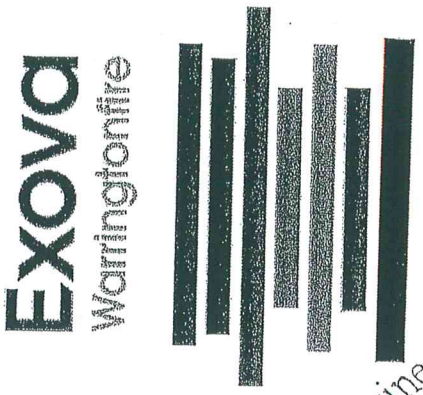

Assessment Report

The Fire Resistance Performance Of Timber Based Doorsets To Provide 30 Minutes Integrity

EWA Report No:

23770-01

Report Sponsor:

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DOCUMENT REVISION STATUS

Date Issued DD/MM/YY	Issue No.	Description
10/12/09	23770-00	Initial Issue
12/11/14	23770-01	Technical review of the report content in order to extend its validity for a further period of 5 years

CONTENTS

1 INTRODUCTION

1.1 This report presents an appraisal of the fire resistance performance of timber based doorset designs based primarily on the doorset as described in report R08K13, when modified as detailed in this report.

1.2 The proposed doorsets are required to be capable of performances of 30 minutes integrity and insulation with respect to BS 476: Part 22: 1987.

1.3 This report is invalidated if applied in combination with any other assessment not described in the Appendices of this report.

1.4 The data referred to in Section 7 (Supporting Data) of this report has been considered for the purpose of this appraisal, which has been prepared based on the principles of Fire Test Study Group Resolution 82, 2001.

1.5 Additional data to support specific modifications may be referred to in the appropriate Appendices of this report.

1.6 This report may only be reproduced in full without modifications by the report sponsor. Copies, extracts, or abridgments of this report in any form shall not be published by other organisations without permission of Exova Warringtonfire Aus Pty Ltd.

2 REQUIREMENTS

2.1 Doorsets will be installed into structural openings within supporting construction of brickwork, concrete blocks, or reinforced concrete having shown by fire testing to be capable of supporting steel doorsets without detriment for the required period of 30 minutes

2.2 Doorsets will be in the fully closed and latched position.

2.3 Doorsets will be constructed in a similar manner from materials and components of the same manufacture and equivalent quality as tested or, as otherwise appraised by Exova Warringtonfire.

2.4 Further requirements relating to specific modifications may be stated in the appropriate Appendices of this report.

3 CONCLUSIONS

Integrity performance

3.1 If the doorset design primarily represented by the specimen doorset as described in R08K13 had been modified as described in this report, it is expected it would have been capable of performances of 30 minutes integrity, if tested in a similar manner.

Insulation performance

3.2 When uninsulated features are absent, the modified doorsets are fully insulated and the expected performance 30 minutes insulation as defined in Clause 6 of BS 476: Part 22: 1987.

3.3 When the cumulative area of uninsulated features present is up to area equivalent to 20% of the leaf area, the doorsets are partially insulated, and the expected performance is 30 minutes insulation as defined in Clause 7 of BS 476: Part 22: 1987. Uninsulated features include uninsulated glazing, air transfer grilles and dampers.

Asahi wire reinforced glass: Appendix 13

3.4 Appendix 13 considers 7.2mm thick Asahi wire reinforced glass for applications requiring 30 minutes integrity.

3.5 While the glazing details assessed in Appendix 13 are supported implicitly by the available test data, it is necessary to provide a qualified statement. Accordingly, it is considered that:

- The the propsosed doorsets fitted with apertures glazed with 7.2mm thick Asahi wire reinforced glass as described in Appendix 13 would represent reasonable designs for specimens to be offered for actual testing in accordance with BS 476: Part 22: 1987 with the intention of achieving a performance of 30 minutes integrity.

Additional glazing options: Appendix 14

3.6 Appendix 14 considers apertures glazed with 25mm thick Hengbao FFB-25, 30mm thick Shenzhen Shekou Longdian glass or, 25mm thick Keymax EI60 60-25 insulated glass or, 25mm thick FFB-25 insulated glass intended to provide 30 minutes integrity and 30 minutes insulation.

3.7 In addition, Longdian 8mm and 10mm thick heat-treated glass are intended to provide 30 minutes integrity only.

3.8 While the glazing details assessed in Appendix 14 are supported implicitly by the available test data, it is necessary to provide a qualified statement. Accordingly, it is considered that:

- The the propsosed doorsets fitted with glazed apertures as described in Appendix 14 would represent reasonable designs for specimens to be offered for actual testing in accordance with BS 476: Part 22: 1987 with the intention of achieving a performance of 30 minutes integrity and 30 minutes insulation or, 30 minutes integrtiy only, depending on the type of glass.

Adjacent construction: Appendices 11, 15, and 17

3.9 For the purpose of this assessment, doorsets are interpreted as elements comprising opening leaves and the immediate perimeter frame members. The interpretation of adjacent areas of fixed side and transom panels is at the discretion of the relevant authority.

Validity of supporting data

3.10 This Conclusion is conditional on the supporting test and assessment reports being currently valid. An expired report invalidates this Conclusion.

4 VALIDITY

4.1 This assessment report does not provide an endorsement by Exova Warringtonfire Aus Pty Ltd of the actual products supplied.

4.2 The conclusions of this assessment may be used to directly assess fire hazard, but it should be recognised that a single test method will not provide a full assessment of fire hazard under all conditions.

4.3 Because of the nature of fire testing, and the consequent difficulty in quantifying the uncertainty of measurement, it is not possible to provide a stated degree of accuracy. The inherent variability in test procedures, materials and methods of construction, and installation may lead to variations in performance between elements of similar construction.

4.4 The assessment can therefore only relate to the actual prototype test specimens, testing conditions and methodology described in the supporting data, and does not imply any performance abilities of constructions of subsequent manufacture.

4.5 This assessment is based on information and experience available at the time of preparation. The published procedures for the conduct of tests and the assessment of test results are the subject of constant review and improvement and it is recommended that this report be reviewed on or, before, the stated expiry date.

4.6 The technical content of this report remains the intellectual property of Exova Warringtonfire. Therefore to maintain its applicability, if contradictory evidence becomes available the assessment will be unconditionally withdrawn and Garish Crown Fire Engineering & Consultancy be notified in writing. Similarly, the assessment is invalidated if the assessed construction is subsequently tested because actual test data is deemed to take precedence over an expressed opinion.

4.7 The information contained in this report shall not be used for the assessment of variations other than those stated in the conclusions above. The assessment is valid provided no modifications are made to the systems other than those detailed in this report. All details of construction should be consistent with the requirements stated in the relevant test reports and all referenced documents.

4.8 This assessment is only valid if accompanied by full copies of the indicated supporting data.

5 DECLARATION BY: GARISH CROWN FIRE ENGINEERING & CONSULTANCY

By distributing copies of this report we, Garish Crown Fire Engineering & Consultancy, confirm that:

to our knowledge the component or element of structure, which is the subject of this assessment, has not been subjected to a fire test to the Standard against which this assessment is being made,

we agree to withdraw this assessment from circulation should the component or element of structure be the subject of a fire test to the Standard against which this assessment is being made,

we are not aware of any information that could adversely affect the conclusions of this assessment; if we subsequently become aware of any such information, we agree to ask the assessing authority to withdraw the assessment.

6 AUTHORISATION BY: EXOVA WARRINGTONFIRE AUS PTY LTD

6.1 **Signatures**

Prepared by:

S McKettle

Reviewed by:

K Nicholls

6.2 **Date of Issue**

12th November 2014

6.3 **Date of Expiry**

30th November 2019

7 SUPPORTING DATA

7.1 The following report summaries are provided for information only. Reference shall be made to complete copies of the reports for full specifications.

7.2 **R08K13**

A report of a fire resistance test by RED stated to be in accordance with BS 476: Part 22: 1987 on single-acting, double-leaf timber doorset. Both door leaves were nominally 2300mm high by 1050mm wide by 48mm thick.

The leaf core comprised a 90mm wide by 38mm thick timber framework of perimeter stiles and rails and 50mm wide by 38mm thick intermediate rails infilled with 20~40mm wide vertical timber lamels. The core was clad on both sides with 5mm thick plywood and lipped on all edges with 10mm thick timber. The core and lippings were of timber of stated/unmeasured density 550kg/m^3.

The passive leaf was fitted with an aperture of nominal sight size 1200mm high by 250mm wide glazed with Pyroshield glass retained between timber beads and bedded on Arbo XL1075 intumescent sealant of minimum section 12mm by 4mm. The active leaf was similarly glazed with an aperture having a nominal sight size of 500mm high by 500mm wide. The 19mm by 15mm glazing beads were of timber of stated/unmeasured density 550kg/m^3.

Pyroplex based intumescent seals of 10mm wide by 4mm thick by Gallford were fitted as follows: centrally in the reveals of the head and hanging jambs, in each of the rebated meeting edges, and a 200mm length in the frame reveals adjacent to the hinge blades.

The leaves were fitted with overhead surface mounted closers on the exposed face and were hung in a single-rebated timber frame, of stated/unmeasured density 550kg/m^3, to open towards the furnace. A cylindrical latch and top and bottom flush bolts were fitted.

Integrity	:	32 minutes, no failure, test discontinued
Insulation	:	32 minutes, no failure
Test Date	:	24th November 2008
Test Sponsor	:	Garish Crown Fire Engineering & Consultancy

After 30 minutes, the maximum leaf edge movement relative to the frame was 14mm at mid-height of the hanging edge of the passive leaf; at all other locations, including the meeting edges, the maximum relative deflection was 5mm.

7.3 **R07L06B**

A report of a fire resistance test by RED stated to be in accordance with BS 476: Part 22: 1987 on single-acting, double-leaf timber doorset. Both door leaves were nominally 2300mm high by 1050mm wide by 50mm thick. A cylindrical latch and top and bottom flush bolts were fitted, but were not engaged during the test.

The leaf core comprised a 75mm wide by 40mm thick timber framework of perimeter stiles and rails and 50mm wide by 40mm thick intermediate rails infilled with vertical timber lamels of 40mm thick by 25~50mm wide. The core was clad on both sides with 5mm thick plywood and lipped on all edges with 10mm thick timber. The core and lippings were of timber of stated/unmeasured density 550kg/m^3.

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The passive leaf was fitted with an aperture of nominal sight size 1141mm high by 186mm wide glazed with Pyroshield glass retained using System 90 Plus. The active leaf was similarly glazed with an aperture having a nominal sight size of 815mm high by 315mm wide. The glazing beads were of timber of stated/unmeasured density 600kg/m^3.

Palusol based intumescent seals were fitted as follows: a 30mm wide seal in the frame reveal at the head, 30mm wide seals in the hanging jambs, and two 15mm wide seals in the rebated meeting edges. The hinges blades were bedded on intumescent sheet material.

The leaves were fitted with overhead surface mounted closers on the exposed face and were hung in a timber frame, of stated/unmeasured density 600kg/m^3, to open towards the furnace. The timber door frame profiles were fixed to a plywood sub-frame concealed by planted architraves.

Integrity	:	67 minutes, no failure
Insulation	:	67 minutes
Test Date	:	14th December 2007
Test Sponsor	:	Garish Crown Fire Engineering & Consultancy

After 30 minutes, the maximum leaf edge movement relative to the frame was 11mm at bottom of the hanging edge of the passive leaf; at all other leaf to frame gaps the maximum relative deflection was 7mm and 4mm at the meeting edges. After 45 minutes, the maximum leaf edge movements relative to the frame were up to 20mm, and 11mm at the meeting edges.

7.4 **FR2962**

A report of a fire resistance test stated to be in accordance with BS 476: Part 22: 1987 (the furnace equipment did not fully comply with BS 476: Part 20: 1987) on a latched, single-acting, single-leaf doorset. The leaf was 2060mm high by 890mm wide by 50mm thick, and based on an internal timber framework of laminated perimeter stiles and rails, and mid-rail, infilled with further vertical laminations, plywood facings, and timber leaf edge lippings.

The doorset included a transom panel similar to door leaf construction. The transom panel lower edge and top edge of the leaf were rebated. Two 15mm wide intumescent seals were fitted in the frame reveals and in the lower edge of the transom panel.

Integrity	:	62 minutes, no failure
Insulation	:	62 minutes
Test Date	:	3rd October 2001
Test Sponsor	:	The sponsor, whose details are retained on the file relating to this assessment, has given permission for the use of this data.

* A section of lipping had charred away near a bottom corner after 51 minutes. After 57 minutes, the leaf was penetrated, by charring, near the bottom hinge. Intermittent flaming was observed at the lockset position after 59 minutes.

After 60 minutes, the maximum leaf edge movements relative to the frame were up to 30mm at the bottom latch corner. At the head, the maximum movement was 13mm.

7.5 **FR3028**

A report of a fire resistance test by BRANZ stated to be in accordance with BS 476: Part 22: 1987 on a latched and bolted, single-acting, double-leaf doorset. The leaf construction comprised an internal framework and infill of laminated timber sections, mineral based sub-facings, plywood skins, and timber lippings. The leaves were 2270mm high by 990mm wide by 49mm thick and were mounted on three butt hinges in a back-filled steel frame to open towards the furnace.

30mm wide intumescent seals were fitted in the top and hanging edges of the leaves with the hinge blades bedded on 2mm thick intumescent material. The meeting edge of the passive leaf was fitted with a centrally located, 10mm wide intumescent seal, with two offset seals in the meeting edge of the active leaf. The leaf was fitted with a cylindrical lockset, which interrupted the intumescent seals, and an overhead surface mounted closer on the exposed side.

Integrity	:	65 minutes, cotton pad held just above the lock position
Insulation	:	65 minutes
Test Date	:	1st October 2002
Test Sponsor	:	The sponsor, whose details are retained on the file relating to this assessment, has given permission for the use of this data.

7.5 **FR3064**

A report of a fire resistance test by BRANZ stated to be in accordance with BS 476: Part 22: 1987 on a latched and bolted, double-acting, double-leaf doorset. The leaf construction comprised an internal perimeter timber framework, a continuous particleboard infill panel, mineral based sub-facings, plywood skins, and timber lippings. The leaves were 2299mm high by 1100mm and 350mm wide by 48mm thick. The leaves were mounted on different models of floorspring closers.

Two 10mm wide intumescent seals were fitted in the frame reveals. A 30mm wide seal was fitted in one meeting edge. Addition lengths of 10m wide seal were fitted at the top centre positions.

The active leaf was fitted with a cylindrical lockset. The passive leaf was fixed at the top and bottom by barrel bolts fixed to the exposed face of the leaf.

Integrity	:	51 minutes*
Insulation	:	51 minutes
Test Date	:	7th February 2002
Test Sponsor	:	The sponsor, whose details are retained on the file relating to this assessment, has given permission for the use of this data.

*Loss of integrity was caused by sustained flaming from the top centre position on the passive leaf. Test discontinued after 63 minutes, when sustained flaming was observed at the top centre position of the active leaf. The maximum recorded leaf edge deflection relative to the door frame was 11mm, and the maximum relative movement between the meeting edges was 10mm.

7.6 **BWA No. 23487-01**
A report by Bodycote Warringtonfire presenting a general scope of application for SOSS hinges models 216, 218, 220SS, 416SS, 418SS, and 420SS when fitted to previously fire tested timber doorsets.

Hinge models 416SS and 418SS (formerly 218SS) are approved for applications requiring 60 minutes when fitted to timber doorsets.

The scope of application includes performances of 30 and 60 minutes integrity with respect to BS 476: Part 22: 1987.

Report Sponsor : SOSS Asia Pte Ltd, who has given permission for the use of this data

7.7 **CERTIFIRE – CF184**
Certificate CF184 and its associated data sheets define a scope of application for the System 36 glazing system for Lorient Polyproducts Ltd. The certification is based on manufacture under an approved quality system and fire resistance test data in accordance with BS 476: Part 22: 1987.

Certifire is operated by Warringtonfire Certification, which is accredited by UKAS to EN 450011:1988 (ISO/IEC Guide 65:1996).

A soft copy of CF201 can be downloaded from:
http://www.warringtonfire.net/certifire/

7.8 **CERTIFIRE – CF201**
Certificate CF201 and its associated data sheets define a scope of application for the System 630 glazing system for Lorient Polyproducts Ltd. The certification is based on manufacture under an approved quality system and fire resistance test data in accordance with BS 476: Part 22: 1987.

Certifire is operated by Warringtonfire Certification, which is accredited by UKAS to EN 450011:1988 (ISO/IEC Guide 65:1996).

A soft copy of CF201 can be downloaded from:
http://www.warringtonfire.net/certifire/

7.9 **CERTIFIRE – CF346**
Certificate CF486 and its associated data sheets define a scope of application for the Pyroplex 8193 glazing system for Pyroplex Ltd. The certification is based on manufacture under an approved quality system and fire resistance test data in accordance with BS 476: Part 22: 1987.

Certifire is operated by Warringtonfire Certification, which is accredited by UKAS to EN 450011:1988 (ISO/IEC Guide 65:1996).

A soft copy of CF486 can be downloaded from:
http://www.warringtonfire.net/certifire/

7.10 **CERTIFIRE – CF348**

Certificate CF348 and its associated data sheets define a scope of application for the Pyroplex 30049, 30054, and 8492 30-minute glazing systems for Pyroplex Ltd. The certification is based on manufacture under an approved quality system and fire resistance test data in accordance with BS 476: Part 22: 1987.

