFSA recognised the need for a simple standard test to compare the performance of intumescent fire seals for use in fire doorsets, which was free from the influence of other materials and constructional variations and yet subjected the intumescent material to the conditions which prevail in a full scale test.
It, therefore, sponsored the development of such a test and this is now embodied in BS476: Part 23 (1987). Whilst the results of the test have a limited field of application, only being usable on single leaf, single action, latched doors of limited size and distortion characteristics, it does allow the sealing capability of intumescent seals to be compared without any influence from the leaf.

There is now an ISO equivalent test, i.e. BS ISO 12472: 2003.

Due to its repeatability the test method is being used successfully to evaluate the influence that real time ageing may have on the properties of intumescent fire seals produced by IFSA member companies. The programme is planned to investigate 25 years exposure to a variety of controlled and uncontrolled environments. Early findings showed no detectable visual decline and tests are being undertaken soon to confirm these findings.

A test programme undertaken in conjunction initially with DOE/BRE to produce standardise conditions for evaluating penetration seals formed the basis of the standard configuration incorporated in the CEN test procedure EN 1366-3 for evaluating seals for use with metal pipes. This configuration has been refined and now forms a draft technical report in ISO (DTR 10295-3) where a method of extrapolating the results of penetration sealing tests, using simple solid conductors, can be used to establish the field of application of intumescent sealants due to be published in 2010.

Fire stopping, service penetration sealing, fire doors and fire glass are all critical aspects of fire safe premises and under the new Regulatory Reform (Fire Safety) Order and the ongoing reliance on fire risk assessments, it is vital that risk assessors understand the role and function of these products. IFSA has produced a number of downloadable Good Practice Guides to help risk assessors know and understand when a particular intumescent application is right or wrong, or how a risk may be controlled by the use of the correctly specified sealing product. These guides were commended by the ABE in the 2006 Fire Safety Award competition.

The move away from brickwork, blockwork and cast concrete forms of construction, towards a greater use of studwork and joisted walls, floors and ceilings, has left many of our fire separating constructions compromised by the fitting of electrical services (switches, plug sockets, concealed lighting, extract fans). IFSA has co-operated with the Electrical Safety Council (ESC), in the preparation of their guide, 'Electrical installations and their impact on the fire performance of buildings; Part 1, Domestic Premises'. This did win the ABE's Fire Safety Award in 2009.

Intumescent materials can seriously reduce the impact that such installations may produce.

Correctly fitted sealing systems make a greater contribution to life safety in a fire than almost any other measure. If you do nothing else to enhance life safety – at least seal up the building with fire and smoke seals, preferably from an IFSA Member because they take fire safety seriously.

CURRENT IFSA MEMBERS AND CONTRIBUTORS TO THE INFORMATION SHEET

BASF The Chemical Company

Intumescent Seals

LORIENT

Sealmaster

MANN McGOWAN Advanced Intumescent Technology

PYROPLEX® UK Manufacturer of Passive Fire Protection Products

MINELCO

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walraven BIS – Better Installation Systems

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