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IFC FIELD OF APPLICATION REPORT PAR/10229/01 REVISION B

FIRE TEST STANDARD: BS476: PART 22: 1987

Field of Application of FireFace Plus for Upgrading Timber Panels in Joinery Doors and Panelled Walls

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1. INTRODUCTION

This report has been prepared by International Fire Consultants Ltd (IFC) to determine the Field of Application for the FireFace Plus system when installed on timber panels to upgrade the fire resistance performance of joinery doors and timber panelled walls to 30 minutes, if they were to be tested to the integrity criteria of BS476: Part 22: 1987. IFC have performed the evaluations/analysis, and preparation of the assessment report, on the instruction of Sealmaster Ltd.

Fire resisting assemblies are rarely supplied in an identical form to that which was tested. The specification will invariably require the product to be used, in applications, which are different from that tested. The result of a fire resistance test can apply to variations in constructions as long as they do not reduce the performance to one which is below that specified. The influence of those variations is covered by a judgement, sometimes made by the approving authority.

Where the approving authority does not feel technically able to make such judgement, or does not wish to take responsibility for them, then a third party expert opinion is often sought. Such an opinion is often expressed in the form of an assessment of the performance, which may be supported by numerical/quantifiable methods or may be purely an expert judgement.

The assessment is made with respect to the resistance to burn-through of the panels when exposed to the fire conditions as stipulated in BS476: Part 22: 1987.

The scope of this assessment is limited to the resistance to burn-through of the panel itself. It is assumed that all other aspects of the door leaves and wall construction have been proven by test or assessment to achieve the requested fire resistance within the limitations in Sections 2, 4 and 6, herein.

The assessment is based upon the FireFace Plus information supplied to IFC and upon the fire resistance test evidence summarised in Section 3 of this report. An analysis of the fire resistance performance of the product is presented in Section 4.

2. PROPOSAL

It is proposed that this assessment will define the Field of Application of FireFace Plus, a thin membrane designed to be adhered to the faces of timber panels of joinery timber doors and panelled walls, in order to increase the burn-through resistance of the panels as part of the upgrading process, to provide 30 minutes fire resistance, if they were to be tested to the integrity criteria of BS476: Part 22: 1987.

FireFace Plus is a three-layer membrane, 1.8mm thick overall, comprising a reinforced base layer, a high-density intumescent layer and a Birch ply surface layer to accept finishes or veneers.

This assessment only considers the use of FireFace Plus when applied to panels made from a variety of solid timbers which comply with the sizes, thickness and densities given in this report. The edges of the FireFace Plus, when applied to panels, shall be sealed with Sealmaster Masterseal intumescent compound around their perimeter, at the interface with the beading or framing.

The omission of information on any components or manufacturing methods does not imply a lack of approval of those details but these would need to be the subject of a separate analysis. Only those variations from the tested specification which are specifically mentioned are supported by this document.

The analysis and conclusions given in this report, regarding resistance to burn-through of panels, are based upon the specimens tested. Care must be taken when applying the conclusions of this report to specific existing doors and panelled walls which differ significantly from those tested. It is important therefore that the results of the tests and the conclusions of this assessment are only applied to alternative door or panel constructions by suitably experienced and qualified persons, such as the manufacturer's Technical Department, or International Fire Consultants Ltd, as authors of this approval.

It is important to realise that there are many parameters that have to be addressed in order to ensure that the upgraded door assembly will achieve 30 minutes fire resistance. These include leaf thickness, construction, condition, intumescent edge seals, hardware and door frame construction. Some of these parameters will apply to timber panelled walls. It must be noted that this assessment only addresses the contribution of the panel components to the fire resistance of the complete assembly.

3. TEST EVIDENCE

The following fire resistance test evidence has been taken into account in this assessment of FireFace Plus. The fire tests described in this section have been performed according to the general principles of BS476: Part 22: 1987.