Certifire is operated by Warringtonfire Certification, which is accredited by UKAS to EN 450011:1988 (ISO/IEC Guide 65:1996).

A soft copy of CF348 can be downloaded from:
http://www.warringtonfire.net/certifire/

7.11 **CERTIFIRE – CF316**

Certificate CF316 and its associated data sheets define a scope of application for the Pyroglaze 30 and Mann McGowan 300 glazing systems for Mann McGowan Fabrications Ltd. The certification is based on manufacture under an approved quality system and fire resistance test data in accordance with BS 476: Part 22: 1987.

Certifire is operated by Warringtonfire Certification, which is accredited by UKAS to EN 450011:1988 (ISO/IEC Guide 65:1996).

A soft copy of CF316 can be downloaded from:
http://www.warringtonfire.net/certifire/

7.12 **BETC-NH-2005-426**

A report of a fire resistance test by the Building Engineering Testing Center of China Academy of Building Research stated to be in accordance with BS 476: Part 22: 1987 on a fully glazed, double-leaf, double-acting, doorset of overall size 2300m high by 2100mm wide.

The leaves were 2190mm high by 998mm wide glazed with 25mm thick Hengbao FFB-25 insulated glass of nominal sight size was 2135mm high by 827mm wide (from the drawings).

The perimeter framework of the leaves was based on steel rectangular hollow sections faced on both sides with 12mm thick 'Fire-resistant material' to form the glazing channels. The leaves were mounted on Dorma BTS 65 floorspring closers. The schedule of components refers to a bolt, but this is not shown of the drawings.

Integrity	:	80 minutes*
Insulation	:	53 minutes**
Test Date	:	28th June 2005
Test Sponsor	:	Heshan Hengbao Fire Resistant Glass Factory Co Ltd, who has given permission to use this data.

*Loss of integrity after 80 minutes occurred when 'The glass on left door-leaf melted and fell off'. This is interpreted as failure with respect to the gap criteria of the testing standard.

**Loss of insulation was caused by a temperature rise of 180^{0}C rise on the pane in left hand leaf. A temperature rise in excess of 180^{0}C was recorded on the pane in the right hand leaf after 58 minutes.

7.13 **R05J12B**

A report of a fire resistance test by RED stated to be in accordance with BS 476: Part 22: 1987 on a single-acting, double-leaf, steel doorset that included a transom panel separated from the leaves by a transom rail.

The door leaves were nominally 2400mm high by 1120mm wide by 44mm thick and the transom panel was 400mm high. The construction of the leaves and transom panel was based on 1.2mm thick mild steel skins joined at the vertical edges with lockseam joints and closed with steel channels at the top and bottom edges. The core was an unspecified paper honeycomb material. Additional reinforcement was provided at ironmongery positions.

Each meeting edge was fitted with a 1.2mm thick, h-section steel profile to provide double rebates of 25mm wide. The door leaves were hung in a hollow steel frame in drywall supporting construction to open away from the heating conditions.

The passive leaf was mounted on four butt hinges, retained by top and bottom flush bolts, and was fitted with a Commy 103 overhead closer on the unexposed side. The active leaf was latched, and was mounted on four spring hinges.

Each leaf was fitted with an aperture glazed with 6mm thick Jiangang glass**. The sight sizes were 1000mm high by 200mm wide in the left hand leaf and 500mm by 500mm in the right hand leaf. The glass edges were bedded on ceramic fibre tape and retained by mating, screw-fixed hollow steel beads.

The transom panel was retained in place by two unspecified 'drawer locks' at each vertical edge at 50mm from the corners, and one such lock at the mid-point of the top edge. The hollow transom rail section was 100mm deep by 80mm wide, with rebates of 23.5mm to locate the leaf and transom panel edges. The ends of the transom rail were bolted to the side jambs.

Integrity	:	27 minutes, sustained flaming at the closer position*
Test Date	:	7th October 2005
Test Sponsor	:	The sponsor, whose details are retained on the file relating to this assessment, has given permission for the use of this data.

*After the initial loss of integrity at 27 minutes, subsequent integrity weaknesses occurred at the right hand glazed aperture due to gap development after 47 minutes. At the left hand glazed aperture a similar failure occurred after 71 minutes, and at the left edge of the transom panel sustained flaming was observed after 84 minutes. Test discontinued after 90 minutes.

**The specimen details refer to both Firelite and Jiangang glass in the glazed apertures in the door leaves. Because of the observed softening, and general behaviour of the tested panes, the correct specification has been taken to be Jiangang glass, which is likely to have been a heat-treated float glass.

7.14 **WFRC No. C109437**

A report by Warrington Fire Research presenting an appraisal of the general application of LVV40 intumescent air transfer grilles by Lorient Polyproducts Ltd. The appraisal is based on test evidence relating to both grille designs installed in various forms of supporting construction. The appraised maximum size of LVV40 grilles is 600mm by 600mm providing the target doorset has been fitted with an aperture of similar size.

Report for : Lorient Polyproducts Ltd, who has given permission for the use of this data.

7.15 **WF No. 167746***

A report by Bodycote Warringtonfire of a fire resistance test in accordance with BS 476: Part 22: 1987 performed on a single-acting double-leaf timber based doorset. The door leaves were 2100mm high by 1000mm wide by 54mm thick and opened towards the heating conditions. The door leaf construction was based on an internal timber framework of perimeter stiles and rails infilled with flaxboard, calcium silicate board sub-facings, plywood facings and timber edge lippings. The leaves were each hung of four butt hinges in a timber frame.

A latch was fitted but was disabled for the purpose of the test.

Pyroplex intumescent seals of 20mm by 4mm in G-Lex carriers were fitted in the vertical frame reveals and in the frame reveal at the head. A similar 20mm by 4mm seal in a G-Lex carrier, with an integral smoke seal, was fitted in one meeting edge. Additional intumescent components were fitted at ironmongery positions.

Integrity	:	75 minutes
Insulation	:	75 minutes
Test Date	:	25th November 1996
Test Sponsor	:	Pyroplex Ltd, who's HK representative Gallford Ltd has given permission to use this data.

*This report is a reissue of test report WARRES No. 69701 for Reddiplex Group Plc, in order to reflect a change of ownership of the test data to Pyroplex Ltd.

7.16 **WFRC No. 122567**

A report by Warrington Fire Research Centre presenting an assessment based on test data provided by WARRES No. 68330/B, report C122567 presents a scope of application for LVN 20 and LVN 25 intumescent air transfer grilles.

The scope of application requires the grilles to be fitted in an appropriate manner in timber based doors leaves for applications requiring 30 or 60 minutes integrity, depending on the supporting data relating to the doorset.

Report for : Lorient Polyproducts Ltd, who has given permission to use this data.

7.17 **British Standards Institute**

BS 5268: Part 4: Section 4.1: 1978, Structural use of timber. Fire resistance of timber structures. Recommendations for calculating fire resistance of timber members.

BS 8214: 1990, Code of practice for fire door assemblies with non-metallic leaves.

7.18 **I3E06**

A report of a fire resistance test by RED stated to be in accordance with BS 476: Part 22: 1987 on a two panes of 25mm thick Keymax EI60/60-25 glass of unspecified composition supported in a timber-framed screen.

The screen was of overall size 3025mm high by 1515mm wide and comprised a perimeter frame and a single transom member. The larger, lower pane was 2420mm high by 1415mm wide. The panes were retained by screw-fixed timber beads providing 25mm edge cover. A Gluske intumescent seal was fitted at the bottom of the glazing channel, with Gluske ceramic fibre tape between pane and beads. The pane edges are pointed with Lorient intumescent sealant.

The schedule of components in the report do not appear to fully match the client's drawings with respect to the framing members, which, according to the client's drawings, were clad with 8mm Mega board covered with wood veneer.

Integrity	:	67 minutes, no failure
Insulation	:	64 minutes, by roving thermocouple on the larger pane
Test Date	:	22nd May 2008
Test Sponsor	:	Keymax Development Ltd, who has given permission to use this data.

7.19 **BETC-NH-2000-F-012**

A report of a fire resistance test by the Building Engineering Testing Center of China Academy of Building Research stated to be in accordance with BS 476: Part 22: 1987 on a single pane of 30mm thick glass comprising outer layers of 6mm thick tempered glass with an 18mm thick gel interlayer.

The pane was 2052mm high by 2402mm wide and retained in a steel SHS perimeter frame between hollow steel RHS beads. An intumescent seal is fitted at the bottom of the glazing channel. The material between the pane and bead is not described. The pane edges are pointed with Dow Corning silicone sealant.

Integrity		78 minutes, no failure
Insulation	:	78 minutes, by roving thermocouple
Test Date	:	1st November 2000
Test Sponsor	:	Shenzhen Shekou Longdian Safety Technology Research Ltd, who has given permission to use this data.

7.20 **WARRES No. R12862**

A report of a fire resistance test by Warrington Fire Research in accordance with BS 476: Part 22: 1987 on a steel screen fully glazed with seven panes of Asahi wire reinforced glass of maximum nominal pane size 2010mm high by 1010mm wide. The glass panes were of 6.8mm and 7.2mm thick.

The glass was asymmetrical in that the wire reinforcement was offset from the centre of the panes. The panes were oriented with the wire reinforcement facing towards and away from the heating conditions.

Integrity	:	60 minutes
Insulation	:	6 minutes
Test Date	:	1st October 2002
Test Sponsor	:	Rankin Glass Co Ltd. Asahi Glass Co Ltd has provided this data.

7.21 **BETC-NH-2006-198**

A report of a fire resistance test by the Building Engineering Testing Center of China Academy of Building Research stated to be in accordance with BS 476: Part 22: 1987 on a single pane of 8mm thick, monolithic, heat-treated glass.

The pane was 2100mm high by 120mm wide and retained in a steel perimeter frame between hollow steel SHS beads of 40mm by 40mm by 3mm. There is no schedule of components for confirmation, but the drawings show an unspecified material fitted between the glass and the SHS beads.

Integrity	:	62 minutes, no failure
Test Date	:	31st March 2006
Test Sponsor	:	Shenzhen Longdian Sci-Tech Industrial Co Ltd, who has given permission to use this data.

7.22 **BETC-NH-2005-299**

A report of a fire resistance test by the Building Engineering Testing Center of China Academy of Building Research stated to be in accordance with BS 476: Part 22: 1987 on a single pane of 10mm thick, monolithic, heat-treated glass.

The pane was 2100mm high by 120mm wide and retained in a steel perimeter frame between hollow steel SHS beads of 40mm by 40mm by 3mm. Ceramic fibre material was fitted between the glass and the SHS beads.

Integrity	:	57 minutes, gap development caused by slumping of the pane
Test Date	:	22nd May 2005
Test Sponsor	:	Shenzhen Longdian Sci-Tech Industrial Co Ltd, who has given permission to use this data.

A1 APPENDIX 1
Increased leaf sizes for latched, hinged doorsets

A1.1 Proposal

A1.1.1 It is proposed that the tested leaf size of 2300mm by 1050mm may be increased up to either 2700mm high or, 1200mm wide, as shown in Figure 1.

A1.1.2 When leaves are either higher or wider than tested, the following conditions shall be satisfied:

i) top and bottom hinges centres shall be within 300mm of the top and bottom edges of the leaves,

ii) for all leaves higher than 2300mm or, wider than 1050mm, the distance between hinge centres shall not exceed 850mm

iii) if transom panels are present, they shall be fitted as assessed elsewhere in this report.

A1.1.3 In all other respects, doorsets shall remain as tested or, as otherwise assessed by Exova Warringtonfire.

A1.2 Discussion

A1.2.1 In principle, the relative movement of the leaf edges increases with the size of the leaf. Relative movement of leaf edges is a major contributory factor to loss of integrity at this location.

A1.2.2 Accordingly, the deflection characteristics have been examined of the doorsets described in R08K13, R07L06B, and FR2962. In all cases the door leaf construction is very similar, with an overall thickness of 48~50mm.

A1.2.3 For R07L06B and FR2962, which were designed for 60-minutes applications, the timber density was slightly increased and wider intumescent seals were fitted.

Double-leaves: R08K13, R07L06B

A1.2.4 To support leaf size increases for double-leaves the primary reference data is R08K13.

A1.2.5 Reference is also made to R07L06B to show the extend performance potential of leaves of similar construction, albeit very slight thicker by 2mm and with nominal increases in timber density and wider intumescent seals because of the target performance of 60 minutes integrity.

A1.2.6 The deflection data in both R08K13 and R07L06B are comparable during the initial 30-minute period of testing. This is taken to indicate the performance potential of the basis leaf construction and to support the leaf size increases of approximately 14% as shown in Figure 1.

A1.2.7 It is noted that after 30 minutes there was a movement of 14mm recorded at the hanging edge of the passive leaf described in R08K13. This level of leaf edge movement relative to the door frame would normally be considered significant.

A1.2.8 However, the movement was recorded close to the middle hinge position, which would have provided a positive mechanical connection between the leaf and frame.

A1.2.9 It is therefore assumed, but cannot be proven, that some, or all, of this movement was not relative, and that it was caused by deflection of the actual frame jamb. Whatever the cause, the movement is not considered to have been related to leaf size.

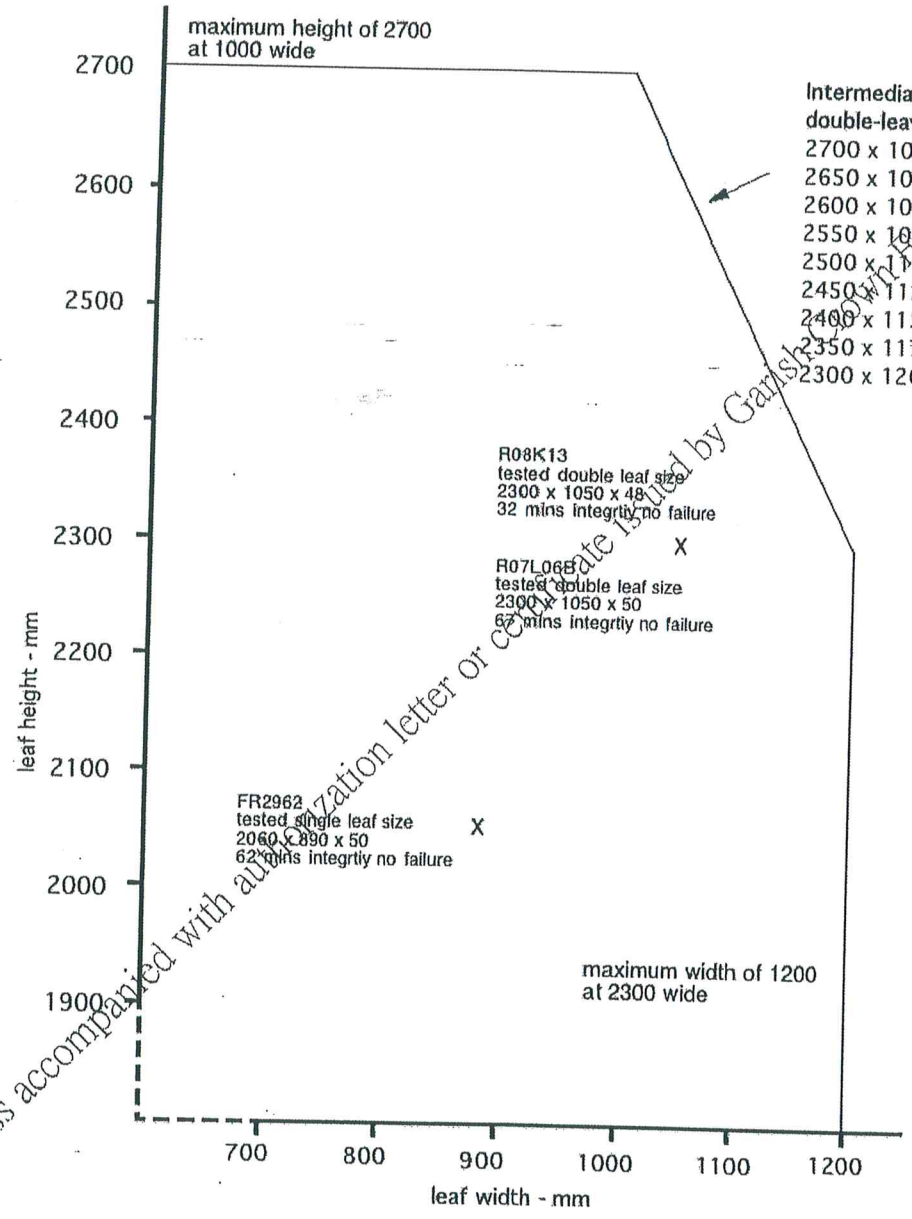
Single-leaves: FR2962

A1.2.10 In principle, a single-leaf locates the meeting edge of a double-leaf in the rebate of a more dimensionally stable frame jamb instead of opposite a member of notionally similar flexibility more likely to deflect in unison.

A1.2.11 The performance of double-leaves cannot therefore be used automatically to support single-leaf configurations. To support single-leaves, reference is made to actual data, i.e. FR2962.

A1.2.12 The test in FR2962 was discontinued after 62 minutes without loss of integrity. The performance margin of 32 minutes with respect o the required period of 30 minutes, and the absence of any significant leaf deflections described prior to 30 minutes have been taken as positive indications that the leaf size may be increased by the approximate value of 14% as shown in Figure 1.

