WEBINAR

Optimising Smoke Control

Presentation slides handout

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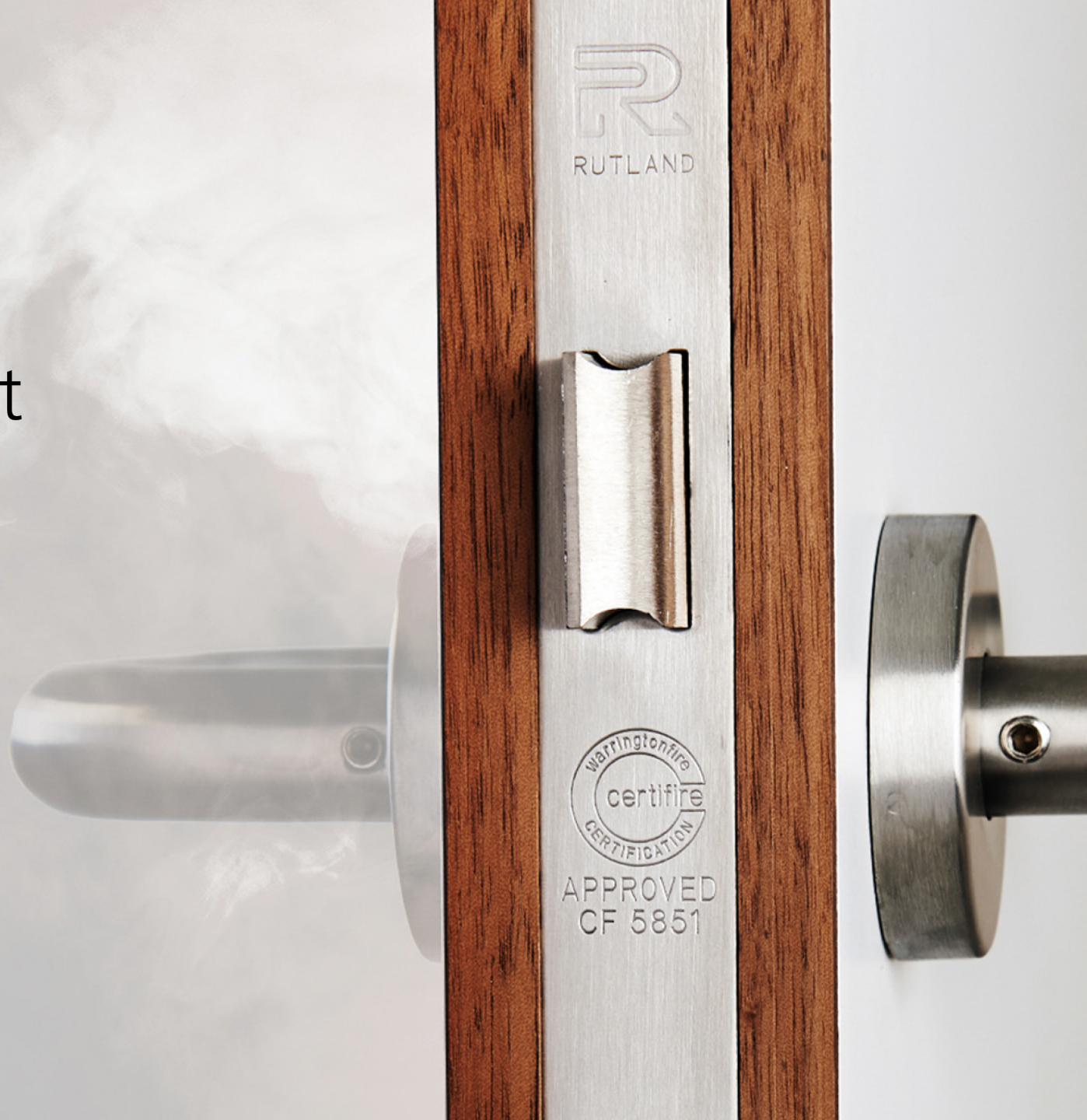

Welcome

Webinar host: Neil Smith

Good morning and welcome to Rutland's latest webinar 'Optimising Smoke Control'. Our aim in this webinar is to raise awareness of the dangers of smoke within buildings and how smoke control can be optimised to meet or exceed mandatory requirements.

We'd like to thank all participants for joining us today. Here are the learning objectives for today's webinar:

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Learning objectives

- → Understand the importance of smoke control within buildings
- → Know the current standards and recommendations within building regulations
- → Understand smoke testing methods
- → Learn ways to overcome difficult fire and smoke door installation
- → Gain a knowledge of the extensive work going on behind the scenes to mitigate smoke risk

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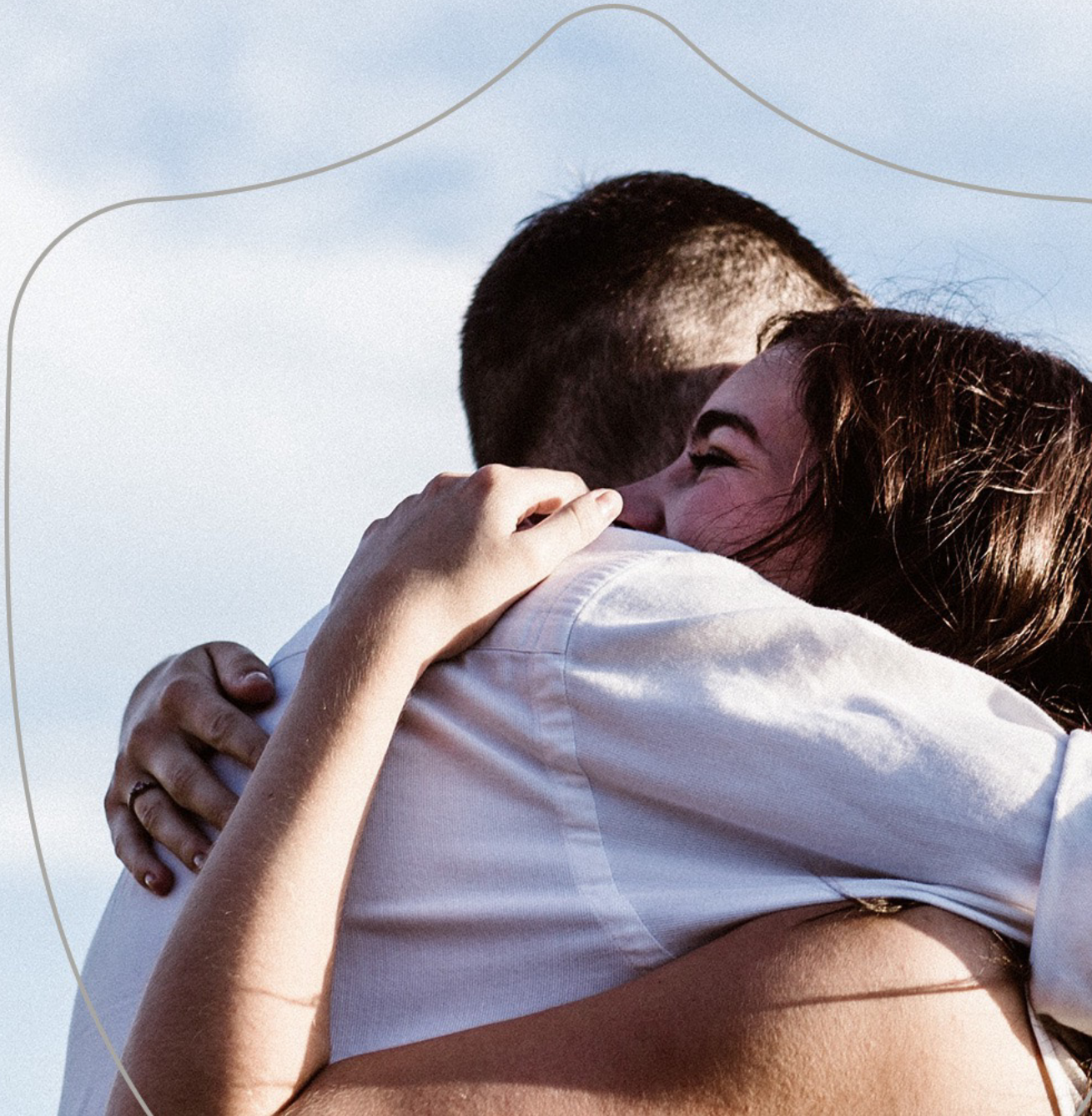
OUR GOAL