3.1 Test 0608243

The test was carried out at the Dixon International laboratory on 24 August 2006, utilising a 1000mm high × 343mm wide × 12mm thick European Redwood flat jointed panel with glued vertical butt joint in the middle of the panel width. The panel was fitted within rebates/grooves machined into a timber frame surround. FireFace Plus, 960mm high × 303mm wide × 1.4–1.6mm thick, was applied to the both sides of the timber panel between the shoulders of the rebates in the surrounding timber frame. After 42 minutes, integrity failure was deemed to have occurred due to ignition of the cotton pad which was applied at mid-width of the top of the panel.

3.2 Test 0201291

The test was carried out at the Dixon International laboratory on 29 January 2002, utilising 2 European Redwood flat panels (panel A and panel B) with panel size of 1000mm high × 350mm wide × 12mm thick. Each panel was jointed with a dry butt joint in the middle of the panel width. FireFace Plus, 972mm high × 322mm wide × 1.7mm thick, was applied to the both sides of the timber panel between the beads of the surrounding timber frame.

- After 28 minutes, integrity failure was deemed to have occurred to panel A due to sustained flaming having commenced.
- After 36 minutes, panel B failed due to sustained flaming having commenced.

3.3 Test 0110171

The test was carried out at the Dixon International laboratory on 17 October 2001, utilising 2 European Redwood flat panels (panel A and panel B) with panel size of 1000mm high × 350mm wide × 12mm thick. Each panel was jointed with a dry butt joint in the middle of the panel width. FireFace Plus, 972mm high × 322mm wide × 1.7mm thick, was applied to the both sides of the timber panel between the beads of the surrounding timber frame.

- After 30 minutes, integrity failure was deemed to have occurred to panel A due to sustained flaming having commenced at the right hand vertical edge of the panel.
- After 32 minutes, panel B failed due to sustained flaming having commenced at the right hand vertical edge of the panel.

3.4 Test 9708211

The test was carried out at the Dixon International laboratory on 21 August 1997, utilising a 540mm high × 600mm wide × 12mm thick Far Eastern Plywood flat jointed panel with a dry butt joint in the middle of the panel width. FireFace Plus, 506mm high × 566mm wide × 2.5mm thick, was applied to the both sides of the timber panel between the beads of the surrounding timber frame.

- After 31 minutes, integrity failure was deemed to have occurred due to sustained flaming having commenced at the edge of the panel.

3.5 Test 9708221

The test was carried out at the Dixon International laboratory on 22 August 1997, utilising a 540mm high × 600mm wide × 12mm thick Far Eastern Plywood flat jointed panel with a dry butt joint in the middle of the panel width. FireFace Plus, 506mm high × 566mm wide × 2.5mm thick, was applied to the both sides of the timber panel between the beads of the surrounding timber frame.

- After 26 minutes, integrity failure was deemed to have occurred due to sustained flaming having commenced at the periphery of the panel.

3.6 Test 0308211

The test was carried out at the Dixon International laboratory on 21 August 2003, utilising a doorset with 4 Scots Pine flat panels. Panel sizes were 910mm high × 218/223mm wide × 11mm thick (panel A and panel B) and 524mm high × 218/223mm wide × 11mm thick (panel C and panel D). FireFace Plus, 906mm high × 214/219mm wide × 1.7mm thick and 520mm high × 214/219mm wide × 1.7mm thick, were applied to the both sides of each panel between the shoulders of the rebates of the surrounding timber frame.

- After 26 minutes, integrity failure was deemed to have occurred to panel D due to sustained flaming having commenced at top left hand corner.
- After 31 minutes, panel C failed due to sustained flaming having commenced at top right hand corner and mid-height of the hanging stile.

3.7 Test 0506131

The test was carried out at the Dixon International laboratory on 13 June 2005, utilising a doorset with 4 Scots Pine flat panels. Panel sizes were 907mm high × 220/216mm wide × 8–9mm thick (panel A and panel B) and 592mm high × 220/216mm wide × 8–9mm thick (panel C and panel D). FireFace Plus, 903mm high × 216/212mm wide × 1.7mm thick and 588mm high × 216/212mm wide × 1.7mm thick, were applied to the both sides of each panel between the shoulders of the rebates of the surrounding timber frame.