Figure 1 Permitted sizes for hinge-mounted, latched leaves without flush transom panels.



A2 APPENDIX 2
Basic timber frame profile, 3 and 4-sided

A2.1 Proposal

A2.1.1 It is proposed that the timber frame profile shown in Figure 2 may be substituted for the timber door frame profiles as tested.

A2.1.2 It is further proposed that door frame may include a member, similar to the jamb profile, at the threshold to form a 4-sided door frame, as shown in Figure 3.

A2.2 Discussion

A2.2.1 The specifications shown in Figure 2 are based on the tested door frames.

A2.2.2 The tested doorsets opened towards the heating conditions of the test. This is normally taken as the worse configuration for timber based doorsets because of the typical thermal response of timber-based composite panels. In this configuration, the door frames were flush with the exposed face of the doorset.

A2.2.3 The proposed door frame shown in Figure 2 is of reduced overall width and depth compared to the tested frame profiles.

A2.2.4 These changes in the overall frame depth affect the section of the frame profile remote from direct exposure, which also includes the doorstop.

A2.2.5 The proposed doorset will include intumescent seals as tested. Seals, when activated, further isolate the section of the door frame remote from exposure.

A2.2.6 The proposed changes will therefore not modify the rate of erosion by charring of the face of the frame that finishes flush with the leaf, which occurs between the leaf edge and the structural reveal.

A2.2.7 The proposal retains the critical features of the tested door frames such as density, clearance gap sizes, and intumescent seals specifications.

A2.2.8 The proposed door frame specifications are considered reasonable for the required period of 30 minutes.

4-sided frame

A2.2.9 The proposal is a simple extension of an existing feature, i.e. the bottom ends of the vertical frame jambs are connected by a timber member of generally similar profile, in the same way the top ends of the jambs are connected by the head of the frame.

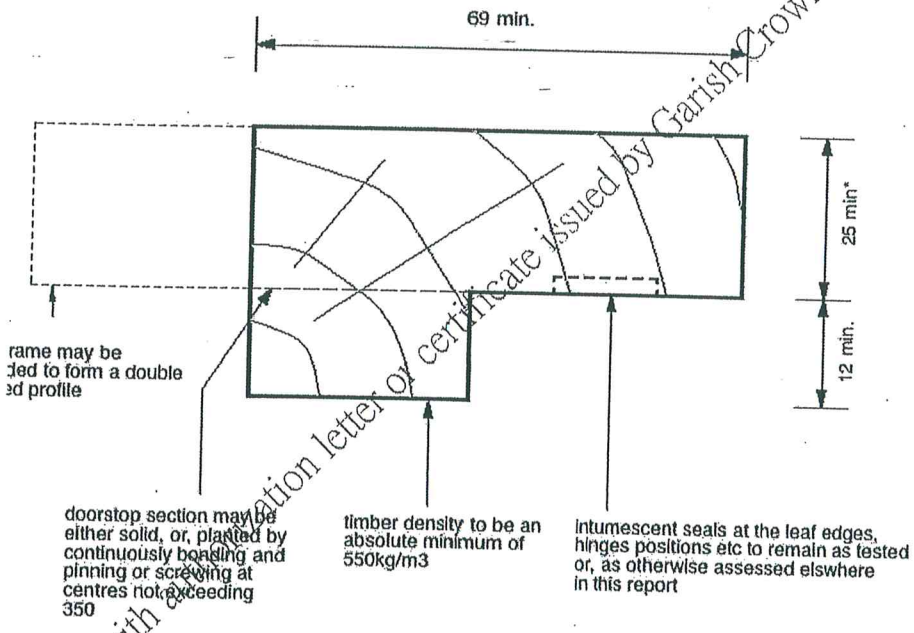
A2.2.10 The testing Standard specifies a slightly negative atmospheric pressure in the furnace chamber coincident with the threshold. This pressure condition tends to cause a flow of cool relatively oxygen rich air into the furnace chamber via the leaf edge gaps.

A2.2.11 There is an unpredictable phenomenon known as "scouring" which is occasionally observed as localised charring associated with the inward flow of oxygen rich air as described above in A2.2.11.

A2.2.12 This phenomenon occurs coincident with the zone of negative atmospheric pressure in the furnace chamber, and is generally more likely to occur towards the lower edge of the leaf, where the atmospheric pressure is at its lowest. Scouring is potentially capable of creating through gaps sufficient to jeopardise the integrity performance of a doorset.

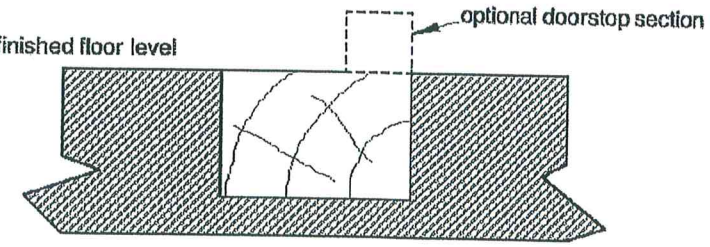
A2.2.13 The proposed sill member is flush with the floor level and may incorporate an optional a rebate. Embedding the main section of the profile in the floor is considered an adequate measure to resist scouring and justify a positive assessment for the required period of 30 minutes.

Figure 2 Basic timber door frame profile. Not to scale, dimensions in mm.



*this dimension may be adequate for the purpose of a fire resistance test but not sufficient in practice to provide an acceptable level mechanical rigidity or adequate hinge screw fixings for normal usage

Figure 3 Threshold frame member.



main frame profile to finish flush with floor level; profile may include a doorstop section as an option

A3 APPENDIX 3
Sub-frame for timber door frames

A3.1 Proposal

A3.1.1 It is proposed that the timber door frames as tested or as assessed elsewhere in this report, may be fixed directly to the structural reveal or, a sub-frame may line the structural opening.

A3.1.2 Figure 4 shows the proposed fixing and sealing detail between the sub-frame and the rear of the door frame, which shall satisfy the following conditions:

i) the timber sub-frame shall be of timber having a minimum density of 450kg/m^3,

ii) the gap between the door frame and sub-frame shall not exceed 25mm wide,

iii) the door frame shall be fixed to the sub-frame at nominal centres of 500mm with 13mm by 25mm corrugated steel fasteners applied to both sides of the door frame or, 25mm by 25mm wire staples applied to both sides of the frame or corrugated fasteners to one side and staples to the other side,

iv) as an alternative to iii), the door frame may be screw-fixed at nominal centres of 800mm as shown in Figure 4, with at least four fixings per jamb

v) the sub-frame may be rebated to accommodate wall finishes, see Figure 1,

vi) the sub-frame may be omitted, and the frame fixed directly to the structural reveal,

vii) intumescent sealant shall be applied as shown in Figure 4; the sealant shall be supported by separate test data showing its capability of contributing to an integrity performance of at least 30 minutes as described in BS 476: Part 20 when tested as a linear gap seal against one or both substrates of timber,

viii) the test data indicated in vii) shall describe a gap size equal to or, greater than, the proposed frame to sub-frame gap without any contributory backing material e.g. mineral or ceramic fibre,

Architraves present

ix) architraves, at least 10mm thick shall make continuous intimate contact with the door frame and the timber sub-frame; the timber architraves shall have a minimum density of 450kg/m^3,

x) the architrave shall overlap the door frame and sub-frame by at least 10mm, and shall be nail or screw-fixed at nominal centres of 300mm,

xi) intumescent sealant shall applied to a depth at least equal to the gap width, with a minimum depth of 5mm

Architraves absent

xii) a bead of intumescent sealant shall be applied to a depth at least equal to the gap width, with a minimum depth of 10mm.

A3.1.3 In all other respects, the door frame details shall be as tested or, as otherwise assessed by Exova Warringtonfire.

A3.2 Discussion

A3.2.1 The principle of continuity of fire resistance performance between timber doorsets and the walls into which they are built is considered in detail in BS 8214: 1990 Code of practice for fire door assemblies with non-metallic leaves. This Code provides a range of sealing options to maintain fire resistance performance at the joint between the wall and door frame.

A3.2.2 The proposed sealing methods are generally consistent with the information provided by BS 8214. The Code refers generically to intumescent sealant. In view of the range of currently available sealants, the proposal has described appropriate sealants in more detail to assist in their selection, to ensure fitness for the proposed application.

A3.2.3 Based on information in BS 5268: Part 4: Section 4.1, a notional charring rate of 20mm in 30 minutes, is attributed to timber having a density of at least 450kg/m^3 when exposed to standard fire test conditions. The proposed sub-frame, and architraves have a minimum density of 450kg/m^3.

A3.2.4 At a charring rate of 20mm in 30 minutes, the planted architraves, having a total thickness of 20mm, provide notional protection of approximately 30 minutes. In addition, the two beads of intumescent sealant, at least 5mm deep, provide further protection and will compensate for variations in the fit of the architraves.

A3.2.6 The proposal allows an option of omitting the architraves if the beads of mastic are increased in depth to 10mm. The overall depth of mastic would be at least 20mm. Following the notional charring rate noted in A3.2.3, 30 minutes resistance to undercutting of the sealant by charring is expected.

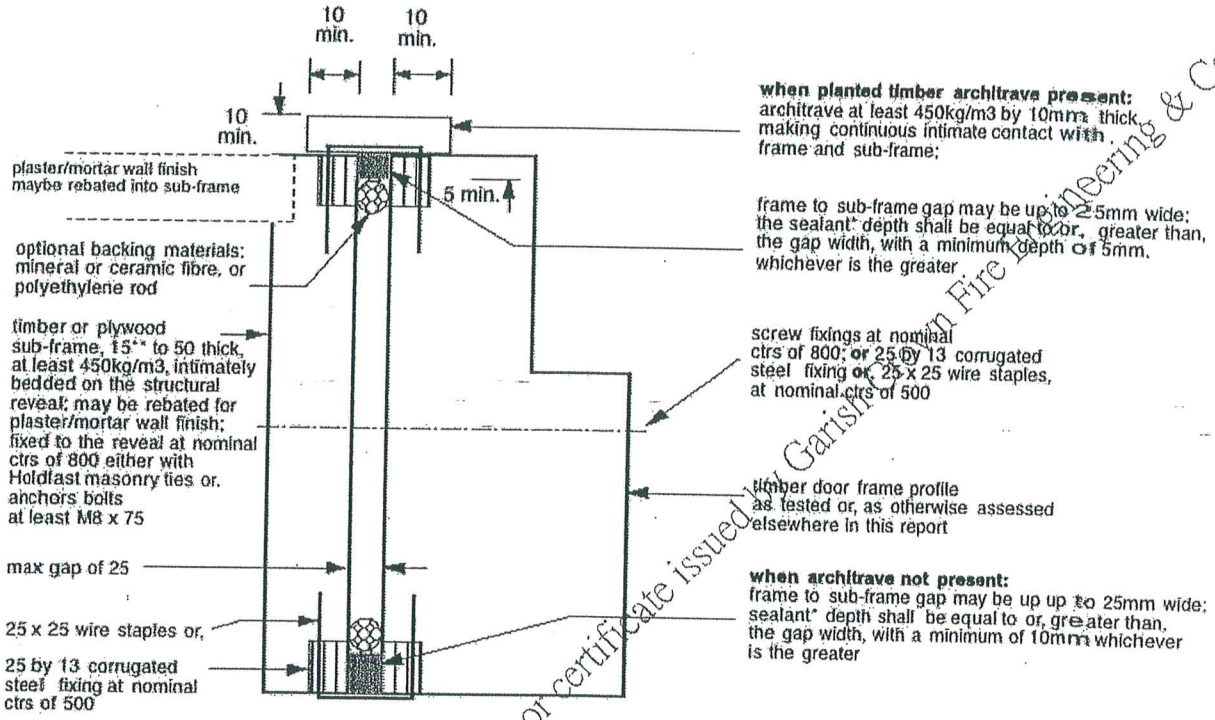
A3.2.7 The aspect ratio of the gap at the rear of the door frame is considered an incidental benefit, and is expected to assist in shielding the seal on the unexposed face. The combined effect of the architraves, intumescent sealant, and aspect ratio of the gap, is expected to maintain a seal for the required period of 60 minutes.

A3.2.8 The mechanical fixings between the door frame and the sub-frame include either corrugated steel fasteners or, steel staples or, steel angles. From whichever direction fire exposure occurs, there will be fixings on the unexposed face that are expected to retain the door frame in position. The proposal also allows describes the use of traditional screw fixings, the shanks of which are effectively protected from direct fire exposure by the timber frames through which they pass.

A3.2.9 The proposed omission of the sub-frame produces a generally simpler assembly and does not introduce any increase in risk of integrity weakness.

A3.2.10 The proposal is considered consistent with good doorset installation practice. The performance of the tested doorsets is not considered compromised for the required period of 30 minutes. The proposal is therefore positively appraised.

Figure 4 Sub-frame details. Not to scale, dimensions in mm.



*intumescent sealant shall be supported by separate test data showing: capability of contributing to an integrity performance of at least 30 minutes with respect to BS 476: Part 20 as a linear gap seal with one or both gaps faces of timber, at a gap size equal to or greater than the frame to sub-frame gap, and without any contributory backing material e.g. mineral or ceramic fibre

** a sub-frame of 15mm thick may be adequate for the purpose of a fire resistance test specimen, but may not necessarily provide a sufficient screw-holding in practice

A4 APPENDIX 4
Basic steel frame profile, 3 and 4-sided

A4.1 Proposal

A4.1.1 It is proposed that leaves may be hung in steel frames, having the basic profile as shown in Figure 5.

A4.1.2 All leaf edges opposite steel frame rebates, except at the threshold, shall be fitted with 30mm wide intumescent seals, and all hinge blades shall be bedded on intumescent sheet material, as described in FR3028.

A4.1.3 The proposed door frame shall be fixed to supporting construction as described in FR3028.

A4.1.4 It is further proposed that door frame may include a member of jamb profile at the threshold to form a 4-sided door frame.

A4.2 Discussion

A4.2.1 The information provided by FR3028 shows that a double-leaf doorset comprising timber-edged leaves, similar to the proposed leaf construction, hung in a single-rebated steel frame profile back-filled with sand/cement mortar was able to contribute towards a performance of 65 minutes integrity. Loss of integrity occurred at the meeting edges.

A4.2.2 The recorded observations indicate that integrity was maintained at the leaf to frame junction for 71 minutes.

A4.2.3 The proposal reproduces the critical leaf edge to frame details in terms of frame fixing, mortar infill, and intumescent specifications to protect the timber leaf edges from heat conducted via the steel frame profile.

A4.2.4 The additional proposal to form a 4-sided frame extends the application of a component shown acceptable by testing. The proposal provides an additional doorstop at the threshold tested with a clear gap, which was tested with a clear leaf edge gap. The addition of a rudimentary physical barrier represented by the doorstop at the threshold is considered incidentally beneficial.

A4.2.5 The proposal is based on specifications shown by testing to be capable of achieving a localised performance of 71 minutes integrity, and is positively assessed for the required integrity performance of 60 minutes.

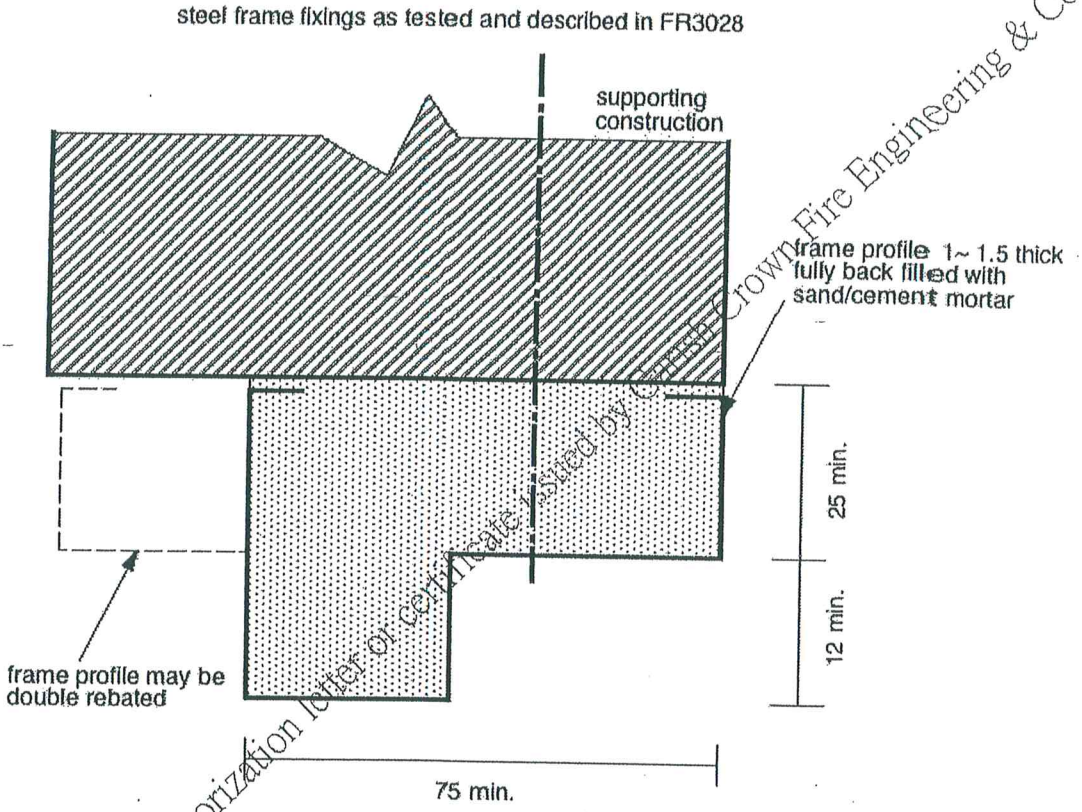
Insulation performance

A4.2.6 The doorset described in FR3028 was tested opening towards the heating conditions. In this configuration, relatively little of the steel frame is exposed.

