

Intumescent Fire Seals Association

The Fire Risk Assessors Good Practice Guide No.1

Guidance to risk assessors in respect of the
use of intumescent door seals



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Purpose of this Document

Intumescent materials and smoke seals play a major role in restricting the spread of any fire with the primary objective of keeping vital protected routes tenable to life during the period of evacuation, thereby reducing death and injury. It is hoped that the Risk Assessor for a project is a skilled and knowledgeable person, but even the most experienced of these is unlikely to have had the opportunity to see at first hand the vital contribution that intumescent seals and smoke seals make to this process. Door assemblies without seals fitted can permit a notionally protected space, particularly if it is a small space, e.g. the size of a corridor, to become smoke logged in a very short space of time. As a consequence, this Information Sheet is designed to provide Risk Assessment auditors with information that will assist them in their Fire Safety Audit.

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In England & Wales*(1), 1st October 2006 saw the introduction of the Regulatory Reform Order (RRO) which repealed the Fire Precautions Act and replaced it with the need for the 'responsible person' to carry out, or have carried out, an ongoing Fire Risk Assessment of the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 2005 and this was implemented on 1st October 2007.*

Door Sealing Principles

Fire doors play an important role in restricting the spread of fire and combustion products. If a door is to work effectively in its normal role it has to have a gap around its perimeter, but this will always compromise its ability to restrict the spread of fire, but even more importantly the spread of hot and cold smoke, unless measures are introduced to prevent it. Cold, 'non-buoyant', smoke is restricted from exploiting these gaps by the use of flexible edge seals that can be of a blade, or brush pile type, whilst heat activated seals control hot smoke.

Intumescent seals have been recognised for more than 30 years as being important in maintaining the 'integrity' of the door assembly. Integrity is a measure of the ability of the assembly to resist penetration by flames. As a consequence, the ability of the intumescent seal to restrict the spread of hot smoke and toxic combustion gases has never fully been recognised. It is probably worth noting that virtually all modern timber fire doors are designed from the start only to achieve their required performance with the use of appropriate fire seals. Such doors would probably fail very rapidly if they are not supported by fire seal technology. The use of fire seals has generally enabled door manufacturers to reduce the cost of



the material constituents of the fire door making them lighter and more user-friendly. It is this ability to contain smoke, however, that does more to provide life safety protection than any other single component. Modern timber doors will invariably incorporate an intumescent seal across the head and down the jambs, including the meeting stiles, but solely due to historic issues, there are many existing fire doors in older buildings that are not fitted with an intumescent seal. Such doors can severely compromise the ability of keeping a protected area free from the products of combustion, and Risk Assessors need to consider whether this is acceptable if life safety is to be guaranteed.

For the last 20 years all timber based fire door assemblies have been based on the incorporation of intumescent seals, even if it is only a 20 minute (FD20) door. The fitting of these seals is therefore deemed to be necessary if the door is to provide a satisfactory level of safety in modern buildings. As a consequence, a Risk Assessor would be wise to take this as his base standard when undertaking any audit and doors without seals should be designated as non-compliant and the fitting of seals should be strongly recommended.

Recognition of different intumescent types

The selection of intumescent seals is important, because the incorrect selection of seal type, or its incorrect positioning, could restrict the effectiveness of the measures. Many fire doors in UK buildings are not latched in use, e.g. cross-corridor doors, doors to protected stairways, in order that they do not impede escape. This is almost unique in Europe. Such doors rely on a door closer to hold the door closed in normal use, but as most closers are made of aluminium they are likely to melt when subjected to fire. As a consequence, the seals selected should be of a pressure forming type or have been shown to have met the test criteria on an unlatched door with a face fixed closer, as these are needed to prevent the door from blowing open under the dynamic air movements that occur in a fire. Guidance on the selection of intumescent seals for timber doors is to be found in Information Sheet No. 1 available from the Association.