- After 26 minutes, integrity failure was deemed to have occurred to panel A due to sustained flaming having commenced at the periphery of the panel.
- After 29 minutes, panel C failed due to sustained flaming having commenced at the right hand vertical edge of the panel.

3.8 WARRES 62398

The test was carried out at the Warrington Fire Research Centre Ltd on 11 October 1994, utilising 2 Douglas Fir flat jointed panels (panel A and panel B) with a vertical joint in the middle of the width of each panel. Each panel size was 800mm high × 397.5mm wide × 6mm thick. A layer of 1.8mm thick FireFace was applied to the both sides of panel A, including underneath the beads fitted to the surrounding timber frame.

A double layer of FireFace with total thickness of 2.2mm was applied to the exposed face of panel B, including underneath the beads.

- After 31 minutes, integrity failure was deemed to have occurred to panel A due to a through gap more than 6mm wide by 150mm long forming at the right hand side of the panel.
- After 33 minutes, the integrity of the panel B remained intact. Then the test discontinued.

4. ANALYSIS

Evaluation of the fire resistance performance of the proposed FireFace Plus applied to timber panels in doors and walls, with the objective of upgrading the fire resistance of the panel to 30 minutes, will address the parameters that influence their overall fire performance under fire test conditions of BS476: Part 22: 1987. The parameters, which will make a contribution to the achievement of the required fire resistance period under BS476: Part 22: 1987 test conditions, are listed as following:

- Panel type: flat or raised and fielded panel
- Panel timber type: softwood or hardwood
- Panel jointing detail: single piece or jointed panel
- Panel surface condition: painted/varnished or untreated
- Application of the FireFace Plus
- Panel retention
- Panel thickness
- Panel size

When establishing the variations in the construction that can achieve the required fire resistance performance, International Fire Consultants Ltd follow the guidance given in BS.ISO/TR12470: 1998, *"Fire resistance tests - Guidance on the application and extension of results"*.

The timber panels with the FireFace Plus attached will be assessed in respect of the integrity criteria of BS476: Part 22: 1987.

4.1 Panel Type

An evaluation of the test reports summarised in Section 3 shows that all of the specimens included flat panels.

It is the experience of International Fire Consultants Ltd (IFC) that raised and fielded panels will provide, at least, the same periods of fire resistance as flat panels, provided that the minimum thickness of the fielded area of raised and fielded panels is the same as the minimum thickness of the flat panels.

Where the raised portion of the raised and fielded panel is in excess of 25mm thick and does not contain a joint it will not burn through prior to 30 minute fire resistance testing. If the panel satisfies the requirements stated in this paragraph then the FireFace Plus need only be applied at the panel fielded parts and any parts less than 25mm thick.

It is, therefore, the opinion of IFC that either flat or raised and fielded panels can be upgraded utilising FireFace Plus to achieve 30 minute fire resistance performance, subject to all other aspects of the panels being within the parameters of this report.

4.2 Panel Timber Type

An evaluation of the test reports summarised in Section 3 shows that all of the specimens included panels of Far Eastern Plywood, European Redwood, Scots Pine and Douglas Fir, of minimum density 510kg/m³.

It is the experience of IFC that, generally, the higher the density of timber the more resistant it is to charring.

It is, therefore, the opinion of IFC that softwood or hardwood panels, of minimum density 510kg/m³, can be upgraded utilising FireFace Plus to achieve 30 minute fire resistance performance, subject to all other aspects of the panels being within the parameters of this report.

4.3 Panel Jointing Detail

An evaluation of the test reports with jointed panels summarised in Section 3 shows that all of the jointed panels included a dry butt joint, apart from one which contained a glued butt joint. The specimen with a glued butt joint achieved the longest period of fire resistance, 42 minutes. All of the dry butt jointed panel specimens achieved in excess of 30 minutes, apart from two which achieved slightly less than 30 minutes, but the results can be attributed to other factors, as discussed below.