Increase **life safety** within buildings



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Panellists

Jim Kelly
IFSA

Richard Kowalski
Stairways Midlands

Carlsson Elkins
Sertus

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Audience poll 1:
Smoke within buildings can lead to...

(A) Disorientation for people trying to escape
(B) Physical distress
(C) Asphyxiation
(D) All the above

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Answer: (D) All the above

Audience poll 2:

What percentage of deaths were as a result of smoke in Great Britain during 2019/2020?

(A) 30 - 40%

(B) 50 – 80%

(C) 40-60%

(D) 60-70%

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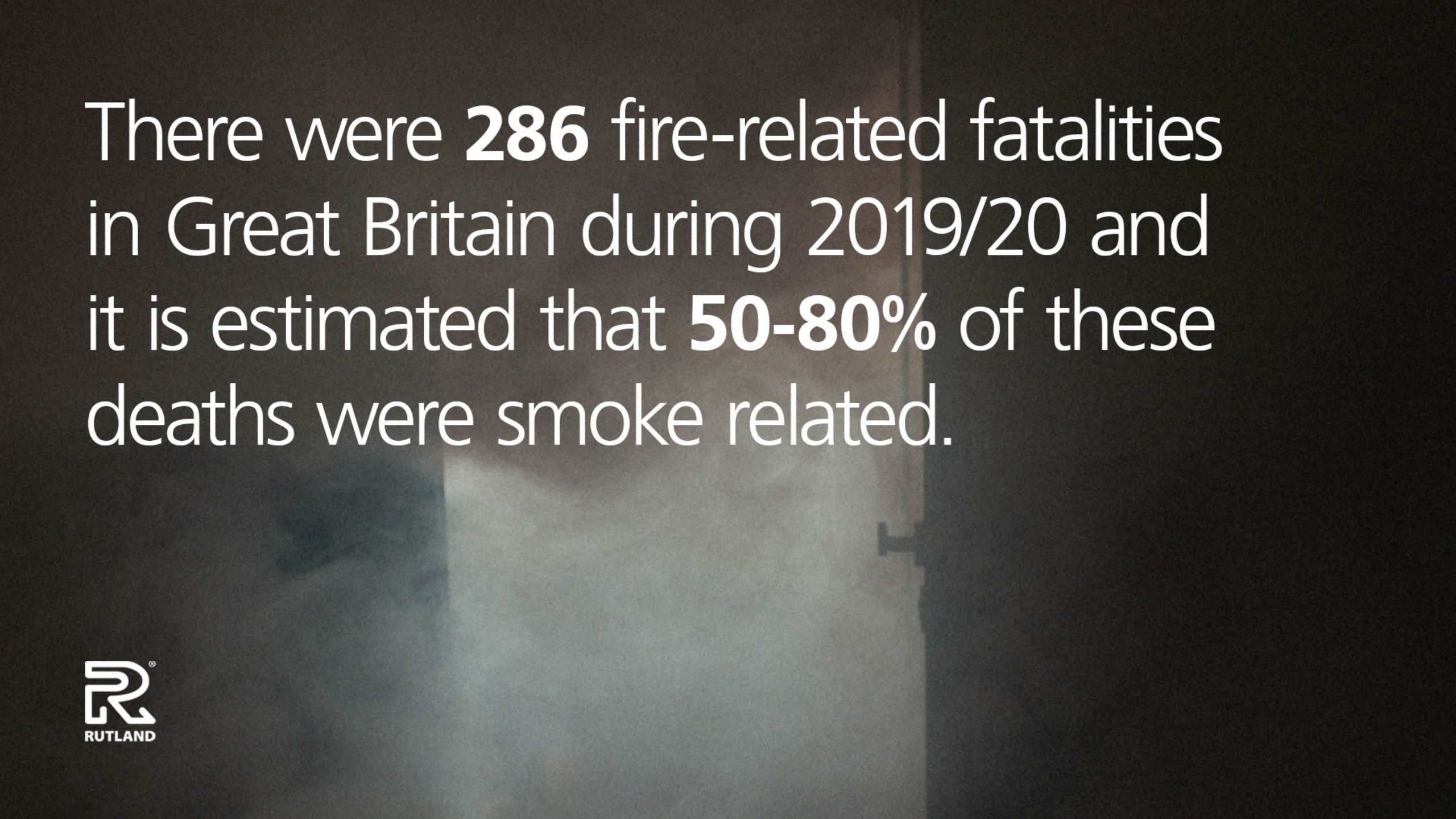
Answer: (B) 50-80% of deaths were caused by smoke inhalation


There were **286** fire-related fatalities in Great Britain during 2019/20 and it is estimated that **50-80%** of these deaths were smoke related.
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As well as causing asphyxiation, smoke can lead to disorientation and physical distress, making escape difficult. It also makes it much harder for rescue services to do their jobs. The Grenfell Tower Fire Inquiry heard that the thick black smoke that filled the building hampered evacuation and rescue.

A sobering note to start a webinar with, but it's what we've been thinking about at Rutland recently in a discussion about fire and life-safety.

In some circumstances, smoke seals are a Building Regulation requirement, but not all. If we know that smoke is so deadly, we asked ourselves, why isn't the legislation as clear or as stringent as that for fire? Are we confident as an industry that smoke doors are being correctly stipulated and fitted where required?

