Information Sheet 06

Guidance on the upgrading of joinery doors

06

Intumescent Fire Seals Association
The home of reactive fire protection systems

ifsa

Contents:

IFSA Information Sheet 6: Guidance on the upgrading of joinery doors

1.0 Guidance on the upgrading of joinery doors

This guidance note has been prepared to provide background information in respect of upgrading joinery doors to achieve a given level of fire performance. When considering the suitability of a door for upgrading, it is first of all necessary to establish what the performance targets are for the door i.e. the period of fire resistance measured in terms of integrity, which will meet the fire protection objectives.

Having defined these objectives, it is then essential to ascertain, by analysis, what the performance of the door would be if it were to be tested in compliance with the fire resistance test procedure called up in legislation (BS476: Part 22: 1987), without any alterations or upgrading. The factors that will affect this performance are:

1. Method of construction (jointing, glues etc).
2. The quality, thickness and nature of the material used in the construction of the panels (if appropriate).
3. The method of retaining panels (if appropriate).
4. The size of the leaf; thickness, height and width.
5. Quality, density, species and section size of the timber used in stiles, rails and muntins.
6. The configuration of the assembly (e.g. single or double leaf, single or double acting).
7. The amount of restraint provided to the leaf(ves) via hinges, latches, closers and/or intumescent seals (if fitted).
8. Size of mortices and morticed components.
9. The size of the gaps.
10. The type and design of any glazing including retaining bead details and fixings.
11. The materials used in the construction of the door frame (density, species) and the cross-sectional area and shape.
12. The current condition of the door and frame to be upgraded.

In a number of cases this exercise is worth carrying out because it can sometimes be shown that very little needs to be done to the leaf and that the correct specification of intumescent seals and hardware (restraint) can maximise the performance. Unfortunately, in other cases, this analysis will reveal that the method of construction is so inadequate that it is pointless spending money upgrading panels or fitting seals. Having established the basic, unmodified performance, it is possible to identify the degree of modification needed in order to achieve the requisite level of performance. At this stage it is important to ascertain the acceptable degree of invasiveness, because in many listed, aesthetically sensitive properties the upgrading methods should ideally be non-invasive and reversible. Where splitting the leaf is contemplated, it has to be accepted that there is little knowledge available as to the long-term durability of doors and/or panels that have been split and reglued and this method of approach needs careful consideration. In all cases the selection of the glue and the choice of sandwiched board must be undertaken with care.

IFSA Information Sheet 6: Guidance on the upgrading of joinery doors

When considering both the basic performance and the upgrading techniques the following aspects should be taken into account:

2.0 Behaviour of the stiles and rails framework

Fire doors normally fail by distortion, rather than burn-through, and controlling or accommodating this distortion must be the primary objective (even purpose-made fire doors can fail as early as 12 minutes due to distortion). It is also considered important that the door prevents the spread of smoke, just as much as the door remaining stable helps prevent the spread of fire, significantly. The fundamental performance of a door leaf will be a function of the factors listed earlier, but the main objective must be to restrain the distortion that will cause a loss of integrity at the leaf/frame interface.

3.0 Controlling distortion

The control that various items of hardware can provide should be used in combination with each other to ensure that the proposed upgrading measures work in unison. Similarly, the correct specification of the intumescent door seal is vital to ensure that it can contribute to the controlled distortion of the door if the analysis identifies this as a requirement, and also provide a gap-filling function between door leaf and frame.

Note: Intumescent seals come in various types, some providing high-pressure expansion, others offering low pressure, also the direction and nature of expansion varies. Use of the wrong type of intumescent material could potentially worsen the situation and also be a complete waste of money.

The balance between hardware and intumescent is particularly important when considering historical/joinery type doors. Correctly specified intumescent seals can greatly improve the performance of the doorset, even if no other measures are carried out. If a door is to provide more than nominally 15 minutes fire resistance when opening towards the fire, the normal situation, intumescent seals are required. Pressure forming intumescent materials are able to help control distortion by restricting door movement, whilst ammonium phosphate based seals are large volume expanders, which are able to deal with the large distortions that non-fire doors are likely to exhibit when heated, unless distortion become too excessive as may happen in the case of thin doors. The complementary method of controlling door distortion is by the correct use of hardware. Some closing devices, or even modes of operation are able to provide more restraint than others and these can be utilised where the door is able to accept the fixings for such devices. As an example, the fixing of the correct type of closer on the non-risk side will increase the door performance, as it will assist in controlling the distortion at the head of the door when fire is on the risk side.

IFSA Information Sheet 6: Guidance on the upgrading of joinery doors

4.0 Dealing with gaps

It is quite common for joinery doorsets to incorporate gaps between the door leaf and frame, which would not normally be acceptable for new doors. Joinery techniques and rehanging of the leaves may enable the gap to be minimized and/or equalised around the perimeter of the leaf. However, by correctly specifying the intumescent seals, it is possible, based on our knowledge of test performance, to seal gaps up to 8mm, and perhaps even wider, if the intumescent seal is correctly specified, detailed and fitted. International Fire Consultants Ltd, now called KIWA Fire Safety Compliance, have helped some manufacturers to develop low profile, face-fixed intumescent seals and these are often the preferred option for historically sensitive doors, particularly when used in conjunction with surface mounted or 'retro-fit' smoke seals. KIWA has a number of methodologies for specifying intumescent seals, depending on leaf size, configuration and gap size, which take into account the unique behaviour of the various products.