A4.2.7 In an outward opening doorset, a larger proportion of the steel frame profile will be exposed and the frame cross-section will be expected to receive greater overall heat input.

A4.2.8 Therefore, it can be conservative assumed that the 60 minute insulation performance can be used to support an assessment for 30 minutes for doorsets in both inwards and opening configurations.

Figure 5 Basic steel door frame profile. Not to scale, dimensions in mm.



A5 APPENDIX 5
Angle-section steel frame profile, 3 and 4-sided

A5.1 Proposal

A5.1.1 It is proposed that the hollow profile steel frame as assessed in Appendix 4 may be replaced with the angle-section steel door frame as shown in Figure 6. The proposed angle-section frames shall be fully welded at the corners.

A5.1.2 All leaf edges opposite steel frame rebates, except at the threshold, shall be fitted with 20mm wide intumescent seals, and all hinge blades shall be bedded on intumescent sheet material, as described in Appendix 4.

A5.1.3 The proposed door frames shall be fixed to the structural reveal by masonry anchor bolts as shown in Figure 6.

A5.1.4 As an option, an angle-section member similar to the jambs may be fitted at the threshold to form a 4-sided door frame.

A5.2 Discussion

A5.2.1 The proposal replaces the hollow steel profile as tested, and assessed in Appendix 4, with a solid steel angle.

A5.2.2 Whereas the tested frame profile was filled with sand/cement mortar, and fixed to the masonry supporting construction as a means of achieving dimensional stability during a standard fire test, the proposed frame is to be fixed directly to masonry or reinforced concrete supporting construction.

A5.2.3 In principle, therefore, the proposal is expected to provide a similar level of mechanical support to the tested frame. However, because the proposed frame is a solid section and is not internally supported by mortar, it may be more prone to localised distortion.

A5.2.4 Figure 8 shows that fixings into the concrete forming the structural reveal are relatively close, with additional fixings at each hinge position, which is intended to prevent torsion of the hanging jambs causing the leaf axis to move relative to the plane of the aperture within the frame reveals.

A5.2.5 To assist in maintaining integrity between the angle-section and the structural reveal, the angle section will be fully bedded on cement mortar or gypsum plaster.

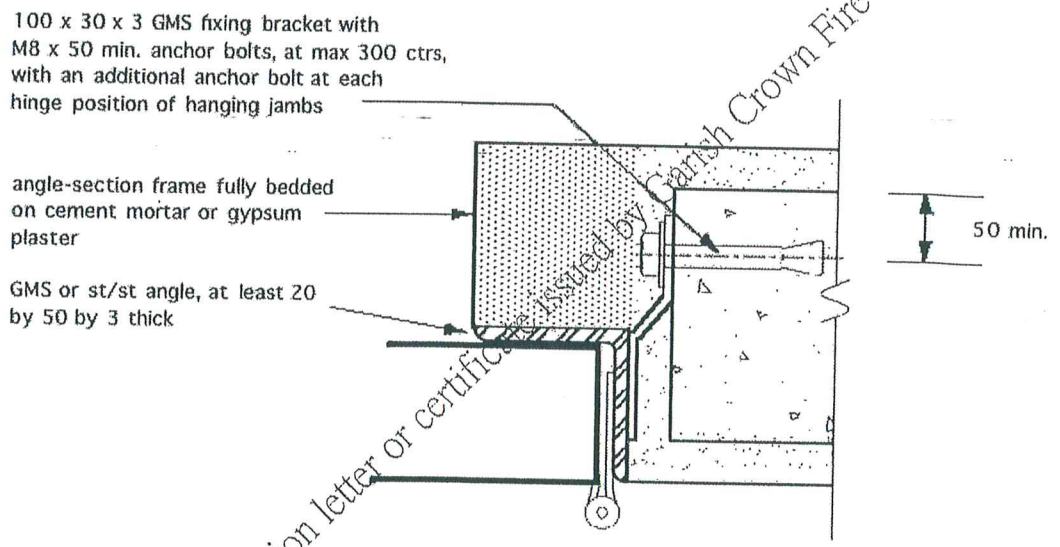
A5.2.6 The Requirements for this report indicate the supporting construction is to be capable of remaining stable and providing adequate support for the required period. To ensure this, the proposed frame fixings are at least 50mm from the arris of the structural opening. This is intended to reduce the risk of a corner breaking out, and rendering fixings ineffective.

A5.2.7 Fitting a frame jamb profile at the threshold to form a four-sided frame represents a simple transposition of a tested feature in addition to the tested specifications, which remain intact. There is no foreseeable adverse effect associated with such a proposed threshold member, which is positively assessed for the required integrity performance of 30 minutes.

Insulation performance

A5.2.8 In the absence of actual test data to indicate insulation performance, the approach in Appendix 4 for hollow section steel frames has been taken and the assessed insulation performance is 30 minutes.

Figure 6 Angle-section door frames. Not to scale, dimensions in mm.



A6 APPENDIX 6
Meeting edge profiles

A6.1 Proposal

A6.1.1 It is proposed that the meeting edges of double-leaf doorsets may be as follows:

i) rebated and fitted with a 10mm wide intumescent seal in each edge as tested and described in R08K13,

or,

ii) square with three 10mm wide seals staggered across the edges to provide 30mm coverage as tested and described in FR3028.

A6.2 Discussion

A6.2.1 The square meeting edge detail described in FR3028 contributed towards an integrity performance of 65 minutes, when failure was indicated by ignition of a cotton pad held over the meeting edges at the latch position.

A6.2.2 The meeting edge detail described in R08K13 was rebated and performed satisfactorily for the 67-minute duration of the test.

A6.2.3 The meeting edge detail described in R07L06B was similarly rebated and performed satisfactorily for the 67-minute duration of the test.

A6.2.4 The available data shows that whether square or rebated, integrity performances of at least 60 minutes can be obtained at the meeting edges.

A6.2.5 The data is considered to support the ability to use either square or rebated meeting edges as tested. Hence, the proposal is positively assessed for the required period of 30 minutes.

A7 APPENDIX 7
Rebated leaf edges and door frames

A7.1 Proposal

A7.1.1 The top edge of the tested leaf described in FR2962 was rebated. It is proposed that rebates may be formed at the top and vertical leaf edges within a three-sided door frame. The proposed door frame profile is shown in Figure 7.

A7.1.2 When the vertical edges of the leaf are rebated as proposed the maximum leaf size shall be 2060mm high by 890mm wide, as described in FR2962.

A7.2 Discussion

A7.2.1 The furnace overpressure specified by the testing standard increases with height above the notional floor level. Therefore, the rebated top edge of the door leaf as tested was subjected to generally more onerous testing conditions than the vertical jambs, which included full width rebates to locate square leaf edges.

A7.2.2 The target doorset as described in R08K13 included rebated meeting edges, with a 10mm wide intumescent seal in each edge.

A7.2.3 In principle, the available evidence provides confidence in the acceptability of a rebated leaf edge. However, rebated edges are a poor design detail in terms of tolerating differential movement.

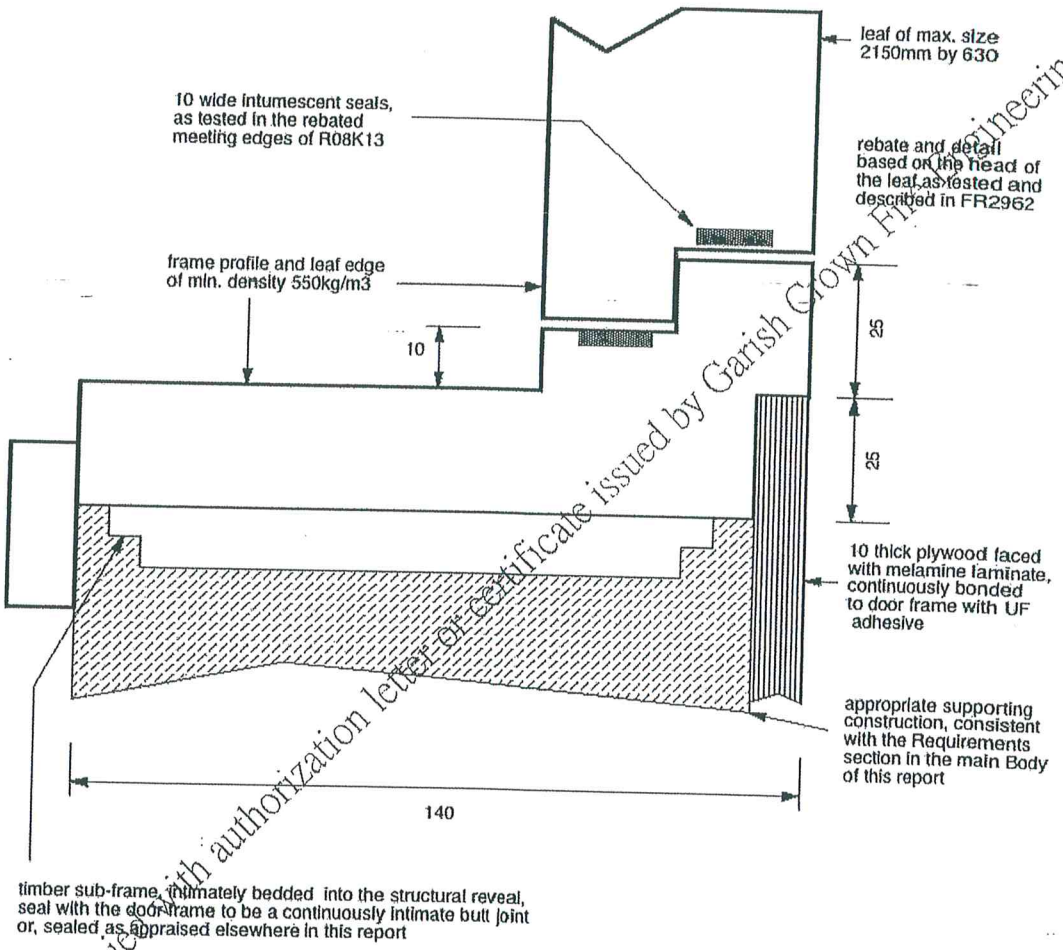
A7.2.4 An otherwise similar leaf of reduced width is expected to exhibit reduced relative leaf edge movement during a standard fire. This is advantageous in the case of rebated edges, which are less able to tolerate movement compared with square leaf edges in a full-width rebate. The proposal to maintain the leaf size as tested and the associated performance margin with respect to the required period of 30 minute provides confidence in the proposal.

A7.2.5 The plywood wall finish that locates in a rebate in the frame profile, as shown in Figure 7, is likely to char more rapidly than the solid timber frame. However, the plywood is only 10mm thick and is considered sufficiently remote from the leaf edge not to constitute significant risk.

A7.2.6 The joint between the door frame and the sub-frame is nominally 120mm deep, and is either an intimate butt joint or is sealed as appraised elsewhere in this report. There is no foreseen risk of premature integrity loss associated with the joint between the door frame and the sub-frame.

A7.2.7 The proposed frame detail is considered adequately supported by available data and is considered acceptable for a period of 30 minutes.

Figure 7 **Rebated leaf edge and frame detail for the top and vertical leaf edges. Not to scale, dimensions in mm.**



A8 APPENDIX 8
Alternative ironmongery

A8.1 Proposal

A8.1.1 It is proposed that items of alternative ironmongery may be fitted in place of equivalent items as tested, based on specifications derived from the tested ironmongery and empirical experience.

A8.1.2 Particular conditions and limitations are given as appropriate. Where there is insufficient data to assess acceptability, additional test evidence is required as described.

A8.1.3 **Overhead surface mounted door closers for latched doorsets**

i) Closers shall be capable of fully closing and latching the leaf from any angle.

ii) All components shall be surface mounted and shall not occur between the leaf edge and the frame reveal.

iii) The closers shall have power ratings suited to the weight and size of the door leaf.

iv) Closers may incorporate a back-check option but not a hold-open facility unless acceptable to the relevant authorities.

A8.1.4 **Steel butt hinges, 102mm long**

i) Hinge knuckles shall incorporate either at least one plain joint, or steel washers.

ii) Hinge blades shall be by-passed by an uninterrupted intumescent seal, as shown on Page 24 of R08K13.

A8.1.5 **Cylindrical and mortice locks, latches, handlesets, deadbolts, and strikes**

i) Latch forends shall be by-passed by an uninterrupted intumescent seal, and strikes bedded on intumescent material, as shown on Page 24 of R08K13.

ii) The mortice for any lock or latch body formed in the leaf edge will not exceed a nominal width of 23mm, and the lock case shall be fully wrapped in intumescent sheet material at least 1mm thick.

iii) Locks or latches shall be fitted no higher than 1100mm, and no lower than 900mm, from the floor level.

iv) Knobs, lever handles, escutcheons, and roses shall be made entirely of non-combustible materials.

A8.1.6 **Rim latches**

i) The latch keep flange, which returns onto the door frame reveal, shall not remove any part of the intumescent seal fitted to protect the leaf edge clearance gap.

ii) A sleeve of graphite based intumescent sheet material, 20mm long by 2mm, thick, shall line the hole in the door leaf housing the latch cylinder.

A8.1.7 **Floorspring door closers**

i) The floorspring bodies, bottom straps, and top pivots shall be fitted as described in FR3064.

ii) Both sides of the mortice in the top edge of the leaf, for the top centre, shall be lined with 4mm thick FT board to simulated the FT board sub-facings described in FR3064

iii) The arrangement of two 10mm wide intumescent seals in the head of the frame as described in FR3064 shall be modified as follows:

the main seal shall be centrally located and 10mm wide as otherwise described in R08K13,

10mm wide intumescent seals shall be fitted adjacent to both long sides of the top centre position; these seals shall overlap the central 10mm wide seal by at least 25mm.

iv) To accommodate the double-action of the floorspring, the door frame profiles, and intumescent seals at the vertical leaf edges, shall be as described in FR3064.

A8.1.8 **Miscellaneous**
(door stops, push and kick plates, selectors, hooks, security chains)

i) Miscellaneous ironmongery shall be entirely surface mounted and shall not require any modification of either the leaf edge or door frame, and shall not introduce any component into the leaf clearance gaps.

ii) Miscellaneous ironmongery shall not penetrate the door leaf other than by fixing screws.

iii) Miscellaneous ironmongery shall not cause any reduction of either the thickness of the door leaf or the door frame section.

A8.2 Discussion

A8.2.1 It is proposed that alternative items of ironmongery may be fitted in place of the corresponding items as tested.

A8.2.2 Determination of the acceptability of the proposed alternative ironmongery has been based on the following principles:

i) a like-with-like substitution in terms of function, material, and dimensional specifications,

ii) no limitations for entirely surface fixed items that do not detract from the specification of the tested doorset,

iii) similar or reduced quantities of door frame or leaf material are removed for installation,

iv) there is no increased interruption of intumescent leaf edge seals,

v) no increase in the overall mass of metal introduced into the leaf edge clearance gap.

A8.2.3 Accordingly, the conditions and limitations given in the Proposal are closely based of the specifications and installation details of the tested items of ironmongery.

A8.2.4 The exception is the inclusion of mortice locks and latches, for which there is no specific test evidence. In principle, because mortised items do not penetrate the leaf to the same degree as the cylindrical locksets as tested, they present less risk.

A8.2.5 However, in the absence of specific test evidence, a conservative approach has been taken to ensure the residual thickness of leaf material at the mortice will be similar to that coincident with tubular component mortised in the leaf associated with the cylindrical locket as tested. Furthermore, lock cases are to be wrapped in intumescent sheet material of 1mm thick.

A8.2.6 The proposal for floorsprings is based on information provided by FR3064, which described a test of a double-leaf doorset, each leaf being mounted on a different closer model.

A8.2.7 One top centre position failed at 51 minutes, and the other floorspring was associated with a local integrity performance of 63 minutes.

A8.2.8 In addition to simulating protection of the top centre by lining the mortice with 4mm FT board as described in FR3064, the proposal requires reinstated intumescent seals coincident with the closer position.

A8.2.9 The proposed method of conservatively adapting the tested specifications from FR 3064 is considered a reasonable means of achieving a performance of at least 30 minutes.

A8.2.10 Therefore, providing an item of alternative ironmongery is generically equivalent to a tested item, and it is fitted in accordance the conditions and limitations in the Proposals section, it is considered a like-with-like substitution in terms of function and contribution and positively assessed for the required period of 30 minutes.

A9 APPENDIX 9
Raven and Lorient acoustic seals

A9.1 Proposal

A9.1.1 It is proposed that doorsets may be fitted with Lorient and Raven acoustic seals as shown in Figures 8, 9, and 10, in which case the following conditions shall be satisfied:

Threshold seal:
Lorient IS8100

i) the mortice in the bottom edge of the leaf to accommodate the seal shall be formed in a timber leaf edge component having an absolute minimum density of 550kg/m^3,

ii) the mortice shall be fully lined with intumescent sheet material at least 1mm thick,

iii) installation of the threshold seal shall not remove any part of the leaf edge seals,

Surface mounted seals, frame:
Lorient IS7025, IS7025Si, IS1010, IS1212, IS1206, IS1507
Raven RP78, RP120, RP150, RP500, RP510, RP520, RP530

Surface mounted seals, leaf:
Raven RP60

iv) installation of seals mounted on door frame shall not cause any of the following:

reduction of the size of the door frame rebate

removal of any part of the intumescent leaf edge seals

increase in the leaf edge clearance gaps

A9.1.2 In all other respects, details shall remain as tested or, as otherwise assessed by Exova Warringtonfire.