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Where are smoke doors absolutely required?

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The current requirement for smoke doors is laid out in ADB and BS 9999. Smoke doors are also mentioned in BS 9991 and BS 8214, which we will come onto later in the presentation. Currently, smoke doors are only required in certain situations because the guidance makes certain assumptions.

For example, a riser cupboard does not require smoke sealing, as the cupboard does not require protection from smoke, only from fire. But what if the fire breaks out on the inside of a riser? What if it spreads through a protected shaft? The result would be smoke leaking into a corridor, potentially on multiple levels of a building.

Naturally, any guidance aims to find a balance between safety and practicality, but could it be that, by only requiring smoke protection in certain circumstances, the guidance allows for other possible scenarios where life-safety is compromised? Some in the industry think smoke seals should be fitted to fire doors across the board.

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Jim Kelly joins us now – Jim, you've been campaigning for changes in fire door smoke control legislation and testing methods for around 20 years now – could you please give us a little background, history and tell us the latest with smoke standards and testing methods?

Jim Kelly: I personally started to look at the issue in the early 2000s, and carried out some investigative testing for my then employer. It mainly revolved around the threshold sealing, or lack of it, and how different gaps would affect the results when the threshold was operable, basically no tape to it, just as it would be in reality. The results at that stage were kept in house by the company I worked for, but chance came to rectify it when, in 2016, BS 8214 was being revised.

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BS 8214 is the document that refers to the threshold gap only being 3mm when the "fitting of a threshold sealing system is not practical". Despite the issue being raised with the BS 8214 2016 panel, nothing changed.

In late 2018, IFSA commissioned a project to solely look at the issue of threshold sealing and in particular the permissible allowance, in test, to seal the threshold with an impermeable material to both the BS and EN standards.

The subsequent reference in other documentation to permit a 3mm gap in the real world was a) impractical to build to and b) a nonsense considering the door had generally not been tested like this (unless the person commissioning the test had decided to seal the threshold).

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We then went to test with a single door and built a Perspex box (see image) in front of it to illustrate the leakage rather than just having the leakage rate numbers as you get from testing. There is an IFSA fact sheet in the public domain and this shows our findings.

At a similar time to IFSA starting the project Charles Malcolm-Brown, of the Dixon International group, was approaching various industry bodies looking to lobby government about various fire door related issues including smoke leakage and ultimately the SCCG group was formed.

Members of the group are IFSA, IFC, ASDMA, BWF, ACDM and GGF. Once the IFSA fact sheet was complete we decided that the best platform for the information to be released would be via the SCCG rather than IFSA as we are trying to build a culture of collaboration between associations rather than a single voice from each one.

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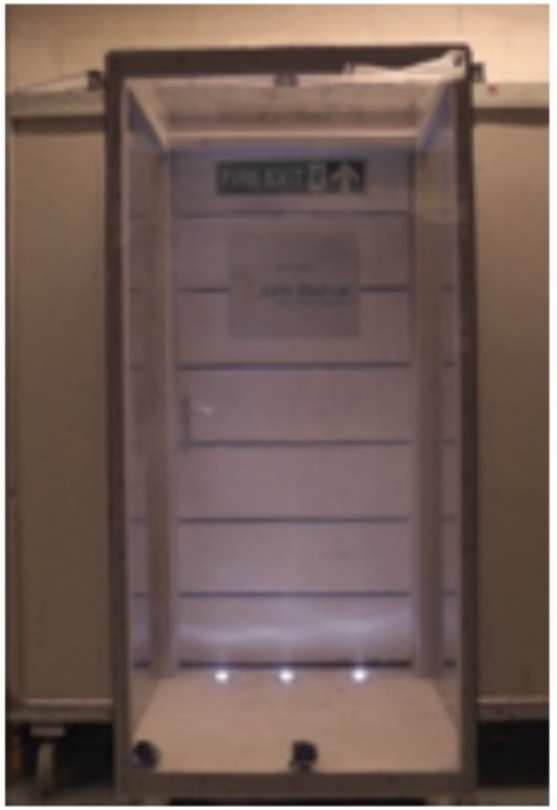
IFSA Fact Sheet 02: Smoke Seals

Smoke control in fire doors

Smoke seals fitted head and jambs

Threshold – Gap 3mm

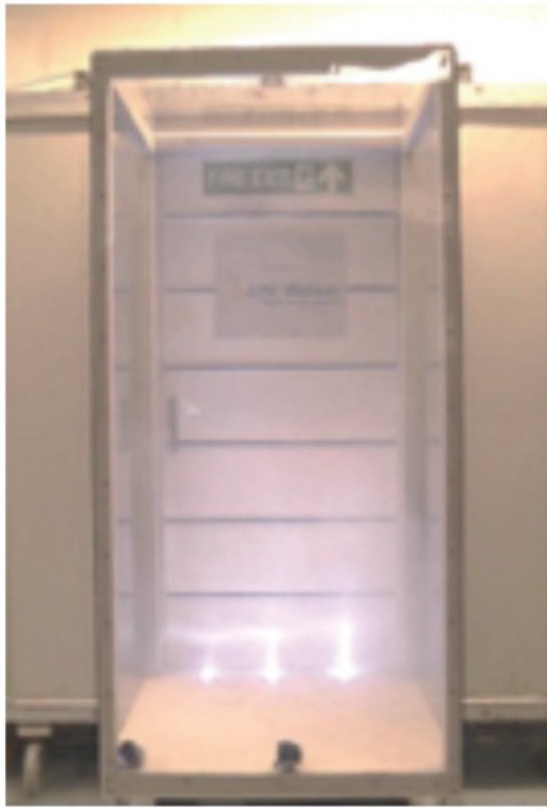
Leakage 10.5m³/h/m



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

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We are aware of government criticism of differing opinions from various trade organisations and we wanted to show a step change. Hence we have since issued the data to MHCLG and BSI. MHCLG have confirmed receipt of the data and thanked us for our input and will be reviewing it.

Neil Smith: Just for interest at this point, could we have a poll on the audience knowledge of standards where smoke doors are mentioned...

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Audience poll 3:

The current requirement for smoke doors is laid out in;

(A) Approved Document B (ADB)

(B) BS 9999, BS 8214:2016 and ADB

(C) BS 9991:2015, BS 9999, BS 8214:2016 and ADB

(D) BS 8214:2016 and BS 9999

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Answer: (C)

BS 9991:
Fire safety in the design, management and use of residential buildings

BS 9999:2017
Code of practice for fire safety in the design, management and use of buildings

BS 8214:
Timber-based fire door assemblies – Code of Practice

ADB:
Approved Document B

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Jim Kelly: BSI have also been active and we believe that changes have been made to the current draft of BS 9991 and this will then follow on to BS 9999 and BS8214. One of the members of the SCCG, Kevin Underwood representing BWF, is the chair of the next BS 8214 update. Once the BS docs are all updated we would hope that Building regs Doc B will be updated in order to follow the revised guidance.

