



IFSA FACT SHEET 02: SMOKE SEALS

Introduction

The smoke control performance of a door assembly is defined by the “leakage” which the assembly allows when under a prescribed differential pressure. This leakage test is conducted separately from the fire resistance test and uses pressurized air rather than smoke. The suffix “S” is added to the fire resistance designation when the relevant door assembly has been tested under the conditions of BS 476-31.1 (S_a under ambient conditions in BS EN 1634-3) and meets the leakage criteria laid down in the relevant building codes. So “FD30S” for example, means an ambient temperature smoke control door with 30 minutes fire resistance.

The required performance for a smoke control door, specified in Approved Document B (2019) to the Building Regulations (Note 2a in Table C1) and in BS 9999: 2017 (Section 32.1.7), is that the ambient temperature leakage rate should not exceed $3\text{m}^3/\text{h}/\text{m}$ (head and jambs only) at a pressure of 25Pa when tested. The overall leakage rate of the door assembly, in m^3/h , is divided by the length of the gap between the leaf and the door head and jambs to arrive at the critical measurement of $\text{m}^3/\text{h}/\text{m}$.

IFSA members, and many others in the fire door industry, have long questioned the rationale of testing head and jambs only and, in the UK, defining prescriptive solutions for sealing the threshold “where practicable” even allowing an unsealed gap of up to 3mm, which is in itself not practicable, and widely abused.

SMOKE CONTROL IN FIRE DOORS

ABOUT IFSA

The Intumescent Fire Seals Association (IFSA) is the trade association dedicated to the science and application of intumescent based sealing materials for the passive fire protection industry.

The Association provides technical advice and guidance on all matters relating to fire door seals, smoke seals, glazing seals and all penetration/gap sealing problems.

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INTUMESCENT FIRE SEALS ASSOCIATION
THE HOME OF REACTIVE FIRE PROTECTION SYSTEMS

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At the time of preparation of BS 476-31.1, however, there were very few commercial threshold sealing systems available, and so it was decided that the threshold should be blanked-off for the test. This methodology was continued for BS EN 1634-3 when it was developed. Numerous commercial sealing systems are now readily available that allow the threshold to remain unhindered to traffic and provide a good smoke seal when the door is closed.

It should also be noted that with pass/fail smoke leakage being specified “per metre”, this means that the door size is taken into account, however, the performance can be affected by the inclusion of hardware items which leave unsealed holes through the door assembly, such as letterplates.

Current Position

The current UK guidance does not require the threshold to be sealed and indeed the threshold is blanked-off with adhesive tape during the relevant tests. Consequently, smoke control fire doors are permitted to have a 3mm gap at the threshold which substantially reduces the effect of the jamb and head smoke seals. Threshold seals are readily available to provide a good seal whilst maintaining unhindered traffic flow.

IFSA Smoke Control Tests



To demonstrate the increased factor of safety that results from a properly sealed threshold, but while still maintaining the functionality of the door, IFSA commissioned a series of tests using the methodology of BS EN 1634-3 showing the smoke leakage performance of door assemblies (a) with the threshold taped, (b) with a 3mm gap and (c) with an automatic threshold seal fitted.

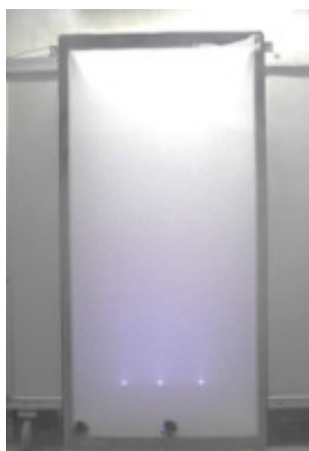
The test rig was modified so that a transparent box was fitted around the outer face of the doorset to represent a corridor and a smoke generator was placed inside the test chamber so that the effect of the air leakage was visible. A Fire Exit sign was affixed to the visible face of a normal sized single acting single leaf door (2010mm x 910mm) and there were other distinguishing features on the face of the leaf so that the obscuration effects of the smoke were readily noticeable to the observer. The pressure was set at 25Pa as required in Approved Document B and the test was run for 2 minutes as required by the test standard.

Results and Conclusion

The door with seals at the head and jambs but with a 3mm gap at the threshold was completely obscured by the smoke after 2 minutes whereas the presence of the automatic threshold seal allowed the Fire Exit sign and other distinguishing features to remain clearly visible after the same 2 minutes and gave very similar results to a blanked-off threshold.

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Smoke seals fitted
head and jambs

Threshold
– Gap 3mm

Leakage 10.5m³/h/m



Smoke seals fitted
head and jambs

Threshold
– Blanked-off

Leakage <1m³/h/m



Smoke seals fitted
head and jambs

Threshold
– Automatic seal

Leakage <1m³/h/m

There is more than a factor of 10 reduction in smoke leakage rate when an automatic threshold seal is fitted compared with the currently approved 3mm threshold gap, which in practice is very unlikely to be achievable as this would be beyond most available floor finish tolerances.

Recommendation

There is no justification to continue with the requirement for the threshold to be blanked-off when testing smoke control doors as this does not reflect “real world” in-use conditions. With a threshold sealing system fitted, the same criteria can be applied as for the leaf edge to frame gap.

It is the recommendation of the Intumescent Fire Seals Association, where doorsets are required to restrict smoke leakage at ambient temperature, that they should satisfy one of the following:

- *have a leakage rate not exceeding 3m³/m/hour for all edges (head, jambs, base and, where applicable, meeting edges) when tested at 25Pa under BS 476-31.1*
- *meet the additional Sa classification when tested to BS EN 1634-3 (with the gap between the bottom of the door and sill remaining as proposed to be installed, not sealed with impermeable material)*

MYTH BUSTERS

- **Smoke seals are designed to prevent smoke passing from one side of a fire door to the other.**

They are effective at ambient temperature, however, whilst they may be effective during the first few minutes of a fire test, once the intumescent seals activate these will be more effective at stopping smoke transfer.

- **A 3mm gap at the bottom of a door leaf will not have much effect on the amount of smoke leakage.**

Whilst this is true for the door keeping back the fire it certainly isn't true for doors further away which have smoke seals fitted to contain ambient temperature smoke.

- **Smoke seals make a door difficult to open or close a door.**

This can be true for badly fitting seals but is not true if the seals are fitted properly.

- **Threshold smoke seals are a trip hazard.**

This is not true for the current generation of drop seals fitted to the bottom of the leaf so there is nothing on the floor.

- **An intumescent fire seal does not control the spread of smoke at ambient temperature.**

This is true but smoke seals, which could be an integral blade or strip or a separate seal around the perimeter of the door leaf are very effective at reducing smoke in the early stages of a fire.

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