5.0 Smoke seals

The fitting of effective smoke seals with the ability to prevent ingress of 'cold smoke' around door edges in the early stages of a fire can be a positive contribution to evacuation of the premises. Smoke seals must meet the requirements of BS476: Part 31: Section 31.1: 1983. They must also provide low closing friction to prevent the seal from inhibiting the door from closing effectively and fully. The action of the intumescent seal may be positively or negatively affected by the presence of a smoke seal and this should be taken into account.

6.0 Panel upgrading

With respect to upgrading of solid panels, it may only be necessary to address any local weaknesses, although, in the case of flat panels this may mean the whole panel. However, all aspects of the panel's potential performance under fire conditions must be considered to ensure that, having addressed one aspect (e.g. burn-through), failure does not occur in another (e.g. panel retention). The fire resistance performance of solid panels has been shown to be dependent upon the following factors:

1. Width across the grain
2. Thickness of panel
3. Design of panel
4. Material or timber type
5. Physical condition of panel and surrounding elements
6. Bead size

An assessment of likely fire resistance of the untreated panels can be established taking into account these factors. For solid timber panels, e.g. raised and fielded, improved burn-through resistance may be achieved from an application of intumescent paint or varnish, providing they are applied correctly with the inclusion of primers, base coats, etc. in accordance with applicable testing. Any improvement of fire resistance due to such coatings can be added to the base fire resistance period calculated solely from the thickness of the timber. The likely improvement in fire resistance due to such coatings varies between an additional 5 and 12 minutes, depending on the type of

material used the substrate and the number of coats applied. Expert judgement, using relevant test evidence, is often needed to ascertain at which end of this range the eventual performance will lie. Improvements of this magnitude may be of minimal use for fire damage limitation, but may still be of critical importance for life safety when this is the main objective. Recent developments involve the use of thin membranes commonly referred to as 'intumescent papers'. These come in a variety of types, each supported by evidence, again of a variable nature.

When considering these, the evidence of performance (test report and field of application assessment report) should be examined thoroughly to ensure that the applied material is able to upgrade the panel that it is applied to, i.e. thin softwood, hardwood, plywood, etc. Tests performed on plywood are not directly applicable to timber panels of similar thickness due to different failure modes. Some thin membranes incorporate a reinforced backing layer that prevents tearing, should the panel fissure when heated. These are far superior to the unreinforced papers. A very acceptable appearance can also be obtained when the membranes incorporate a thin veneer face on the outer surface, but the bonding is critical, as is the strength of the membrane to which it is attached. It may be possible to upgrade raised and fielded panels by applying these membranes to the fielded area, only.

The method of retaining the panel in the structure is important, as conventional bolection mouldings are normally completely consumed by the fire within 15 minutes. It is often vital that panel-retaining fixings, fixed at an angle to engage in timber that will remain uncharred for longer and located at adequate centres to provide support to the panel, are included. Finally consideration should be given to the panel perimeter, which can be exploited by hot gases, particularly when the beads and panel experience charring/shrinkage. The intumescent membranes discussed above, can provide protection against this potential for failure of the panel, as can the application of mastic seals to joints.

7.0 Complete board protection systems

Covering the complete face of a door with a protected board is not generally an accepted method for a Grade 1 listed building, but may be acceptable for lower grades of buildings or for upgrading in non-listed buildings, e.g. Houses of Multiple Occupation (HMO's). A number of published proprietary methods are available from board suppliers but, as stated earlier, the evidence must apply to the design, construction, size and, most importantly, configuration of the door to be upgraded. Fire tests on latched doors do not apply to unlatched doors. Many proprietary systems take advantage of one-sided applications. The guidance in BS5588 and the Approved Document B to the Building Regulations (England and Wales) currently require protected routes to be fire resisting from both directions. This must be formally waived or the evidence must be available to show that this requirement can be met. The selection of seals, hardware, gaps etc is just as important with these doors as with historic doors.

IFSA Information Sheet 6: Guidance on the upgrading of joinery doors

8.0 Glazing in doors

It must be appreciated that replacement of any existing glass with fire resisting glass can be very disruptive to the fabric of the door and, because of the low profile of beads frequently used on historic doors, direct replacement of the glass may not automatically be successful in achieving the required level of fire performance. Non-insulating glass (e.g. GWPP) is highly conductive and allows the passage of radiation, both of which are likely to cause ignition of the unexposed face bead.