Neil Smith: that's a brilliant update from IFSA and our thanks to all on the smoke group for their hard work. What a lot of work going on – incredible. I think that's fantastic the way the industry is responding with, as you say 'one voice', and these 'different conversations' are happening. I got that phrase 'different conversations happening' from Gill Kernick – she told me this is what she wanted to start as a result of catastrophic happenings. Before we go any futher, let's have one more poll to see what people already know about smoke testing fire doors...

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Audience poll 4:

A BS or EN smoke tests on doors is conducted using;

(A) Pressurised Smoke

(B) Pressurised air

(C) Ambient smoke

(D) Either ambient or hot smoke

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Answer: (B) – There is no smoke involved in an actual smoke test.

Jim Kelly: The smoke control criterion required in the UK is $3m^3$ of air loss per hour per linear metre to head and jambs only when measured at 25Pa pressure. The test allows for the threshold to be filled with an impermeable material usually taped with gaffer tape. This is because it is assumed that no smoke will be emitted at the threshold because this is a negative pressure region during a fire.

Smoke leakage testing is an air test, there is no smoke involved at all. Both building regs doc B and various BS guidance docs (primarily BS 8214 for timber doors) advise that the rate should not exceed $3m^3/m/hr$ to jambs and head only. There is no requirement in any document where meeting stiles of pairs are mentioned. The air chamber has both a positive and negative pressure applied to it in two different cycles of the test in order to recreate smoke leakage results from each side of the door.

As the BS 476:31:1 test was written in 1983, the availability of threshold sealing systems was limited, if available at all, so the standards committee agreed to allowing the 3mm gap when threshold sealing

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was not practical and this subsequently entered EN 1634:3 and has remained to this day. As IFSA and the SCCG, we feel that there are more threshold sealing options available now, so the above two standards should be reviewed and amended to remove the allowance of sealing the threshold with an impermeable material.

As I said earlier, IFSA has been concerned about smoke seals for some time and has an active programme of work to demonstrate the benefits of smoke sealing fire doors. There is also the Smoke Control Consultation Group I mentioned, which is trying to coordinate parties with similar interests in getting better smoke protection. This group is trying to get legislators interested in improving smoke control in fire doors.

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Neil Smith: So, what are the next steps with smoke doors, we've got the history if you like, but what would you see as the next steps, Jim?

Jim Kelly: As IFSA, we have data on file for the sealing of single swing pairs of doors and we have prototypes in a smoke rig to look at the sealing of double swing doorsets – neither of these configurations are really looked at in any of the BS docs or Doc B, as the $3m^3/m/hr$ rate quoted relates only to jambs and head, very little mention of meeting stiles.

Neil Smith: Thank you Jim. It seems the more you learn about smoke control, the more you just realise it's a 'wide science': it requires in-depth knowledge of the building layout, the technical aspects and the bewildering array of building regulations in force. Each type of building has its own peculiarities, and some have specific regulations and guidance on smoke ventilation.

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In reality, specifying a smoke control door or systems is not always easy, and you can't afford to get it wrong. Smoke doors are life-saving devices and their failure could have dramatic consequences. And a lack of confidence or knowledge can lead to over-specification with consequent unnecessary costs as we covered in our last webinar. However, it is equally easy to under-specify through lack of expert knowledge or trying to excessively cut costs (and corners).

Let's hear now from Carlsson Elkins, as a smoke system guru... how he views fire and smoke control doors forming part of the overall package to protect life-safety within a building.

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Smoke ventilation systems

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Carlsson Elkins: Something that's often overlooked is the fact that door closers are fundamental parts of smoke ventilation systems. They are found in two different places in a typical apartment block setting:

Firstly, they are used to keep apartment doors shut at all times. Whilst the key function of these door closers is to preserve the integrity of the compartmentation, part of this is the prevention of more smoke coming into the common parts of the building following an evacuation. Without a door closer in place and maintained, it is likely there will be more smoke than the smoke ventilation system can cope with within the common corridor.

The other place you will find a door closer is on the stair door. It's imperative that these are well maintained, too. Sometimes, the door to the stair is used as an inlet to

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a mechanical smoke ventilation system. The door closer, in this case, must be carefully calibrated to ensure the door swings open with just enough force from the MSVS system.

Occasionally we see fire doors added to buildings where they weren't originally planned. If this blocks the flow of air through a smoke ventilation system it can have one of two effects. If they block off the extract, the smoke ventilation system will fail to do its job. Arguably more seriously, if the doors block off the make-up or inlet air, the zone will depressurise with the likely result of trapping residents in their apartments.

There's also the matter of people using fire doors in the wrong places, in particular, I'm thinking of people using them as vents into smoke shafts. Whilst when reading

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Approved Document B, this sounds acceptable, it is not acceptable in BS EN 12101-2 as it is not a tested assembly. We've seen fires in buildings where this 'solution' has been used and the vents have failed to open - prime examples of why these should not be used. The new BS 9991 also clarifies this in very plain language.

It states:

Note 1: Products tested as "smoke rated fire doors" are not acceptable replacements for smoke control dampers (e.g. BS EN 12101-2 products with additional tests).

Note 2: The fitting of actuators to other components to "make" natural smoke vents or smoke control dampers is not acceptable, as no performance has been tested.

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Neil Smith: Thank you Carlsson! So the point I'm picking up here is the need to ensure smoke control system components work together seamlessly - which includes fire and smoke doors.

Richard, could you please give us some real-life smoke door experiences and how you overcame them?

Richard Kowalski: Hello everyone, and thank you Neil. The bottom gap on smoke doors is one of simplest and hardest gaps to seal and is in the top three complaints / site issues most companies have.

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Examples of why these are an issue is generally down to a few factors,

1: Doorsets are sometimes supplied with a guessed undercut as the floor covering thickness is not known at the time of manufacture, and install making the completed doorset have the incorrect threshold gap.

This is then only picked up at the end of the project, when building control etc inspects the project and rejects the gaps, it should not be left to the end of the project for this to be picked up and both the fitting team and site management should check the gaps before it is too late. Unfortunately, it is now harder to rectify this at this point. It is essential these floor coverings are known so the correct sized gap can be calculated at the build stage.

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2: Floor levels, this is mainly an issue on commercial builds, schools and Hospitals projects where you have large cross corridor doorsets.

The issues here are the fact that we have heard in the past that for example the concreate slab companies could have a level tolerance of 5mm over 1 metre, so over a 2m wide doorset the floor could run out 10mm. Yes this will then be screeded but will still often be unlevel. To the naked eye and you walking down the corridor, you wouldn't notice this, however for a doorset that you MUST have a threshold gap of no more than 3mm for smoke this is a major issue as the gap could be 1mm at one end and 11mm at the other, this would be the worse case but I have seen this and I know Jim probably has as well.