A9.2 Discussion

Threshold seal, Figure 8

A9.2.1 In principle, the removal of material from the thickness of the leaf to form the seal mortice does not represent any greater risk than the lock mortices as originally tested and as assessed elsewhere in this report.

A9.2.2 Although the flexible component is combustible and may flame, the prevailing furnace underpressure at the threshold, as specified in the testing standard, is expected to draw flaming in towards the furnace chamber so that it is not observable as a cause of integrity failure on the unexposed face.

A9.2.3 However, in the absence of specific test data, a conservative approach has been taken and the seal carriers shall be fully bedded on intumescent material. The heat activated swelling action of the intumescent material is expected to compensate by preventing accelerated erosion of the leaf thickness via the seal mortice.

A9.2.4 Furthermore, the seals are to be mortised into timber having an absolute minimum density of 550kg/m3, which can be expected to exhibit a notional charring rate of 20mm in 30 minutes.

A9.2.5 The residual leaf thickness at the seal mortice is 27mm (48mm leaf – 21mm mortice).

A9.2.6 The combined effect of the residual leaf thickness, the intumescent protect of the mortice, and the period for which the seal carrier remains intact, and the prevailing furnace underpressure, is expected to ensure integrity is maintained.

Surface mounted seals

A9.2.7 Figure 8 and 9 illustrate the following seals:

Lorient IS7025, IS7025Si, IS1010, IS1212, IS1206, IS1507
Raven RP78, RP120, RP150, RP500, RP510, RP520, RP530

A9.2.8 These seals do not occur centrally at the leaf edges. Should the seals occur on the exposed side of a doorset, it is expected they would consumed without risk of integrity loss.

A9.2.9 Should they occur on the unexposed side, they would be protected by the inherent insulating properties of the timber leaves, as proven by the supporting test data.

A9.2.10 In addition, protection would be provided by the activated intumescent leaf edge seals, which would prevent any significant flow of heated gasses to impinge of the acoustic seal profiles.

Overall performance

A9.2.11 The proposed seals do not cause the critical loss of leaf or frame material, and although they include combustible components, they occur at locations such that significant flaming is not expected to be observed on the unexposed face of the target doorsets.

A9.2.12 The seals are considered to present no greater risk of ignition than the combustible timber based materials of the test doorsets, and are therefore positively assessed for the required period 30 minutes.

Figure 8 Lorient IS8100 acoustic threshold seal, reproduced from proprietary sales literature.

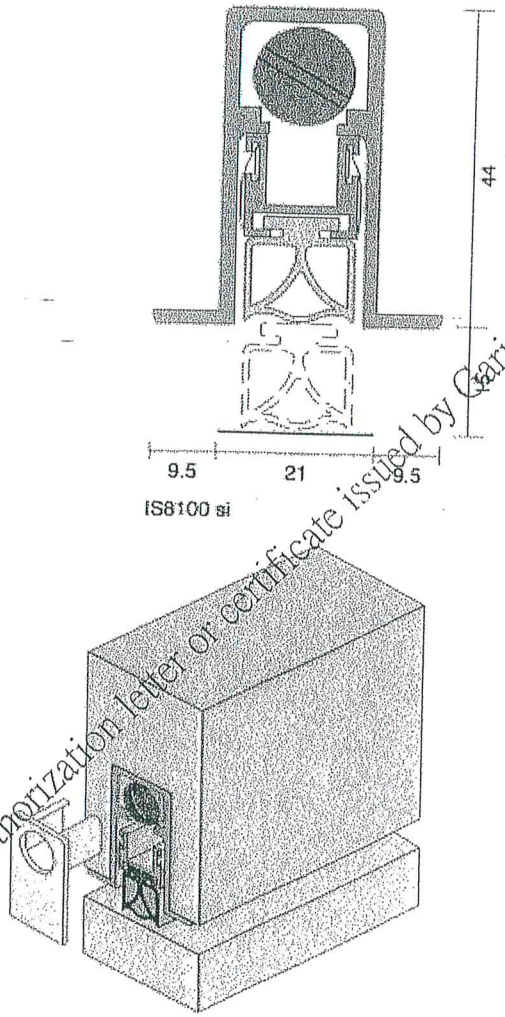


Figure 9 **Lorient IS7025, IS1212, IS1515 and Raven RP78, RP120, RP530 surface mounted seals. Reproduced from proprietary sales literature.**

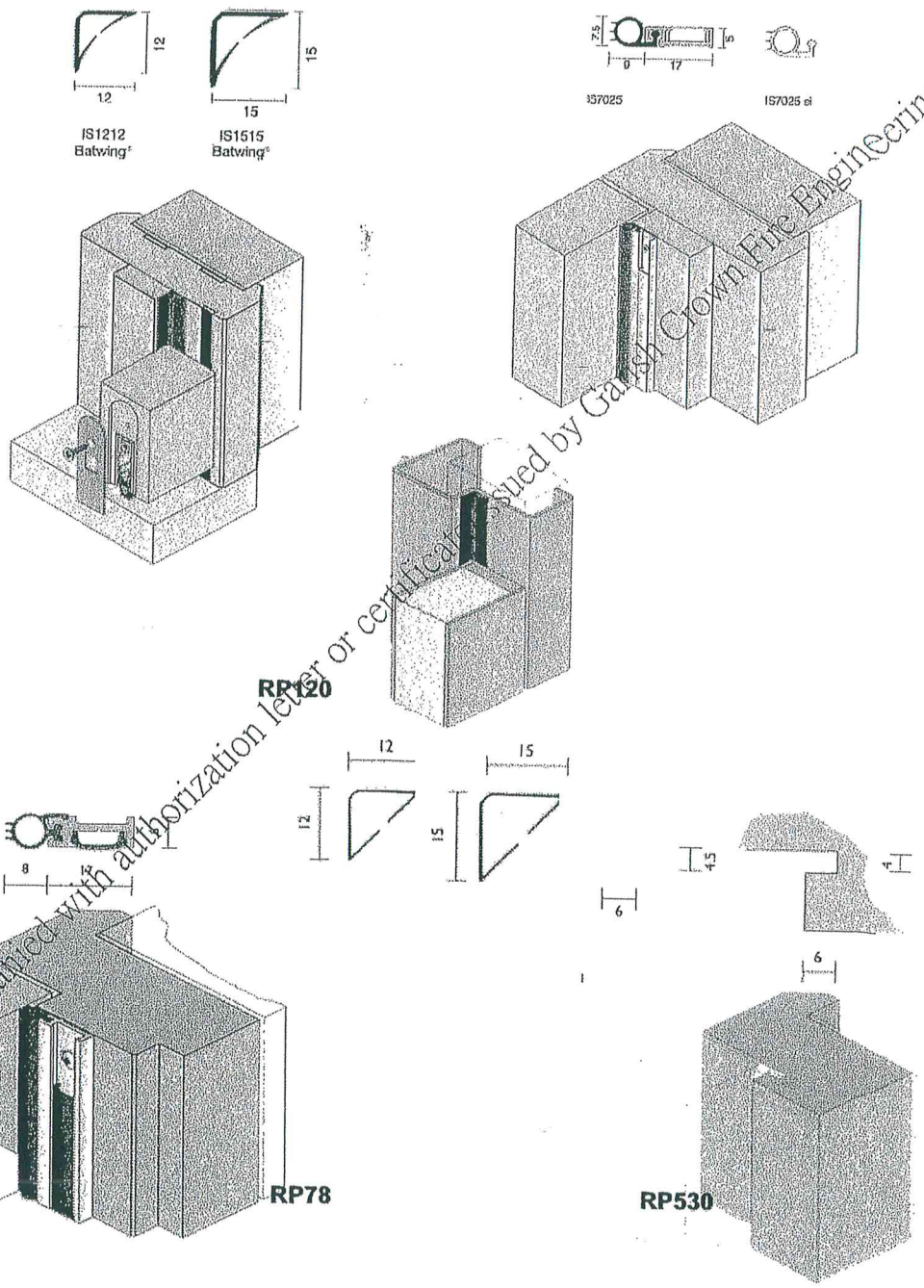
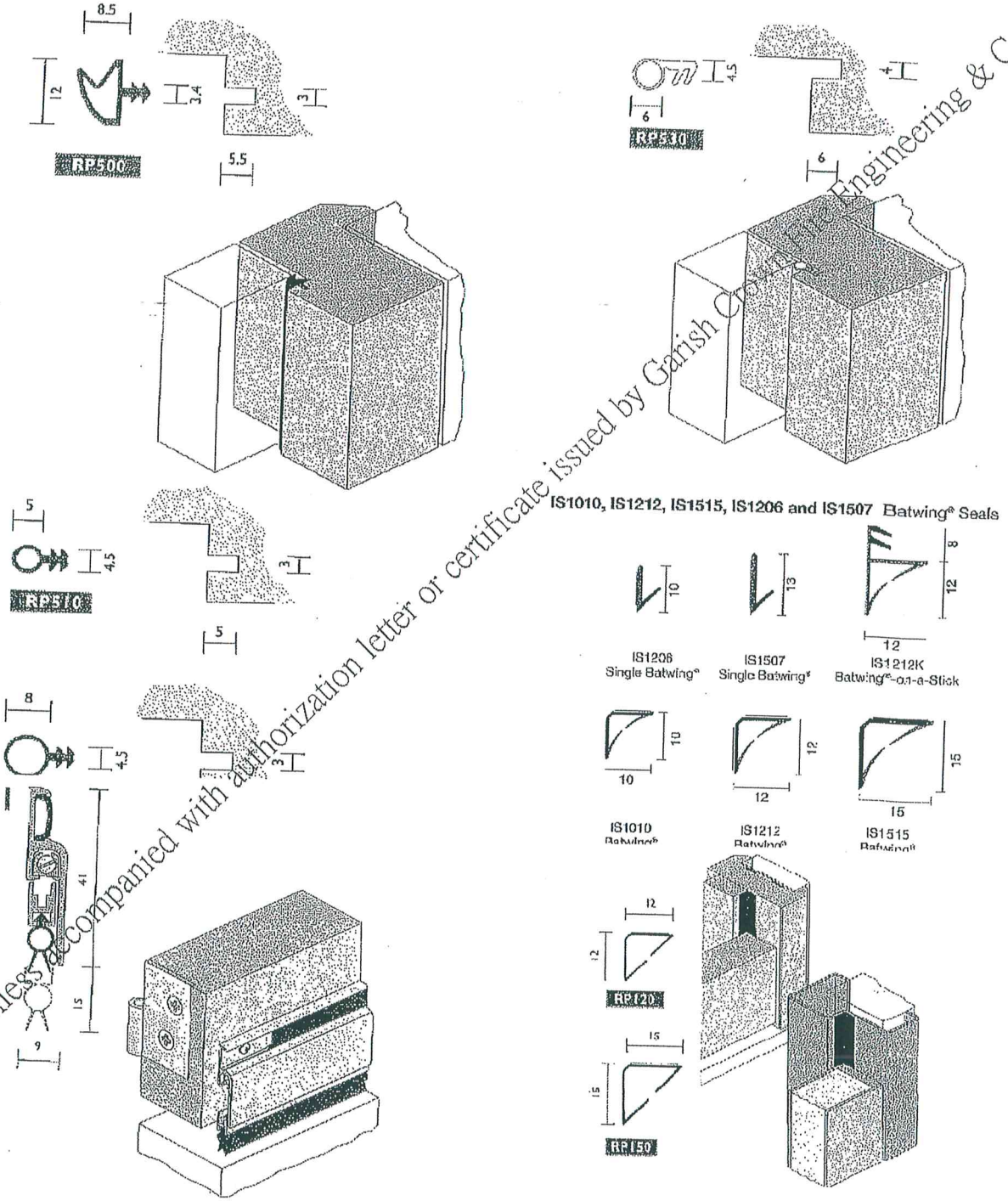


Figure 10 Lorient IS1010, IS1206, IS1507 and Raven RP60, RP500, RP510, RP520, and RP150 surface mounted seals. Reproduced from proprietary sales literature.



A10 APPENDIX 10
Decorative metal cladding

A10.1 Proposal

A10.1.1 It is proposed that sheets of either aluminium, stainless steel or, mild steel up to 1.2mm thick may be bonded to the visible faces of the door leaves and frames of the tested doorsets in the closed position.

A10.1.2 The edges of the sheets shall return onto the leaf edges and frame reveals by no more than 5mm.

A10.1.3 The adhesive shall be thermo-softening, such as a solvent-based contact adhesive, and

A10.1.4 A non-combustible upstand (e.g. masonry, concrete, or metal) at least 6mm high shall be set into the floor opposite the centreline of the bottom edge of the leaf.

A10.1.5 When metallic facings are present, glazed apertures shall not be fitted.

A10.1.6 The proposal will add weight to the leaves. It is therefore recommended that consideration be given to closer and hinge specifications as appropriate.

A10.2 Discussion

A10.2.1 The proposal restricts the amount by which the metallic facings can return onto the leaf edges. The supporting data includes a doorset originally tested with a steel frame, which gives confidence in the acceptability of metallic components at the vulnerable leaf edge gap.

A10.2.2 In the absence of specific evidence for facings, the proposal is intended to maintain an essentially timber leaf edge opposite a steel frame reveal. The limited return of 5mm will maintain the particular combinations of leaf edge and frame reveal materials as tested.

A10.2.4 In addition, the limited return will ensure the facings do not interact with the intumescent leaf edge seals, allowing them to contribute in a manner similar to the seas as originally tested.

A10.2.5 The proposed facings are to be bonded in position. It is likely that the exposed facings will fall away because of degradation of the adhesive caused by heat conducted through the facing. The underlying leaf will receive protection from the effects of fire exposure for as long as the facings remain in position.

A10.2.6 The expected early loss of aluminium-based facings from the exposed face effectively returns the doorset to its tested specification.

A10.2.7 In the case of a temperature rise on the unexposed face of the door leaf it is expected that a degraded glueline would allow a degree of relative movement, and therefore render the facing of neutral significance.

A11 APPENDIX 11
Transom panels: with and without transom rails

A11.1 Proposal

A11.1.1 It is proposed that single and double-leaf doorsets may be fitted with transom panels up to 1000mm high, as shown in Figure 11. The panels shall be of door leaf construction and retained within a 4-sided framework. There shall be no clearance gaps at the edges of the panels.

A11.1.2 It is also propsoed that, for single-leaf doorsets only, that transom panels may be fitted with a transom rail, in which case the leaf to transom panel details shall be as formed as either suare or rebated edges, following the meeting edge details assessed in Appendix 6 of this report.

A11.1.3 This assessment is prepared on the assumption that no part of the proposed door and transom assemblies will be subject to an overpressure of more than 20 Pascals during exposure to standard fire test conditions. With respect to the furnace overpressure conditions of the testing standard, this effectively limits door and transom assemblies to a maximum overall height of 3m.

A11.2 Discussion

Transom rails fitted

A11.2.1 The proposed transom panels are of door leaf construction and are smaller than the tested door leaves, in these respects, therefore, the transom panels are not associated with any increase in risk.

A11.2.2 The transom and side panels are to be mechanically fixed at four edges without potentially vulnerable operating clearance gaps that would otherwise be required for door leaves. In addition, intumescent seals are included at the panel edges. The features are considered to present a less onerous case than the tested leaves.

A11.2.3 The proposed transom panels are expected to behave independently of the door leaf because they are fixed in a manner such that no significant interaction with the door leaves is expected to occur. The proposal is considered acceptable for the required period of 60 minutes.

Transom rails not fitted

A11.2.4 The single-leaf doorset as tested and described in FR2962 included a transom panel flush with the door leaf.

A11.2.5 The joint between the leaf and transom panel is considered analogous to the meeting edges of double-leaf doorsets.

A11.2.6 The proposal provides the option of either square or rebated panel edges, as assessed in Appendix 6.

A11.2.7 There is no specific data to support the onerous T-joint condition at the top of the meeting edges of a double-leaf doorset. At this location, two side hinged leaves are required to remain in alignment with the continuous edge of a transom panel fixed at both ends.