Test 0308211 was carried out on a 4-panel joinery doorsets and experienced integrity failure in the lower panels before 30 minutes. The failure of these panels was adjacent to the joint between the muntin and mid-rail of the door leaf, which was showing signs of being exploited in the test at 23 minutes. It is therefore the conclusion of IFC that the premature integrity failure experienced in these panels was due to deficiencies in the construction of the door leaf rather than the upgrading using the FireFace Plus material.

Test 0506131 was carried out on a 4-panel joinery doorsets and experienced integrity failure in two of the panels before 30 minutes. The panels were 8–9mm thick and were reported to 'have dished convex' at 18 minutes. It is therefore the conclusion of IFC that the premature integrity failure experienced in these panels was due to the thickness of the panels and their perimeter fixings (see Section 4.6) rather than the upgrading using the FireFace Plus material.

It is the experience of IFC that a panel constructed from a single piece of timber will achieve better test results than that achieved by a jointed panel. It can also be seen that a glued butt joint will achieve a better result than a dry butt joint.

It is, therefore, the opinion of IFC that single piece panels, glued butt jointed panels and dry butt jointed panels, can be upgraded utilising FireFace Plus to achieve 30 minute fire resistance performance, subject to all other aspects of the panels being within the parameters of this report.

4.4 Panel Surface Condition

The tests reports summarised in Section 3 were carried out utilising panel which were untreated, i.e. without paint or varnish.

It is the opinion of IFC that the FireFace Plus should only be applied to timber without paint or varnish, i.e. if the panel is painted or varnished this should be removed before the application of the FireFace Plus.

4.5 Application of the FireFace Plus

An evaluation of the test reports with the applications of FireFace Plus summarised in Section 3 shows that the majority of the panels included FireFace Plus on both faces of the panel. One test was carried out with FireFace applied in a double layer to the side of the specimen exposed to the furnace.

The majority of the test reports summarised in Section 3 included FireFace Plus material applied between beads/rebates. Test WARRES 62398 included FireFace Plus applied under 'loose' beads, with one specimen having it applied to both faces and one with the double layer on the side of the specimen exposed to the furnace.

In all of the tests the FireFace Plus was bonded to the face of the timber panel, using FireFace Plus adhesive, and a 'bead' of Sealmaster Masterseal sealant applied at the perimeter of the FireFace Plus, at the junction with the bead/framing.

It is the opinion of IFC that the FireFace Plus should be applied to both faces of panels. The FireFace Plus shall cover the complete face of flat panels, and, where the raised portion of a raised and fielded panel is in excess of 25mm thick, the FireFace Plus need only be applied at the parts of the panels that are less than 25mm thick. The FireFace Plus should be bonded using FireFace Plus adhesive and sealed around the edges with minimum 2mm x 1.8mm Sealmaster Masterseal intumescent material.

The approvals herein assume that the panel perimeter is fitted within a rebate or groove; i.e. with a 'solid' bead on one or both faces of the panel. Where a panel is only retained with 'loose' beads fitted to both faces of the panel, the FireFace Plus shall extend underneath the beads; which may necessitate replacement of existing beads.

An alternative to applying the FireFace Plus to both faces is to apply a double layer of material to one face, but the FireFace Plus must be fitted underneath the beads. All other aspects of the application should be as stated above. This application only applies in scenarios where the direction of fire exposure can be predicted, and the FireFace Plus shall be applied to the 'fire-exposed' face. Such scenarios must be agreed with the Approving Authority prior to commencement of works.

4.6 Panel Retention

An evaluation of the test reports summarised in Section 3 shows, that where panels were included within rebates in the surrounding framing, then no pin fixings were included. Where panels were installed utilising 'loose' beads, the beads were retained by means steel pins of at least 38mm long and 2.3mm diameter, at 45° to the plane of the panel, and at 100mm centres.

Tests 0308211 and 0506131 included panels retained in rebates in the surrounding framing which were 14mm deep. Both of these tests experienced premature integrity failure, due in the main part to other factors, however, the presence of pin fixings in the rebate shoulders would have resulted in enhanced fire resistance periods. It is noted that the 25mm rebate in test 0608243 retained the panel edge for in excess of 30 minutes.

For the majority of existing doors, the depth of the rebate into which a panel is retained is not something that can be determined from a 'non-invasive' inspection, and additional measures must be controlled to prevent exploitation of the panel perimeter.