So how do we solve this? Well, there are a few ways, and like I said at the start there are simple ways to resolve this, but there are many complications, as it will depend on the client, the size of the gap the type of gap which will depend on the solution.

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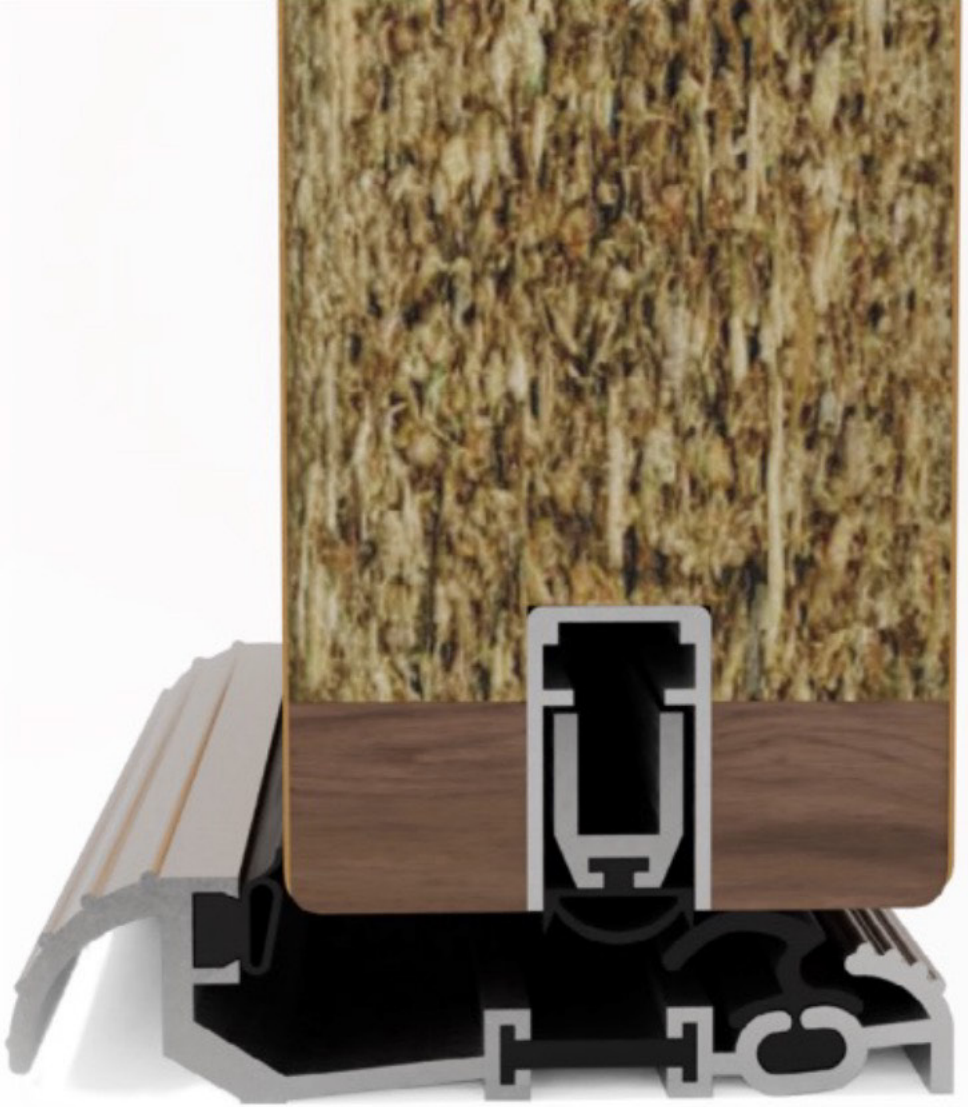
The other solutions would be a threshold seal. If you cannot achieve the 3mm gap you can seal the bottom edge with a seal, this would duplicate the taping of the threshold as mentioned all ready.

However, whatever you are looking at using, make sure it has in fact been tested for smoke. These could be an aluminium threshold with a smoke seal in the bottom of the door, the threshold would be required in this case to stop the smoke seal catching the floor, however this type would not be suitable for a hospital as the threshold would produce a bump for beds and trollies.



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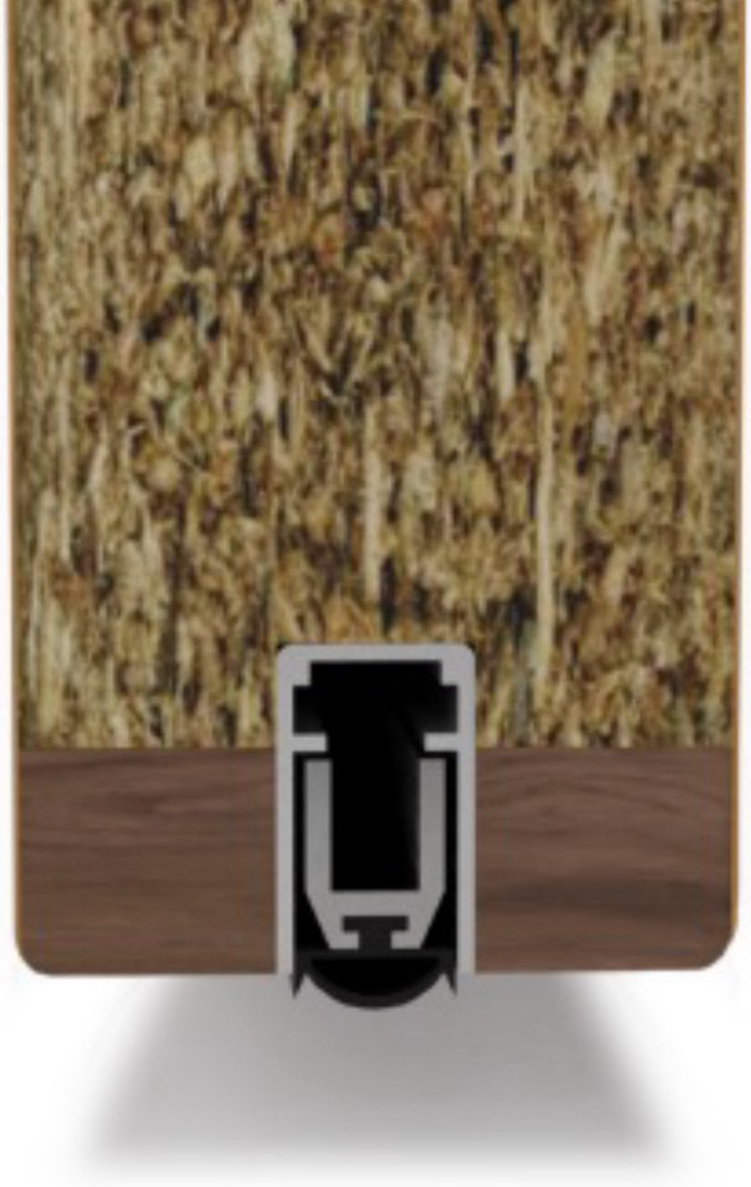
The second would be a drop seal and would be the best option, however these have their own issues, some health authorities do not like these due to infection control and the maintenance they require and setting up. Check with your client before choosing the option or solution.