Metal doors have not traditionally been fitted with an intumescent seal, primarily because the inherent expansion of the metal means that they

can satisfy the integrity requirements of the standard, which, in the case of uninsulated metal doors, is invariably evaluated solely in respect of the measurement of gaps, without the use of a seal. As a consequence, metal doors have never been given the ability to restrict the spread of hot smoke in the same way that a timber door has. It is the opinion of the Association that people in a protected space separated by metal doors should be provided with similar levels of protection against the spread of combustion products as those separated by timber doors.

Again, the Risk Assessor should feel confident that the door assembly, whether metal or wood, is capable of providing tenable conditions in the space that is deemed to be 'protected' for the period that the egressing persons, including the disabled, will need. By fitting intumescent seals to the perimeters of metal doors, the leakage of hot smoke can be significantly reduced, thereby maintaining tenable conditions for longer. The selection of intumescent type and the method of fixing it to metal doors will generally require consultation with an intumescent strip supplier to ensure the suitability of the product.

It must be recognised that just fitting an intumescent seal to a fire door does not guarantee that it would pass the fire test as all aspects of the construction need to work in harmony, e.g. hardware, glazing, frame fixings, but it will improve the performance of what exists. To ensure the fire resistance, a formal assessment and appropriate upgrading will probably be needed. Guidance on upgrading is available in the Upgrading Protocol, published by IFC Ltd, and available from the Secretariat.

Limiting smoke spread

In a Code compliant building, many, but not all, of the doors will be designated as smoke control. Smoke control doors will normally be fitted with a seal that, when properly installed, will be capable of demonstrating that the door assembly can satisfy the conditions when tested in a similar doorset to BS476: Part 31.1. The guidance asks that they will not leak more than the $3\text{m}^3/\text{hr}/\text{m}$ (of edge) at a pressure of 25Pa recommendations in Guides in support of National Regulations; these Guides permit the bottom of the door to remain unsealed.

As smoke is almost invariably recognised as being



a primary cause of death and injury, a Risk Assessor should consider whether more doors than the statutory minimum should be provided with smoke seals. Similarly, as these seals are designed to prevent the leakage of fully mixed non-buoyant smoke at low temperatures, the Risk Assessor must feel confident that the leakage of smoke under the threshold will not negate the benefits of the other seals. The Association believes that threshold sealing for doors other than that to the room on fire, can make a major contribution to life safety and recommends its implementation. As all doors may become the door remote from the room of fire origin the threshold should always be sealed. This also restricts the passage of air to fire.

It must also be recognised that a smoke seal must fully fill the gap between the leaf and the frame, i.e. be in contact with both surfaces. If it does not, then the assembly will generally fail to contain the smoke as intended. There is also a limit on the number and length of any interruptions that can be tolerated in the seal. As a rule of thumb the ability to achieve the regulatory recommended level will be badly compromised if the total length of gaps of more than 150mm exists in the perimeter seal. Where there is a break in the seal of greater than 150mm, a separate length of seal may need to be inserted alongside the item(s) causing the gap, overlapping the existing seal by at least 25mm, unless the seal in question has test evidence to the contrary.

Smoke seals have been cited as producing unacceptable resistance to door operation. Little attention has been given to the pressure differential from one side of a door to the other. If a door is effectively smoke sealed, but the air distribution system calculations are inaccurate, then the differential pressure may rise considerably above 25Pa after a door has been closed and time elapses.

Also when a series of adequately smoke sealed doors are positioned close together in a corridor, opening the first door may create an initial partial vacuum thus increasing the drag and resistance to opening. A solution to this pressure differential problem maybe to fit fire and smoke containment air transfer grilles in the fire doors or any adjacent side panels.

Selection and Installation

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



Audit Checklist

TIMBER DOOR ASSEMBLIES

Does the door under consideration need to perform a fire door function? (i.e. in its position in the building should the door be a fire door?)

- Yes** - Is written evidence available to support its performance and if not, does the door incorporate the critical construction characteristics such that it could satisfy the test e.g. heat activated and smoke seals ⁽¹⁾.
- No** - When properly hung (see IFSA Information Sheet No. 4), would the door benefit from the fitting of a cold smoke seal to reduce potential contamination and provide enhanced reduction of fire risk?