It is the opinion of IFC that, in all panel configurations, additional fixings should be introduced, such that there are minimum 38mm long and 2.3mm diameter steel pins or screws, at 30–45° to the plane of the panel, at maximum 100mm centres; through existing solid rebates or loose existing or new beads.

4.7 Panel Thickness

An evaluation of the test reports for 12mm thick panels summarised in Section 3 shows that all of the panels included a dry butt joint or a glued butt joint, and FireFace Plus fitted between beads/rebates of the surrounding timber frame. Two of the specimens achieved slightly less than the required 30 minutes but they also included a slightly different arrangement of panel, and/or of the FireFace Plus material, to that which is assessed.

Tests 0308211 and 0506131 included 4-panel joinery doorsets with non-jointed panel thickness of 11mm and 8–9mm, respectively. Analysis of the premature failure of some of these panels is outlined in Section 4.3, but it can be seen that failure occurred at the perimeter of the 8–9mm thick panels, resulting from deflection of the panel during the fire resistance test, where the FireFace Plus is fitted between the beads.

It is noted from the test WARRES 62398 that two panels, with only 6mm thickness, each achieved 31 minutes and 33 minutes fire resistance respectively, when applying the FireFace underneath the beads of panels.

Panel thickness is known to be important in determining the burn through resistance and the degree of distortion that a timber panel will experience under fire resistance test exposure. A thicker panel will take more time to char through and will be stiffer, thus placing less stress on the perimeter.

It is, therefore, the opinion of IFC that flat panels that have a minimum thickness given in Table 1, and raised and fielded panels where the fielded areas have a minimum thickness given in Table 1, can be upgraded utilising FireFace Plus to achieve 30 minute fire resistance performance; with FireFace Plus material between beads/rebates or under the beads, as indicated, subject to all other aspects of the panels being within the parameters of this report.

Panel Jointing Detail	FireFace Plus Positioning	Minimum Panel Thickness
No Joint	Between Beads/Rebates *	10mm
Glued Butt Joint	Between Beads/Rebates *	10mm
Dry Butt Joint	Between Beads/Rebates *	12mm
No Joint	Under Beads	6mm
Glued Butt Joint	Under Beads	6mm
Dry Butt Joint	Under Beads	6mm

Table 1 – Minimum Panel Thickness

Note Where a panel is only retained with loose beads fitted to both faces of the panel, the FireFace Plus shall extend underneath the beads; irrespective of the panel thickness.*

4.8 Panel Size

An evaluation of test 0608243, summarised in Section 3.1, shows that a 1000mm high × 343mm wide × 12mm thick panel containing a glued butt joint achieved 42 minutes fire resistance performance.

An evaluation of tests 0201291 and 0110171, summarised in Sections 3.2 and 3.3, shows that the specimen comprised four 1000mm high × 350mm wide × 12mm thick panels containing dry butt joints. Three of the panels achieved in excess of 30 minutes fire resistance, the other one was slightly less than the required 30 minutes fire resistance, as it had a slightly different arrangement of the FireFace Plus material.

An evaluation of test WARRES 62398, summarised in Section 3.8, shows that two 800mm high × 397.5mm wide × 6mm thick panels incorporating a vertical joint achieved 31 minutes and 33 minutes fire resistance.

An evaluation of tests 9708211 and 9708221, summarised in Sections 3.4 and 3.5, shows that the specimen comprised two 540mm high × 600mm wide × 12mm thick panels containing dry butt joints. One of the panels achieved 31 minutes fire resistance, the other one was less than the required 30 minutes fire resistance due to a slightly different arrangement of the FireFace Plus material.

Tests 0308211 and 0506131, summarised in Section 3.6 and 3.7, included 4-panel joinery doorsets with non-jointed panel which were smaller than those given above. Analysis of the premature failure of some of these panels is outlined in Section 4.3.

The maximum tested panel area was 0.35m², the maximum panel height was 1000mm and the maximum panel width was 600mm.