Both of these solutions can be discussed early on in the build, if as a team you feel a 3mm is not achievable then look at the alternatives. Most companies will raise this as a concern, I know I do. In some cases there is no physical solution apart from levelling the concrete floor, uninstalling the doorset and re-fitting, this can be a very costly job



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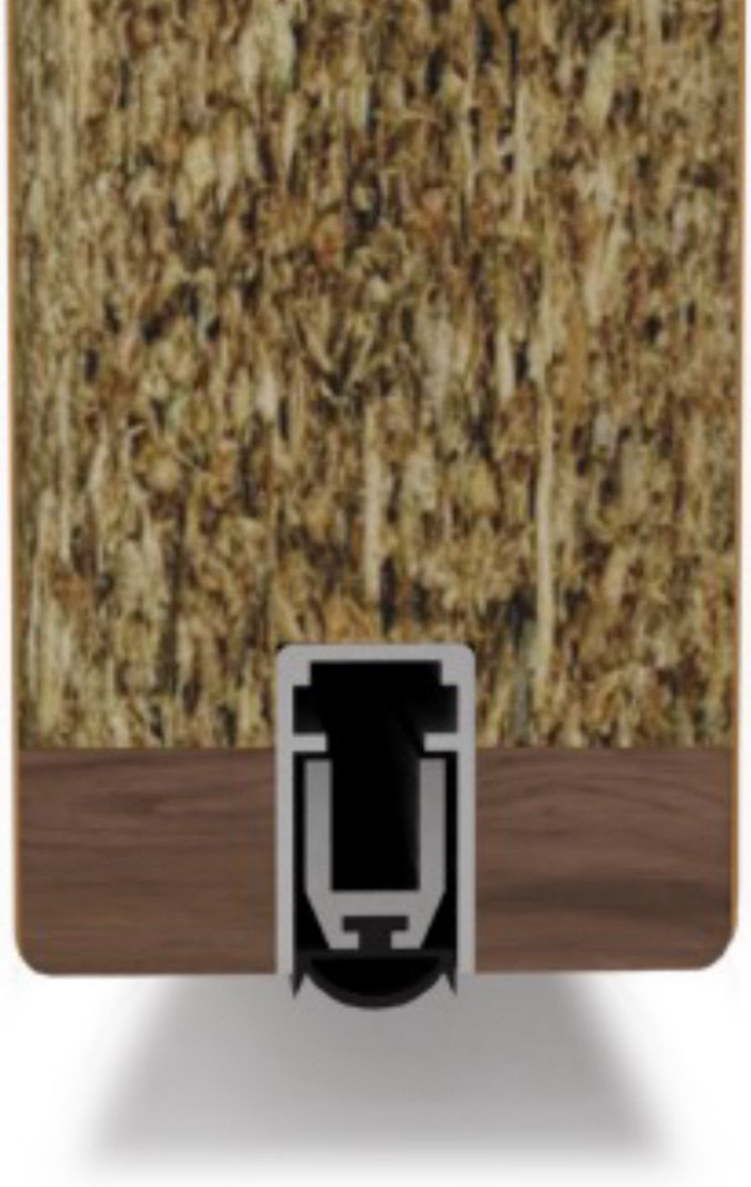
to do and in some cases is not an option due to cost or a structural issue etc. I know in the past and I have had a couple of projects where building control has excepted larger gaps as it was deemed impossible to achieve the required 3mm. I'm not saying this is correct and I'm unsure if this would be the case if it was discussed today, but it is a possible option, however, it would go against building regulation.

One thing I'd like to ask Neil is any advice on door closers where there's excessive air pressures and smoke seals that may conflict with doors closing?



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Neil Smith: It's very relevant Richard. So we raised the question at the start, what's the link between door closers and smoke control? As we've just heard from Carlsson, "door closers are fundamental parts of smoke ventilation systems". So there's a direct link. **The door closer closes the door fully which activates any drop seal and engages any smoke fins or brush seals.** That means the closer ultimately helps to comply with both fire and smoke performance criteria.

So coming back to your question Richard on excessive air pressures or excessive seals, pressurisation, seals and smoke shaft systems can put additional demands on door closers. Both the size and weight of the fire door and the closer adjustment have significant impacts on the success of the smoke system design and performance.
As a designer, specifier or building owner, you will want to be sure that your smoke ventilation system will provide fire and smoke safety in the event of a fire – but equally that your doors will close when the smoke system is in operation.

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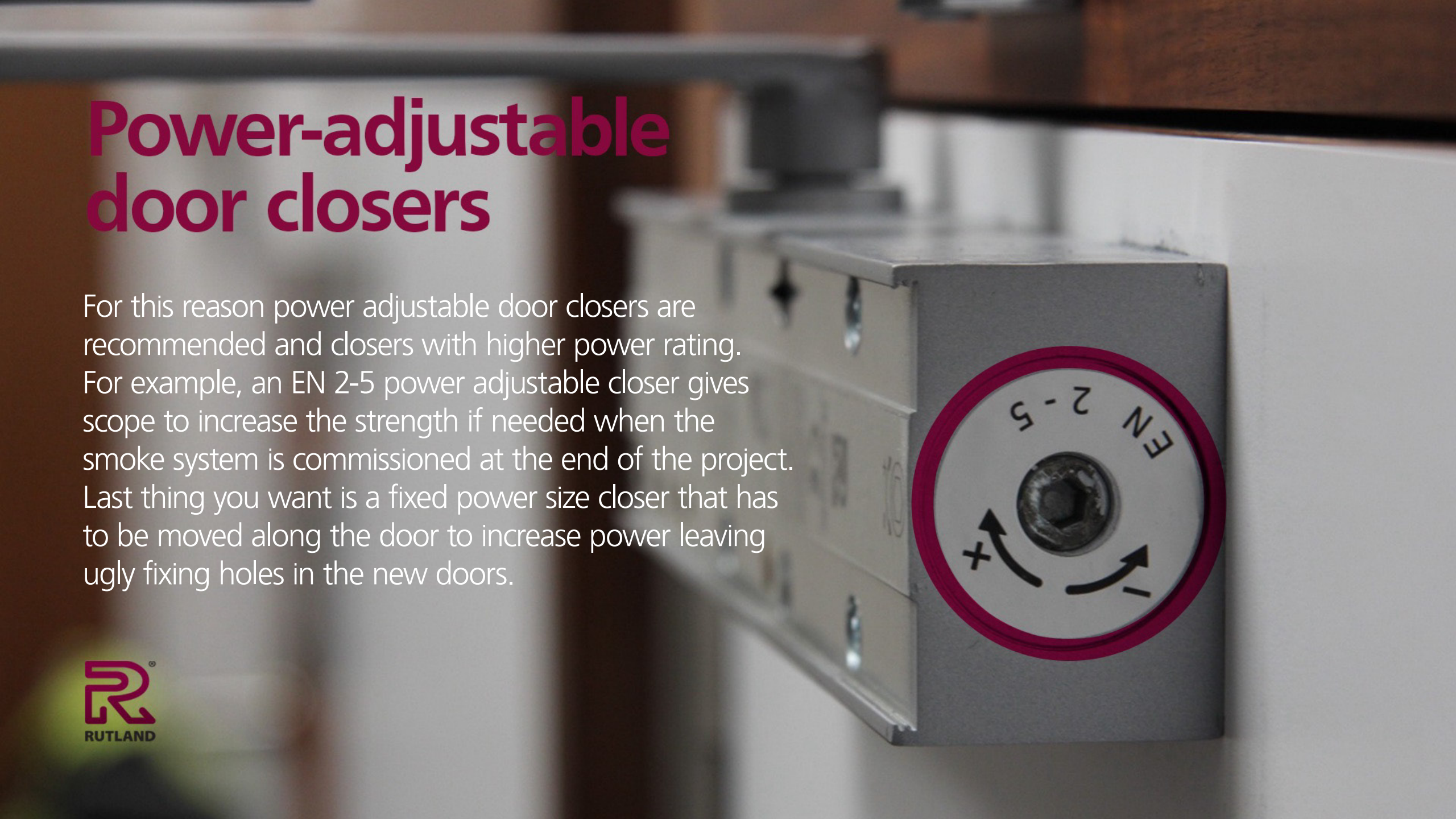
Power-adjustable door closers