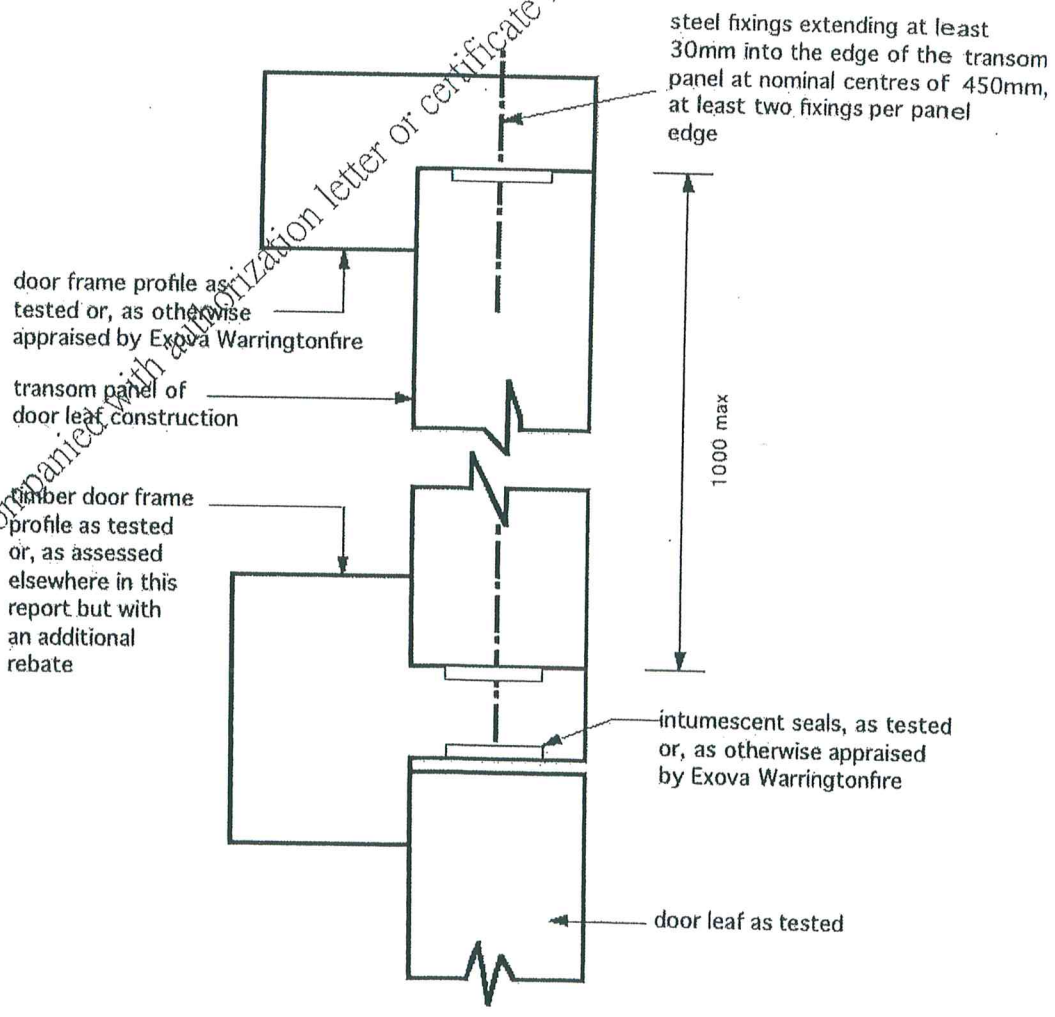
A11.2.8 Therefore, because of the unpredictable deflection, transom panels without rails are limited to single-leaf assemblies, which more closely resemble a single leaf-doorset in terms of potential relative deflections at the leaf head.

A11.2.9 Formal assessments are based on test experience and available evidence derived from standard tests. Commercial test furnaces for vertical specimens typically accommodate 3m high specimens.

A11.2.10 Although the size of individual components and any possible interaction are not considered an issue, a doorset and transom assembly might exceed an overall height of 3m.

A11.2.11 To be consistent with the maximum specified overpressure gradient stated in the testing standard, and the comments above, it has been necessary to make the additional assumption in A11.1.3 for the purpose of this assessment of transom panels, should doorsets exceed 3mm in overall height.

Figure 11 Proposed details for transom panels for single and double-leaf doorsets when transom rails are fitted. Not to scale, dimensions in mm.



A12 APPENDIX 12
Lorient air transfer grilles

A12.1 Proposal

A12.1.1 It is proposed that the tested door leaves may be fitted with LVN 20 or LVV40 intumescent air transfer grilles by Lorient Polyproducts Ltd, as shown in Figure 12.

A12.1.2 The installation of grilles shall satisfy the following conditions:

i) grilles may be up to 600mm by 600mm, and shall be fitted as described in WFRC No. C122567 or WFRC No. C109437, i.e. the grilles shall be screw-fixed in place and the grilles edges shall be fully bedded on Lorient intumescent mastic,

ii) apertures to accept grilles shall not occur higher than 1000mm from the notional finished floor level,

iii) apertures reveals shall be formed with timber sections having a minimum density of 550kg/m^3,

iv) the formation of apertures shall not remove any part of the internal timber framework of perimeter stiles and rails of the door leaf, the apertures shall not occur within 100mm of any leaf edge.

A12.2 Discussion

A12.2.1 WFRC No. C122567 describes a scope of application for LVN 20 air transfer grilles, and requires the target door leaf to have been shown by testing to be capable of tolerating apertures for the required period of 30 minutes.

A12.2.2 The the tested leaves included glazed apertures, which gives confidence in the ability of the leaves to accept apertures for air transfer grilles.

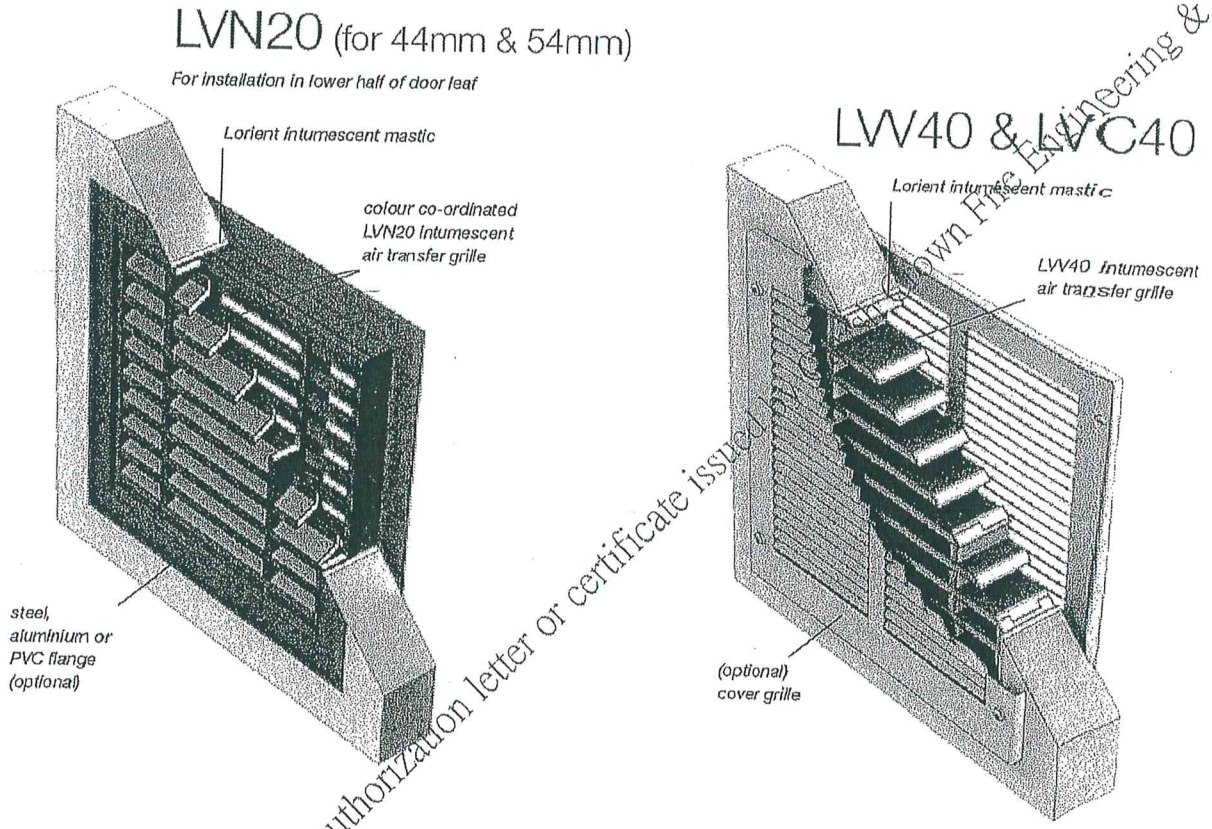
A12.2.3 The required installation technique of screw-fixing the grilles and bedding the grille edges on itumescent material is to be replicated.

A12.2.4 The proposal limits the height of installation of the grilles. This ensures that the grilles would be subject a similar atmospheric conditions as tested.

A12.2.5 WFRC No. C109437 similarly provides a scope of application for LVV40 grilles, the necessary conditions of which can also be satisfied by this proposal.

A12.2.6 The installation conditions of the proposal are consistent with the critical requirements of WFRC No. 122567 and WFRC No. C109437, and a positive assessment is made for the required period of 30 minutes.

Figure 12 **Installation of Lorient LVN 20 and LVV40 air transfer grilles.**



A13 APPENDIX 13
Glazing apertures

A13.1 Proposal

A13.1.1 It is proposed that door leaves may be fitted with glazed apertures as follows:

Arbo XL1075 sealant of12mm by 4mm+ Pyroshield, based on R08K13

i) leaves may be fitted with a single aperture having a sight size of up to 1440mm high or up to 600m wide, subject to a maximum sight size area of 0.36m^2,

ii) the bead profiles, bead fixings, and glazing media shall be as tested,

System 36, fully consistent with CF184

iii) installation details, sizes and glass types shall be shown in Figures 13 and 14, which are extracted from CF 184,

System 630, fully consistent with CF201

iv) installation details, sizes and glass types shall be shown in Figures 15 and 16, which are extracted from CF 201,

Pyroplex 8193, fully consistent with CF346

v) installation details, sizes and glass types shall be shown in Figures 17 and 18, which are extracted from CF 346,

Pyroplex 30049, 30054 and 8492, fully consistent with CF348

vi) installation details, sizes and glass types shall be shown in Figures 19 to 24, which are extracted from CF 348,

Pyroglaze 30, fully consistent with CF316

vii) installation details, sizes and glass types shall be shown in Figures 25 and 26, which are extracted from CF 316,

7.2mm thick Asahi wire reinforced glass

viii) the maximum pane size of 7.2mm thick Asahi glass shall be 500mm by 500mm,

ix) Asahi glass may be fitted in any of the glazing systems proposed above in A13.1.1 1) to vii),

All glazing options

x) apertures shall not occur within 100mm of the leaf edges,

xi) if both glazed apertures and grilles are fitted then the total area of both shall not exceed 0.5m^2, or 20% of the leaf area, whichever is smaller.

A13.1.2 In all other respects, glazing details shall be as tested or, as otherwise assessed by Exova Warringtonfire.

A13.2 Discussion

A13.2.1 The glazed apertures fitted in R08K13 establish that the tested leaf construction is able to tolerate glazed apertures of sight sizes of 1200mm high by 250mm wide in one leaf and 500mm by 500mm in the other leaf.

A13.2.2 Despite the different aspect ratios of the apertures, which caused the structural elements to vary in their relative positions in each leaf, there was no apparent effect on the dimensional stability of the leaves and the meeting edges remained in alignment.

A13.2.3 The apertures were performing satisfactorily when the test was discontinued after 32 minutes.

A13.2.4 Despite the positive performance aspects of the glazed leaves as tested, the proposal represent a conservative approach and has limited the increase in sight size area to 0.33m^2, which is 10% larger than tested. This is because of the limited performance margin beyond the required period of 30 minutes.

A13.2.5 The proposal includes additional glazing options within the scope of CF184, CF210, CF348, CF348, and CF316.

A13.2.6 Having shown the ability to accept glazed apertures of different aspect ratios for the required period of 30 minutes without failure, the doorset described in R08K13 is considered an acceptable target doorset for the glazing options in the indicated Certifire documentation.

A13.2.7 For ease of reference, information from CF184, CF210, CF348, CF348, and CF316 is reproduced in Figures 13 to 26.

Asahi wire reinforced glass, 7.2mm thick

A13.2.8 The proposal includes Asahi wire reinforced glass, which has not been tested in the target doorsets and has not been tested in a timber based glazed system.

A13.2.9 Data provided by WARRES No. R12862 indicates that 6.8mm and 7.2mm thick variants of Asahi wire reinforced glass at nominal pane sizes of up to 2010mm high by 1010mm or, approximately 2.03m^2, are capable of contributing towards an integrity performance of 60 minutes.

A13.2.10 Test data relating to glass in a steel-based framing system does not ordinarily support installation into timber door leaves. One reason is that unlike steel beads, which are expected to retain their section during fire exposure, timber beads will be eroded by charring and may provide less positive support.

A13.2.11 However, the proposed pane size is considerably smaller than the tested pane sizes. The smaller pane size reduces the effect of self-weight. This is associated with the risk of glass tending to slump downwards and allowing the passage of heated gases around the glass edges that can ignite unexposed timber glazing beads pre-heated by radiant energy passing through the glass pane.

A13.2.12 Small changes in glass formulation can vary the level of radiated heat received by the unexposed timber beads

A13.2.13 The proposed maximum pane size is 500mm high by 500mm wide or, approximately 0.25m^2, which is smaller than the largest tested pane size by a factor of eight.

A13.2.14 In view of the lack of data relating to a timber beaded glazing system, the Conclusion of this report has been worded accordingly.

Figure 13 System 36 installation, reproduced from CF184. Not to scale, dimensions in mm.

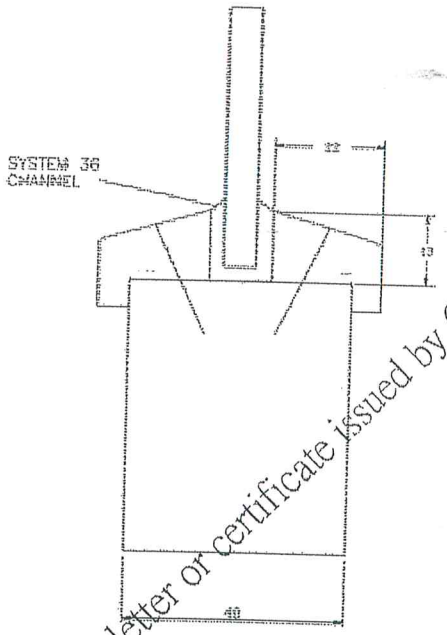


Figure 14 System 36 glass types and sizes, reproduced from CF184. Not to scale, dimensions in mm.

Table 2 - Acceptable glass sizes for door leaves

Glass	Glazing System	Maximum pane height (mm)	Maximum pane width (mm)	Maximum Pane Area (m^2)
Firelite	36/5	1100	700	0.65
Pyroshield Safety	36/6-36/7	1100	700	0.65
Pyran S	36/6	1100	700	0.65
Pyrocet	36/6	1100	700	0.65
Pyrobelite	36/7	875	750	0.66
Pyroguard C / W	36/7	875	750	0.66
Pyrodur +	36/7	875	750	0.66
Pyrostem	36/7	1100	700	0.65

This Certificate of Approval relates to timber based door leaf constructions consisting of timber faces coupled with timber or other cellulosic cores of not less than 40mm overall leaf thickness.

Figure 15 System 630 installation, reproduced from CF201. Not to scale, dimensions in mm.

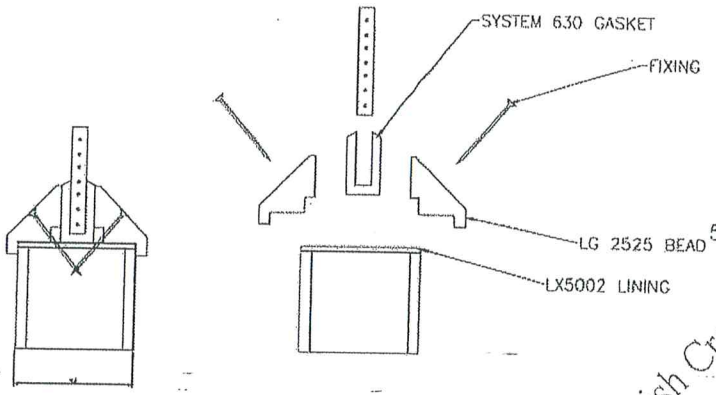
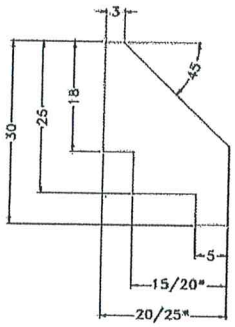


Figure 3
54mm thick leaves



No variations in retaining bead profile are allowable, Figure 4 shows the bead detail which shall be used. The beads are manufactured using 8 pieces of finger jointed timber using either Oak, Beech, Ramin, Utile and Columbian Pine with a minimum density of 615 kg/m³. Suitable types may include Oak, Beech, Ramin and Utile (subject to the above minimum density).

* relates to the use of this bead with a 54mm thick door leaf (bead reference LGC 2525) or a 44mm thick door leaf (bead reference LGC 2520)

This approval relates to on going production. Product and/or its immediate packaging is identified with the manufacturer's name, the product name or number, the CERTIFIRE name or name and mark, together with the CERTIFIRE certificate number and application when appropriate.'

Figure 16 System 630 glass types and sizes, reproduced from CF201. Not to scale, dimensions in mm.

Table 2 - Acceptable glass sizes for door leaves with a solid laminated core

Glass	Maximum leaf cut out diameter (mm)
Pyroshield	462
Pyran S	462
Firelite	462

Figure 17 Pyroplex 8193 installation, reproduced from CF346. Not to scale, dimensions in mm.