Is the fire door fitted with intumescent seals on head and vertical edges? ⁽²⁾

- No** - Fit seals of appropriate type. ⁽³⁾
- Yes** - Are seals of the correct type, size and position for the door under consideration? ⁽³⁾

Is the fire door a one hour door, or greater?

- Yes** - Ensure the intumescent seals are not interrupted at any hardware positions, either continuously or by additional protection local to the door hardware
- No** - Assume it is only a 30 min door and therefore the seals may be interrupted as long as the hardware does not extend to closer than 12mm from door edge.

Is the fire door a joinery door, probably untested, or an oversize door (larger than 2100 x 900mm)?

- Yes** - Ensure that seal specification is enhanced so that it can restrict or accommodate greater distortion. ⁽⁴⁾
- No** - Try and trace original door manufacturer's intumescent specification and replicate. Default sealing specification is as in Note 2.

Is the fire door unlatched in normal use?

- Yes** - Ensure head seal is either of the pressure forming type, or has test evidence to support its use on unlatched door assemblies of the appropriate configuration.
- No** - Use the default intumescent specification ⁽²⁾ for latched doors.



METAL DOOR ASSEMBLIES

Does the door open into an area where persons may be escaping, whether or not it is designated as a fire door?

- Yes** - Fitting of intumescent seal strongly recommended to reduce the risk to escapees.⁽⁵⁾
- No** - Intumescent Seals not needed unless edge gap is greater than 5mm, but a smoke seal should be fitted to prevent smoke logging (see below).

Are materials/equipment that is protected by this door prone to contamination by combustion gases?

- Yes** - Fitting of intumescent seal and possibly smoke seals is strongly recommended.⁽⁵⁾
- No** - Fitting of seals have no direct benefit.

ALL DOOR TYPES

Is the assembly a smoke control door assembly?⁽⁶⁾

- Yes** - Is there a gap of more than 150mm in length in the continuity of the seal, e.g. at hardware positions, if so, fit additional lengths of smoke seals alongside all items which interrupt the seal.
- No** - OK, but check that seal contacts the leaf and frame in all positions and if not, adjust seal, or fit a seal that does.

Would a reduction in smoke flow around door increase life safety tenability, or reduce contamination damage?

- Yes** - Fitting of smoke seal strongly recommended.⁽⁷⁾
- No** - Are you sure? Is a smoke seal fitted to the threshold?
 - No** - Consider whether the area being protected is critical, e.g. is a refuge for the disabled, or includes smoke sensitive equipment, such as, computers, and fit threshold seal if it is.



Notes:

- (1) *The written evidence that the door is a fire door may take the form of:*
- *Test Report from testing authority*
 - *Field of Application Report issued by a suitably qualified body (A1 of Approved Document 'B')*
 - *Assessment of Performance in lieu of test evidence also issued by the above*
 - *A Third Party Certification Assessment of the door which covers the size and mode and configuration of the assembly in use*

If the door is not supported by such evidence it may be prudent to recommend that its performance is assessed by such an authoritative body

- (2) *Check that the intumescent is not concealed behind the lipping (this may require an inspection of the head of the leaf). If a plastic plug is fitted with a green core, this is one way that this may be identified.*

- (3) *It is the Association's view that for FD30 (E30) doors a 15mm wide strip to the jambs and a 20mm to the head are appropriate and the FD60 (E60) doors, either 2 x 12mm, 2 x 15mm or 1 x 25mm fitted to the jambs and 2 x 15mm across the head to be used with protection at hinges. If the performance of the door has to be quantified this should be achieved by assessment by a suitably qualified engineer*

- (4) *It is preferred that the seals across the head of a door assembly are capable of producing pressure which may restrict movement of the leaf head, or if non-pressure forming seals are fitted can they produce copious quantities of expanded foam which can tolerate much movement. Soft seals are preferred in a meeting stile, albeit pressure forming seals may be used with the manufacturer's guidance*

- (5) *Many seals can be surface mounted in frame reveal or door edges; contact potential supplier*

- (6) *Insurance considerations as well as life safety, may designate the door to be smoke restricting door*

- (7) *If assembly is steel, the potential for smoke seal igniting must be investigated*



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



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November 2012