For this reason power adjustable door closers are recommended and closers with higher power rating. For example, an EN 2-5 power adjustable closer gives scope to increase the strength if needed when the smoke system is commissioned at the end of the project. Last thing you want is a fixed power size closer that has to be moved along the door to increase power leaving ugly fixing holes in the new doors.



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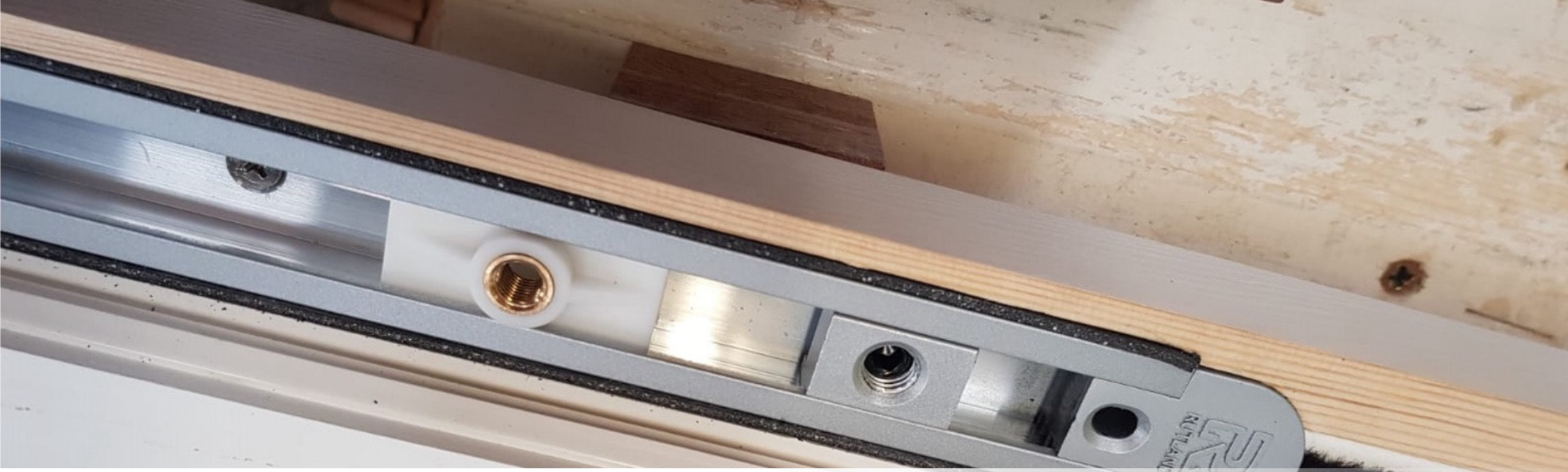

Another thing with concealed door closers is making sure smoke seals bypass the mortice. You can see in this image of a head frame, the brush seal is interrupted, but there is a continuous smoke and acoustic seal added around the frame rebate which bypasses the door closer channel uninterrupted.

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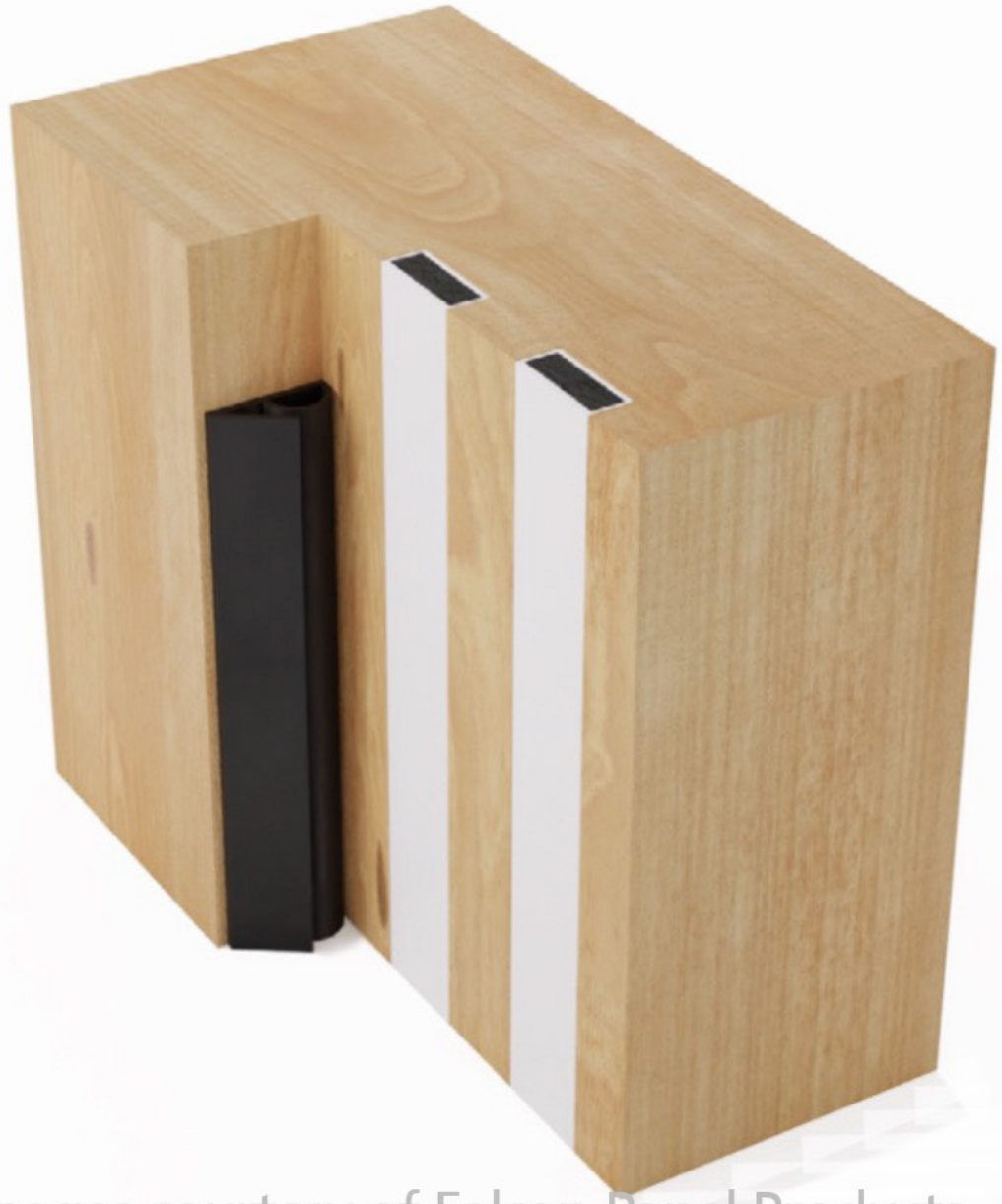
Another thing that can be a challenge for door closing is changing a fire only door to a smoke door. Or when retro fitting smoke seals inside the rebate of a doorset.