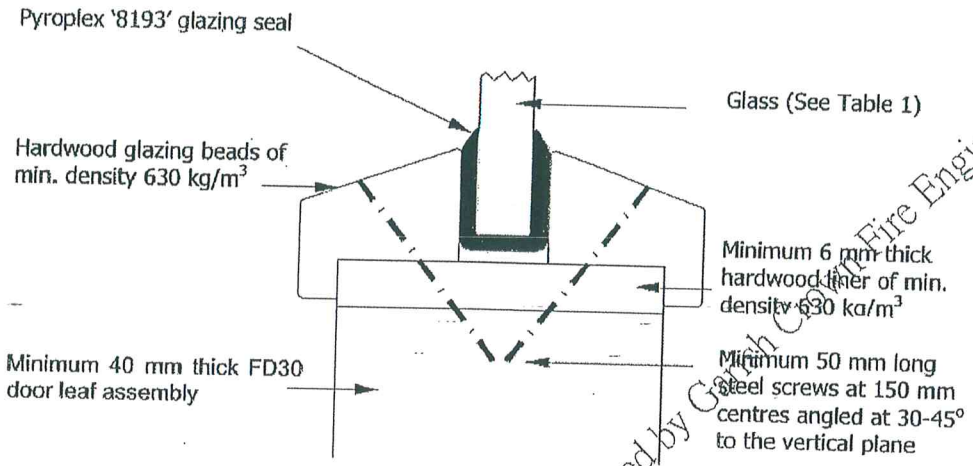


Figure 1. Cross-Section Through Glazing System

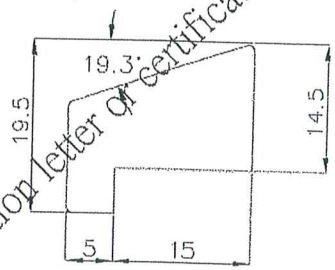


Figure 2. Cross-Section Through Glazing Bead

Figure 18 Pyroplex 8193 glass types and aperture sizes, reproduced from CF346.

Glass	Maximum Aperture Height	Maximum Aperture Width	Maximum Aperture Area
Pyroshield Safety	600 mm (at 600 mm wide)	600 mm (at 600 mm high)	0.36 m^2
Pyrostem	600 mm (at 600 mm wide)	600 mm (at 600 mm high)	0.36 m^2
Pyrodur Plus	600 mm (at 600 mm wide)	600 mm (at 600 mm high)	0.36 m^2
Pyroguard C/W	600 mm (at 600 mm wide)	600 mm (at 600 mm high)	0.36 m^2

Table 1. Acceptable Glass Dimensions

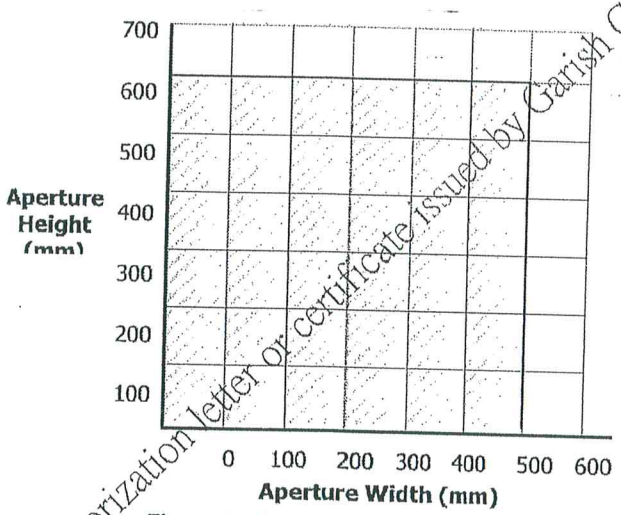


Figure 3. Acceptable Glass Dimensions

* Aperture dimensions shall fall within shaded area as detailed above.

Figure 19 Pyroplex 30049 installation, reproduced from CF348. Not to scale, dimensions in mm.

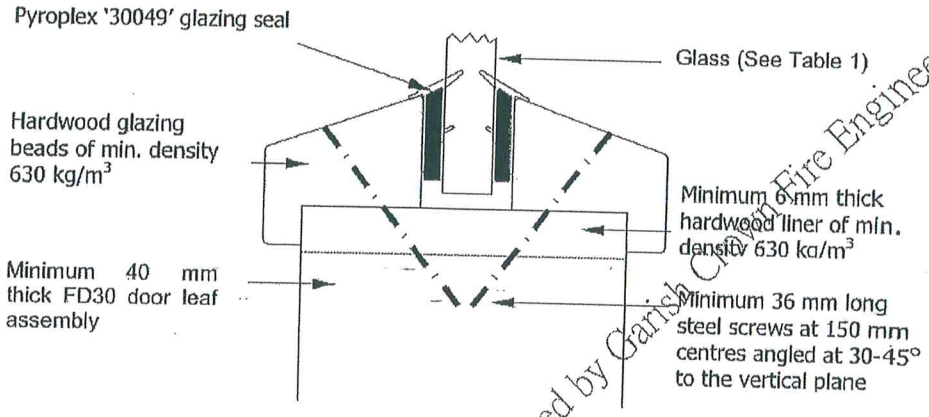


Figure 1. Cross-Section Through Glazing System

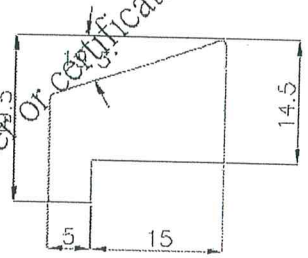


Figure 2. Cross-Section Through Glazing Bead

Figure 20 Pyroplex 30049 glass types and sizes, reproduced from CF348. Not to scale, dimensions in mm.

Glass	Maximum Aperture Height	Maximum Aperture Width	Maximum Aperture Area
Pyroshield Safety	1550 mm (at 290 mm wide)	750 mm (at 600 mm high)	0.45 m^2
Pyrostem	1550 mm (at 290 mm wide)	750 mm (at 600 mm high)	0.45 m^2
Pyrodur Plus	1550 mm (at 290 mm wide)	750 mm (at 600 mm high)	0.45 m^2
Pyroguard C/W	750 mm (at 750 mm wide)	750 mm (at 750 mm high)	0.56 m^2

Table 1. Acceptable Glass Dimensions

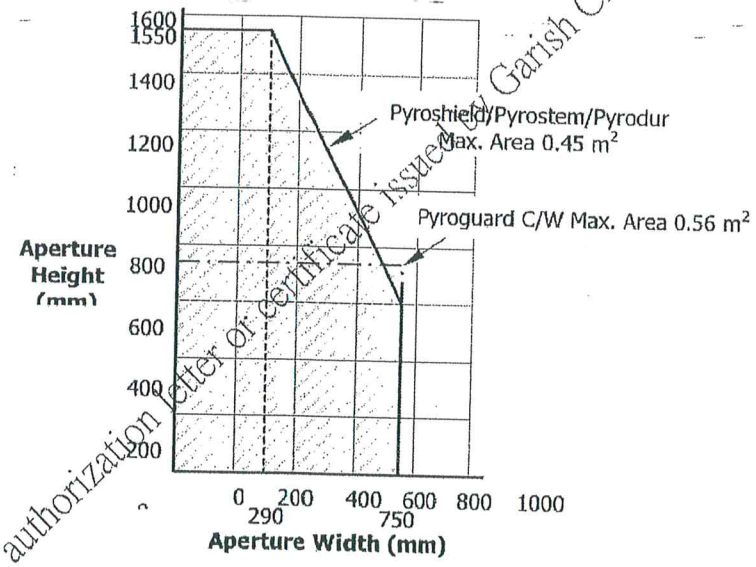


Figure 3. Acceptable Glass Dimensions

* Aperture dimensions shall fall within shaded area as detailed above.

Figure 21 Pyroplex 30054 installation, reproduced from CF348. Not to scale, dimensions in mm.

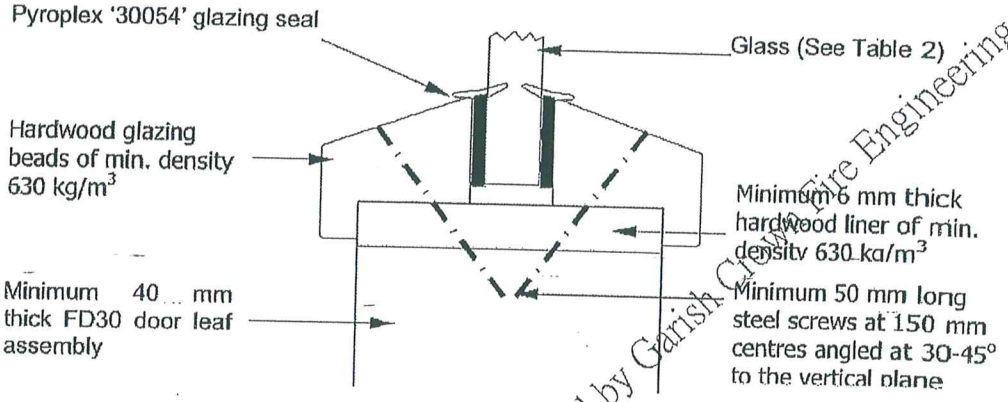


Figure 4. Cross-Section Through Glazing System

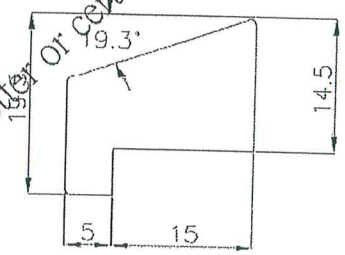


Figure 5. Cross-Section Through Glazing Bead

Figure 22 Pyroplex 30054 glass types and aperture sizes, reproduced from CF348.

Glass	Maximum Aperture Height	Maximum Aperture Width	Maximum Aperture Area
Pyrodur Plus	750 mm (at 750 mm wide)	750 mm (at 750 mm high)	0.56 m^2
Pyroguard C/W	750 mm (at 750 mm wide)	750 mm (at 750 mm high)	0.56 m^2

Table 2. Acceptable Glass Dimensions

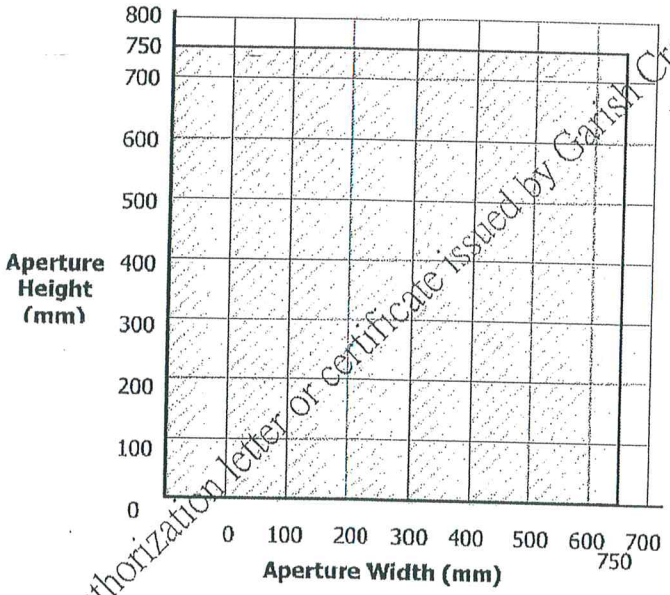


Figure 6. Acceptable Glass Dimensions

* Aperture dimensions shall fall within shaded area as detailed above.

Figure 23 Pyroplex 8942 installation, reproduced from CF348. Not to scale, dimensions in mm.

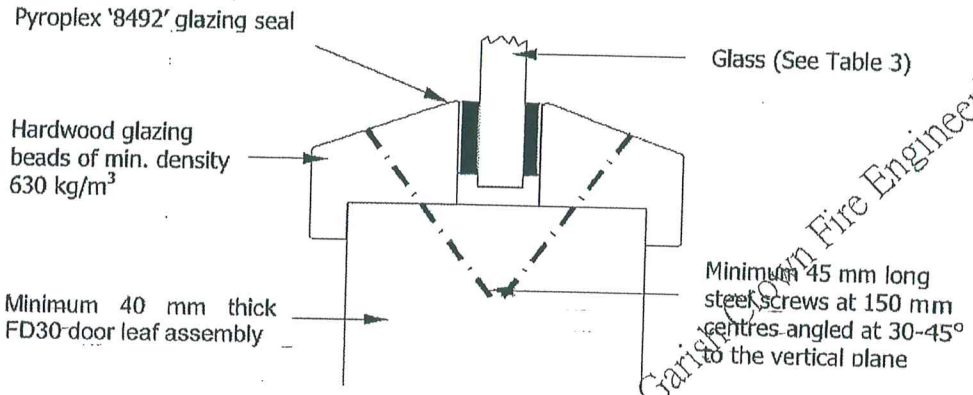


Figure 7. Cross-Section Through Glazing System

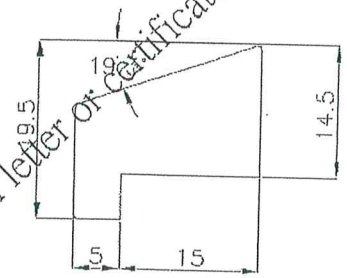


Figure 8. Cross-Section Through Glazing Bead

Figure 24 Pyroplex 8942 glass types and aperture sizes, reproduced from CF348.

Glass	Maximum Aperture Height	Maximum Aperture Width	Maximum Aperture Area
Pyroshield Safety	403 mm (at 626 mm wide)	626 mm (at 403 mm high)	0.25 m^2
Pyrostem	403 mm (at 626 mm wide)	626 mm (at 403 mm high)	0.25 m^2
Pyrodur Plus	403 mm (at 626 mm wide)	626 mm (at 403 mm high)	0.25 m^2
Pyroguard C/W	403 mm (at 626 mm wide)	626 mm (at 403 mm high)	0.25 m^2

Table 3. Acceptable Glass Dimensions

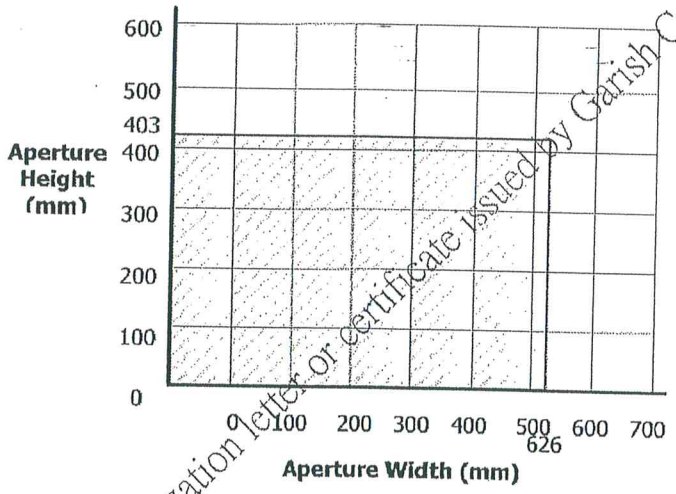
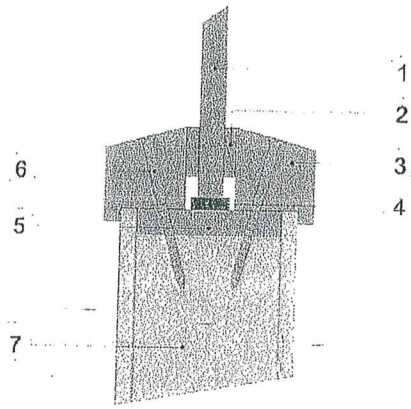


Figure 9. Acceptable Glass Dimensions

* Aperture dimensions shall fall within shaded area as detailed above.

Figure 25 Pyroglaze 30 installation, reproduced from CF316. Not to scale, dimensions in mm.



1. 6 mm thick Pyroshield glass
2. 10 mm wide by 3 mm thick Pyroglaze 30 glazing seal
3. 15 mm high by 19 mm wide with 15° chamfer (plus a 3 mm high by 3 mm wide bolection) hardwood glazing beads, minimum density 640 kg/m³
4. Non-combustible / hardwood setting blocks
5. 6 mm thick hardwood aperture liner
6. 38 mm long steel screws at 150 mm centres (40° to glass)
7. Nominally 44 mm thick FD30 door leaf

Figure 26 Pyroglaze 30 aperture sizes, reproduced from CF316.

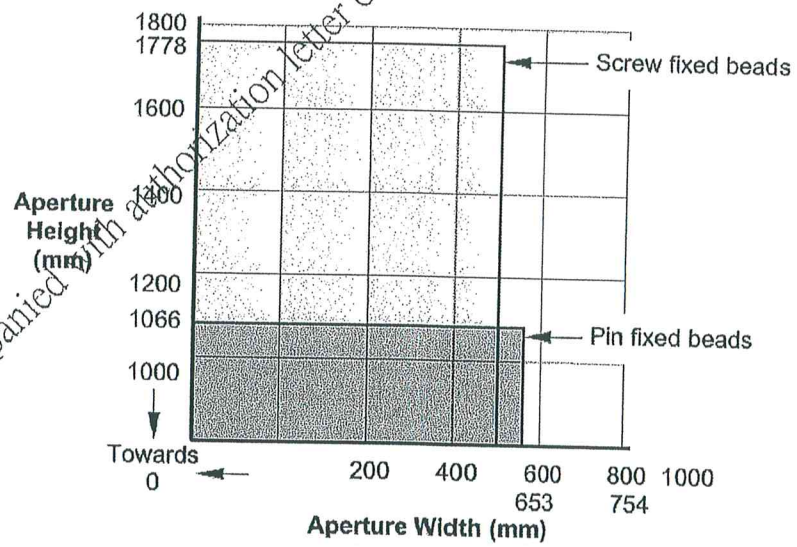


Figure 1. Maximum Permitted Glazed Aperture Dimensions

A14 APPENDIX 14
Additional glazing options

A14.1 Proposal

A14.1.1 For applications requiring nominally 30 minutes integrity and 30 minutes insulation, it is proposed that leaves may be fitted with an aperture glazed with insulated glass using the glazing system as shown in Figure 27, in which case the following conditions shall apply:

All apertures

i) leaves may be fitted with a glazed aperture having a sight size of up to 600mm high or up to 300m wide, subject to a maximum sight size area of 0.15m^2,

ii) apertures shall not occur within 100m of the leaf edges,

iii) the glazing system shall be based on 1.2mm thick mating steel profiles, as shown in Figure 21,

iv) the reveal of the aperture shall be fully lined with two layers of 2mm thick Palusol intumescent material,

30 minutes integrity and insulation

v) the proposed types of glass are: 25mm thick Hengbao FFB-25, 30mm thick Shenzhen Shekou Longdian glass or, 25mm thick Keymax EI60 60-25.