Where safety permits, partially insulating glass used as secondary glazed panes may be used to upgrade in a sympathetic manner. Unlike insulating glasses which limit temperature rise to 140°C, partially insulating glasses keep temperature rises to around 300-350°C and at these levels of temperature rise, ignition of timber beads on the non-exposed face is not possible without a pilot ignition source. These glasses provide additional protection in terms of reduced heat radiation, such that they allow lower profile timber beads to be used, and their characteristic of becoming opaque when exposed to heat can be an aid to evacuation. It is beneficial to use performance vetted fire resistant glasses and glazing systems. Many monolithic clear glasses are incompatible with timber beaded constructions because they cannot accept the amount of insulation protection that a timber bead provides with the result that they break in the early stages of exposure. It is vital when selecting glass to ensure that it has test evidence in timber doors with beads of the size to be used.

IFSA Information Sheet 6: Guidance on the upgrading of joinery doors

9.0 Summary of the protocol

Enhancing the performance of an existing door, particularly a joinery-panelled door, is not a simple matter of 'slapping on some intumescent paper'. If the door is inherently unstable this may do very little with respect to improving the fire resistance. Similarly, fitting intumescent seals may have no benefit if they are of the wrong material. Therefore if money is not to be wasted, or if the performance is to be guaranteed for safety reasons, then the upgrading should be undertaken correctly as a package of measures. The important stages in this process are:

1. Survey the door, frame, hardware and gaps in some detail.

2. Establish the likely fire resistance/ fire behaviour of the untreated door assembly by analysis.

3. Select and specify the intumescent seals, membrane protection and hardware needed to make good any shortfall in performance between the value established in 2) and that required.

Note: The test evidence used to substantiate the ability of the specified product to make up for the shortfall must relate to the substrate/materials used in the door to be upgraded. Frequently tests include plywood or chipboard in lieu of thin timber. In some cases further testing may be required to quantify the level of protection that can be provided should no appropriate evidence currently exist.

4. Prepare a detailed upgrading specification based upon the materials and components selected in above.

5A. Submit the proposed upgrading proposals to the appropriate regulatory body (Fire Service, Building Control, Environmental Health Officer, and District Surveyor) for their approval.

Note: Their approval effectively forms an assessment of performance as is legally required in Regulations and they would be seen to accept responsibility should the door fail in a fire.

Or alternatively

5B. Submit the proposed upgrading proposals to a suitably qualified, underwritten, independent body for an assessment report on the upgraded assembly and submit this to the relevant authority.

6. Instruct competent persons to modify the door exactly to the specification given in 4) above. Audit the final assembly to ensure compliance with the specification and to ensure that there has been no substitution of materials by persons not appreciative of the critical role of the products specified.

It can be seen that the correct methodology for upgrading a door assembly can be fairly onerous, requiring a number of specialist skills if the process is to be carried out correctly. If the authorities listed in 5) are willing to underwrite your specification without significant proof of performance, then it may be possible to eliminate some of these stages, but early consultation is urged to establish how lenient they may be in respect of their endorsement of your proposal.

10.0 The Role of the IFSA Technical Consultant in this process

Where full justification of the performance is required there are obvious benefits in seeking professional assistance in respect of stages 1, 2, 3, 4 and the audit in stage 6. If the authorities are not willing to underwrite your proposal at stage 5A then independent third party assistance will be required for stage 5B anyway.

KIWA Fire Safety Compliance, is able to provide the stages above, and the assessment report referred to in stage 5B as it is a nationally recognised independent fire safety authority that has actively worked alongside the Government bodies, England Heritage, BSI, Electrical Safety Council, in the preparation of Codes and Standards and fulfil the regulatory guidance recommendation of being a 'suitably qualified fire safety engineering body'. IFC carry substantial professional indemnity (PI) insurance as a measure of its confidence to carry out the task correctly.

Other suitably qualified fire safety engineering bodies may be able to provide an alternative underwriting service, but it is important to ensure the adequacy and range of cover of their PI.

As a measure of the Association's willingness to help, we may recommend selected IFSA Members literature that we believe will be of value in your upgrading task. Should any proprietary literature be suggested, this does not infer a formal endorsement of its suitability, although we are careful to only include information on materials that we think are supported by a wide range of evidence of performance and supplied by reputable manufacturers.

IFSA Information Sheet 6: Guidance on the upgrading of joinery doors

11.0 Information about IFSA

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

1. To promote the life safety benefit associated with the use of intumescent and smoke seals

2. To promote research and development into extending the areas where these benefits can be utilised

3. To participate in the development of test procedures for fire protection products in BSI, CEN and ISO which are fair, repeatable and reproducible.

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 door assemblies, 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 planned to investigate 25 years exposure to a variety of controlled and uncontrolled environments. Findings showed no detectable visual decline.

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 incorporated in ISO/TR 10295-3: 2012 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.

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.

Get in touch

Visit ifsa.org.uk for more information and expert technical guidance on fire door seals, smoke seals, glazing seals, and solutions for penetration and gap sealing.

Together, we're raising standards in fire safety - working to maximum safety and compliance across the fire protection industry.

Scan to meet our members

Visit the member showcase to discover how our community is shaping a fire-safe future.