If there's a new seal added like in this image which is called 'compression mode', you need to move the door stop by the compression dimension, otherwise the door will bind and not close.



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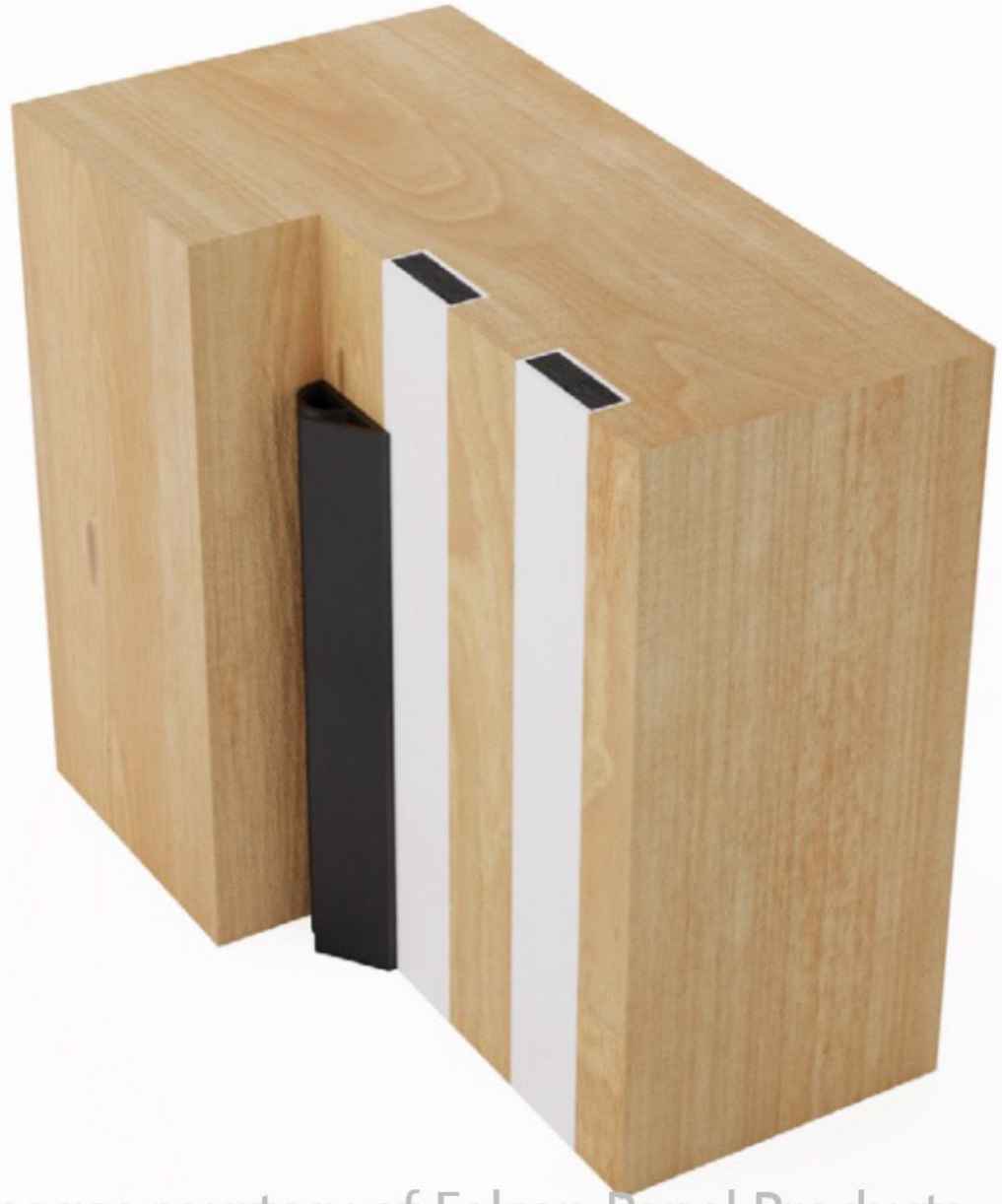
Or if a rebated frame meaning no flexibility, a smoke seal in swipe mode can be fitted as shown in this image.

A rule of thumb is, **if you can close the door with the push of your little finger, then the closer should operate.**

Door closers are not designed to overcome excessive air pressures, seals or poor door installation.



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Neil Smith: So, what have we learned in this webinar?

For me, I've had my mind opened I think to question whether smoke tests measure up to real life, for example the allowance for taping the threshold during smoke testing. Also we've been helped in this webinar to start thinking more deeply 'What can we do to further protect life safety'? I've learnt the extent of work going into campaigning for change in standards and methods of smoke control, and the benefit of 'one-voice' with groups working together.

We've learnt how important it is not to change partitions or add smoke doors where they shouldn't be and to work in coordination on the overall building safety design. And we've learnt some ideas how to overcome everyday challenges for installers and methods of compliant smoke sealing of doors.

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Again, a really informative and relevant webinar today, thank you so much Jim, Richard and Carlsson for what you've shared with us.

Our next webinar will be mid-December... watch this space!

Thank you all and enjoy the rest of your day.

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Optimising Smoke Control

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