It is, therefore, the opinion of IFC that panels of maximum area 0.35m², maximum height 1100mm and maximum width 600mm, can be upgraded utilising FireFace Plus to achieve 30 minute fire resistance performance, subject to all other aspects of the panels being within the parameters of this report.

5. CONCLUSIONS

It is the opinion of International Fire Consultants Ltd that, if the proposed FireFace Plus was applied to timber panels (with a view to upgrading the burn-through resistance of the panel as part of the contribution of the fire resistance performance of joinery doors and panelled walls), and was installed in accordance with the requirements of this report, the timber panels would satisfy the integrity criteria for 30 minutes when tested to the conditions of BS476: Part 22: 1987.

The conclusion is limited to the resistance to burn-through of the panel itself. It is assumed that all other aspects of the door leaves and wall construction, as applicable, will have been proven by test or assessment to achieve the required level of fire resistance; within the limitations in Sections 2, 4 and 6, herein.

6. LIMITATIONS

This Assessment Report, which is only valid for proposed FireFace Plus (when applied to timber panels for upgrading the burn through resistance performance of joinery doors and panelled walls, as part of the contribution to the fire resistance), addresses itself solely to the ability of the material described to satisfy the criteria of the fire resistance test. It does not imply any suitability for use with respect to other unspecified criteria.

This document only considers the proposed FireFace Plus applied to timber panels as part of the upgrading process of the fire resistance performance of joinery doors and walls, and assumes that the surrounding construction (i.e. the door leaf, or the wall into which the assembly is installed) will provide no less restraint than the tested assemblies, and that it will remain in place and be substantially intact for the full fire resistance period.

Where the constructional information in this report is taken from details provided to International Fire Consultants Ltd (IFC) and/or from fire resistance test reports referenced herein, it is, therefore, limited to the information given in those documents. It is necessarily dependent upon the accuracy and completeness of that information. Where constructional or manufacturing details are not specified, or discussed herein, it should not, therefore, be taken to infer approval of variation in such details from those tested or otherwise approved.

The analysis and conclusions within this report are based upon the likely fire resisting performance of a complete assembly that is manufactured and installed in accordance with this document, and offered for fire resistance testing in 'perfect' condition. In practice, management procedures must be in place in any building where the products are installed, to ensure that no parts of the assembly are damaged or faulty. Determination of what constitutes wear or damage, and any corrective actions in order to return the panels to the required condition, should only be carried out following consultation with the manufacturer and IFC.

Where the assessed constructions have not been subject to an on-site audit by International Fire Consultants Ltd, it is the responsibility of anyone using this report to confirm that all aspects of the assemblies fully comply with the descriptions and limitations herein.

Any materials specified in this report have been selected and judged primarily on their fire performance. IFC do not claim expertise in areas other than fire safety. Whilst observing all possible care in the specification of solutions, we would draw the reader's attention to the fact that during the construction and procurement process, the materials used should be subjected to more general examination regarding the wider Health and Safety, and CoSHH Regulations. Designers, manufacturers and installers are also reminded of their responsibilities under the CDM Regulations; particularly with regard to installation and maintenance.

This Report is provided to the sponsor on the basis that it is a professional independent engineering opinion as to what the fire performance of the construction/system would be should it be tested to the named standard. It is IFC's experience that such an opinion is normally acceptable in support of an application for building approvals, certainly throughout the UK and in many parts of Europe and the rest of the world.

However, unless IFC have been commissioned to liaise with the Authorities that have jurisdiction for the building in question for the purpose of obtaining the necessary approvals, IFC cannot assure that the document will satisfy the requirements of the particular building regulations for any building being constructed.

It is, therefore, the responsibility of the sponsor to establish whether this evidence is appropriate for the application for which it is being supplied and IFC cannot take responsibility for any costs incurred as a result of any rejection of the document for reasons outside of our control. Early submittal of the Report to the Authorities will minimise any risks in this respect.

7. VALIDITY

This assessment has been prepared based on International Fire Consultants Ltd's present knowledge of the product described, the stated testing regime and the submitted test evidence. For this reason anyone using this document after August 2021 should confirm its ongoing validity.

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