30 minutes integrity only

vi) the proposed types of glass are: 8mm and 10mm thick Longdian heat-treated monolithic glass.

A14.1.2 In all other respects, glazing details shall remain as tested or, as otherwise assessed by Exova Warringtonfire.

A14.2 Discussion

A14.2.1 Based on the proven ability of the tested leaves to accept glazed apertures, an assessment of glazing specifications is presented in Appendix 13 of this report.

A14.2.2 Following a generally similar approach to that in Appendix 13 in terms of aperture size and positional constraints, apertures intended to provide 30 minutes integrity and insulation are to be glazed with 25mm thick Hengbao FFB-25 glass, 30mm thick Shenzhen Shekou Longdian glass or, 25mm thick Keymax EI60 60-25 glass, as respectively tested and described in BETC-NH-2005-426, BETC-NH-2000-F-012, and I3E06.

A14.2.3 Apertures intended to provide 30 minutes integrity only are to be glazed with 8mm and 10mm thick Longdian heat-treated glass, as respectively tested and described in BETC-NH-2006-198, BETC-NH-20005-299.

A14.2.4 The proposed glazing system shown in Figure 27 is derived from the glazing system as originally tested in steel door leaves as described in R05J12B, but conservatively modified when adapted for timber based leaves.

25mm thick Hengbao FFB-25 glass

A14.2.5 The modifications are a reduction in aperture size and the fitting of a double layer of 2mm thick intumescent sheet material across the full width of the aperture reveal, compared with the single layer forming part of the System 90 Plus system as described in R07L06B.

A14.2.6 The reduction in size is because of a cautious approach with respect to reaction of steel beads, which are expected to exhibit thermal expansion, with a timber leaf. In addition, In addition, the double layer of intumescent material is expected to further assist in reducing any adverse thermal interaction between the steel beads and the timber components of the leaf.

A14.2.7 The data provided by BETC-NH-2005-426 shows that Hengbao FFB-25 glass is capable of remaining in place and contributing towards the required performance of 60 minutes integrity in fully glazed door leaves providing a sight size 2135mm high by 827mm, albeit of steel, at a much larger pane than proposed.

A14.2.8 However, the insulation performance of the glass pane in the left hand leaf failed after 53 minutes, and after 58 minutes in the right hand leaf.

A14.2.9 It is not clear from the recorded data whether the loss of insulation was a localised phenomenon, which could occur with a pane of any size or, whether it was associated with the pane size and the self-weight of the thermally softened glass layers and activated intumescent interlayers.

A14.2.10 If the premature failure was caused by self-weight, this will be addressed by the significantly smaller pane size proposed in this case.

A14.2.11 The required performance of 30 minutes integrity and full insulation for 30 minutes is strongly indicated by the available data. However, there is no specific test data to support the overall glazing system as proposed. The Conclusion of this report has been qualified accordingly.

30mm thick Shenzhen Shekou Longdian glass
25mm thick Keymax EI60 60-25 glass

A14.2.12 These glass types have been included in the scope of this Appendix because of their generic similarity to Hengbao FFB-25 glass, being insulated glass based on glass outer layers with a gel core.

A14.2.13 The similarity extends to the large tested pane sizes of these glasses compared to the panes size for the proposed doorset.

A14.2.14 However, it is inappropriate to assess glazing for door leaves based solely on screen data. While the level of foreseeable risk is considered limited, the Conclusion of this report has been necessarily qualified.

8mm and 10mm thick Longdian heat-treated monolithic glass

A14.2.15 This glass is supported by BETC-NH-2006-198, BETC-NH-20005-299. Similar to the types of glass discussed above, it is inappropriate to assess glazing for door leaves based solely on screen data.

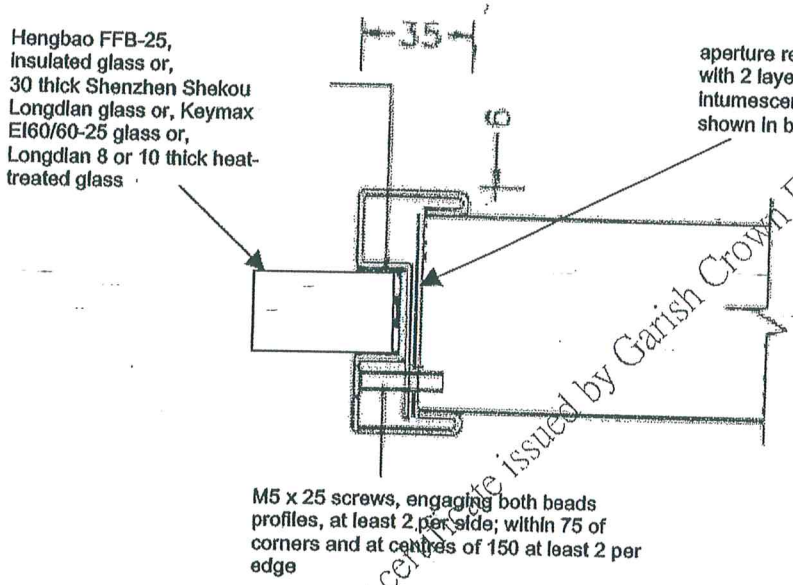
A14.2.16 Similarly, there is also compensation in terms of the small pane size as proposed compared with the tested pane size, and the performance margins beyond the required period of 30 minutes.

A14.2.17 However, in this case the glass is heat-treated and monolithic, and will likely be more sensitive to temperature gradients developing at the pane edges during the early stages of a standard fire test.

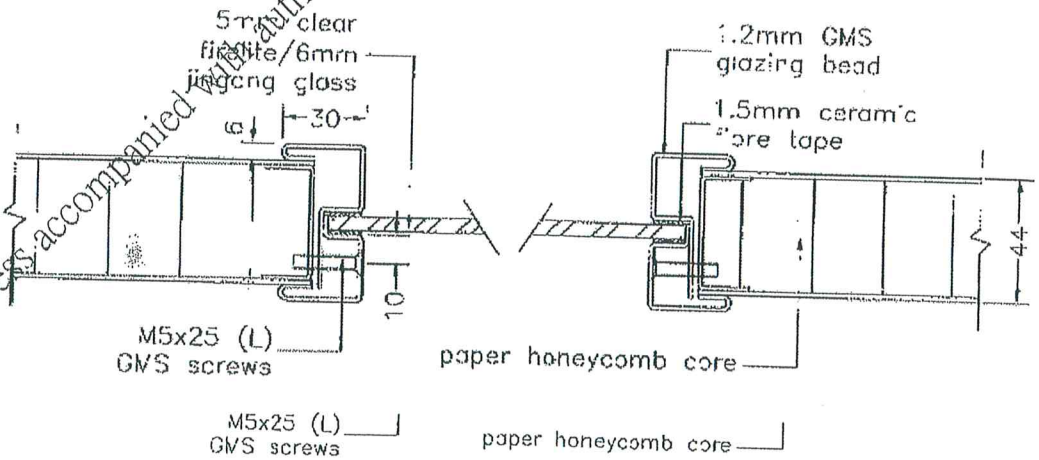
A14.2.18 It is therefore appropriate use the system shown in Figure 27 as it is based on hollow steel profiles, which will provided uninsulated support similar to the hollow steel beads as described in BETC-NH-2006-198, BETC-NH-20005-299.

A14.2.19 While the level of foreseeable risk is considered limited, the Conclusion of this report has been necessarily qualified.

Figure 27 Glazing system fitted with alternative types of glass. Not to scale dimensions in mm.



For comparison, glazing system as tested, reproduced from report R05J12B



A15 APPENDIX 15
Adjacent hinged and fixed leaf panels

A15.1 Proposal

A15.1.1 It is proposed that several doorsets may be fitted within the same structural opening such that adjacent doorsets share frame jambs, as shown in Figure 28.

A15.1.2 Alternatively, fixed panels of leaf construction may relace hinged leaves. Fixed panels shall be fitted in a simialr manner to trnasom panels as assessed in Appendix 11.

A15.1.3 There is no limit to the number of doorsets in a single structural opening.

A15.2 Discussion

A15.2.1 In the case of fire exposure on the opening (hinge knuckle) face of the proposed assembly the charring of a shared frame jamb is expected to be similar to the charring of a normal perimeter jamb. This is because only the edge of the frame is directly exposed.

A15.2.2 In the case of exposure on the closing (doorstop) face of the proposed assembly, it is possible that a shared frame jamb would be subject to multi-directional charring. This is a more onerous case than a perimeter jamb.

A15.2.3 In order to compensate for a potentially greater degree of charring, and greater mechanical load resulting from the possibility of supporting two door leaves, the cross-section of shared jambs is larger than the tested frame jambs. Figure 22 shows the proposed jamb, fixed to a brickwork or reinforced concrete pier.

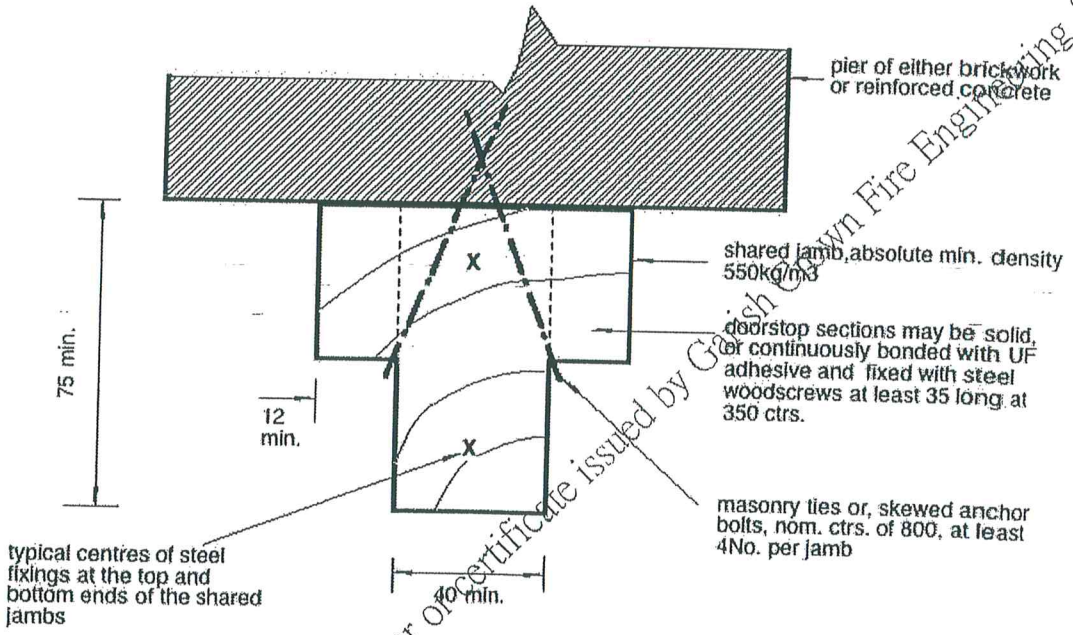
A15.2.4 The proposal requires that the top and bottom joints of a shared jamb comprise at least two separated steel fixings. In addition, the jamb is secured to the adjacent pier by angled fixings. These are considered reasonable measures to ensure that from whichever direction fire exposure occurs there will be operative fixings to maintain the stability of the shared jamb.

A15.2.5 The proposed fixed side panels are to be mechanically fixed at four edges without potentially vulnerable operating clearance gaps that would otherwise be required for door leaves. In addition, intumescent seals are included at the panel edges. The features are considered to present a less onerous case than the hinged leaves.

A15.2.6 The proposed leaves and panels are expected to behave independently of each other because they are fixed in a manner such that no significant interaction is expected to occur.

A15.2.7 An assembly comprising adjacent doorsets, with the option of fixed panels of leaf construction, with shared jambs as proposed is expected to provide the required performance of 30 minutes fire resistance.

Figure 28 Shared frame jamb for adjacent doorsets and/or fixed panels of door leaf construction. Not to scale, dimensions in mm.



NB
Intumescent seals as tested or, as otherwise appraised elsewhere in this report

A16 APPENDIX 16
Intumescent seal location

A16.1 Proposal

A16.1.1 It is proposed that the tested specifications of intumescent seals at the leaf edges may be fitted in either the leaf edge or, the frame reveal.

A16.2 Discussion

A16.2.1 Remote from leaf corners, the heat activated swelling action of intumescent seals, whether seals are fitted in the leaf edge or the frame reveal, is generally expected to be equally effective.

A16.2.2 The effectiveness of activated seals can, however, be affected at the head of the doorset at the top leaf corners and directly above the meeting edges.

A16.2.3 At the top edges of leaves, where the furnace overpressure will be at its greatest during a standard fire test, it is critical to avoid any risk of fissures or discontinuities in the activated seal.

A16.2.4 Because some types of seal exhibit greatest swelling in their thickness, rather than laterally, there can be a risk of incomplete sealing at the top leaf corners and directly above the meeting edges if seals are fitted in the top edges of leaves.

A16.2.5 However, in this case, the seals are Pyroplex and are based on vermicular graphite, which expands in all directions to form a gap-filling mass of exfoliated granules. This mode of activation, combined with the required period of 30 minutes reduces the risk of exploitation at the leaf corners.

A16.2.6 In the absence of any expected difference in contribution towards integrity performance for the required period of 30 minutes, the proposal for alternative seal locations is positively assessed.

A17 APPENDIX 17
Glazed side and transom lights

A17.1 Proposal

A17.1.1 It is proposed that glazed side and transom light may be fitted adjacent to doorsets, based on the use of System 90 Plus within the scope of CF 185, as follows:

System 90 Plus, fully consistent with CF185

i) installation details, sizes and glass types shall be shown in Figures 29 and 30, which are extracted from CF 185, (a typical configuration of a doorset with adjacent glazed side and transom lights is shown in Figure 31),

ii) in all aspects, glazing shall be within the scope of CF185.

A17.1.2 In all other respects, glazing details shall be as tested or, as otherwise assessed by Exova Warringtonfire.

A17.2 Discussion

A17.2.1 The proposed screen installations are to be consistent with the scope of CF185, which describes applications requiring 60 minutes integrity.

A17.2.2 There will be shared framing members between doorsets and areas of glazing. Despite this, there is no reason to expect the exposed faces of these members to be eroded any more rapidly compared with members acting as door frames only or, shared members with areas of glazing.

A17.2.3 The minimum framing member width indicated in CF185 is 45mm. A typical configuration for a proposed doorset and screen installation is shown in Figure 29. The members are shown as 50mm wide, which satisfies CF185.

A17.2.4 In the absence of any contra-indications, the proposed glazed areas are expected to perform in manner that will not adversely affect the performance of the proposed doorsets for the required period of 30 minutes.

Figure 29 **System 90 Plus installation for screens, reproduced from CF185. Not to scale, dimensions in mm.**

Timber framing members shall be of minimum density 650kg/m3. Ash timber (Fraxinus spp.) is not permitted.

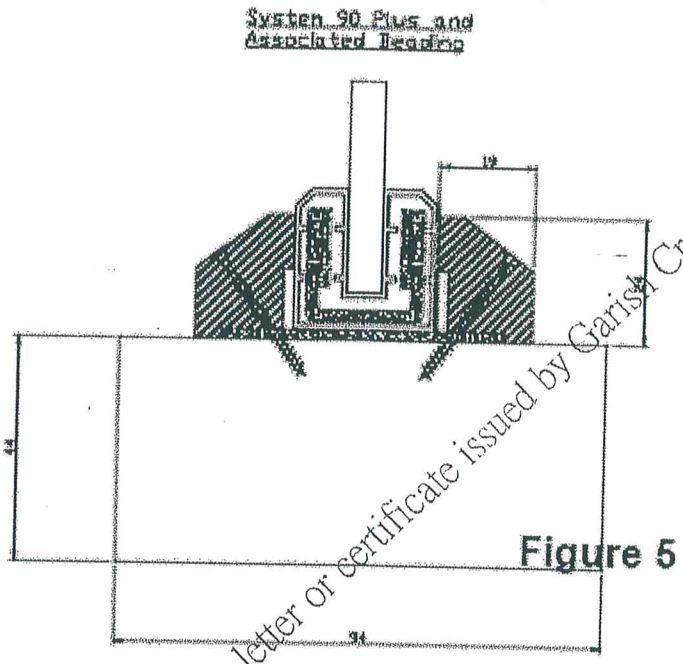
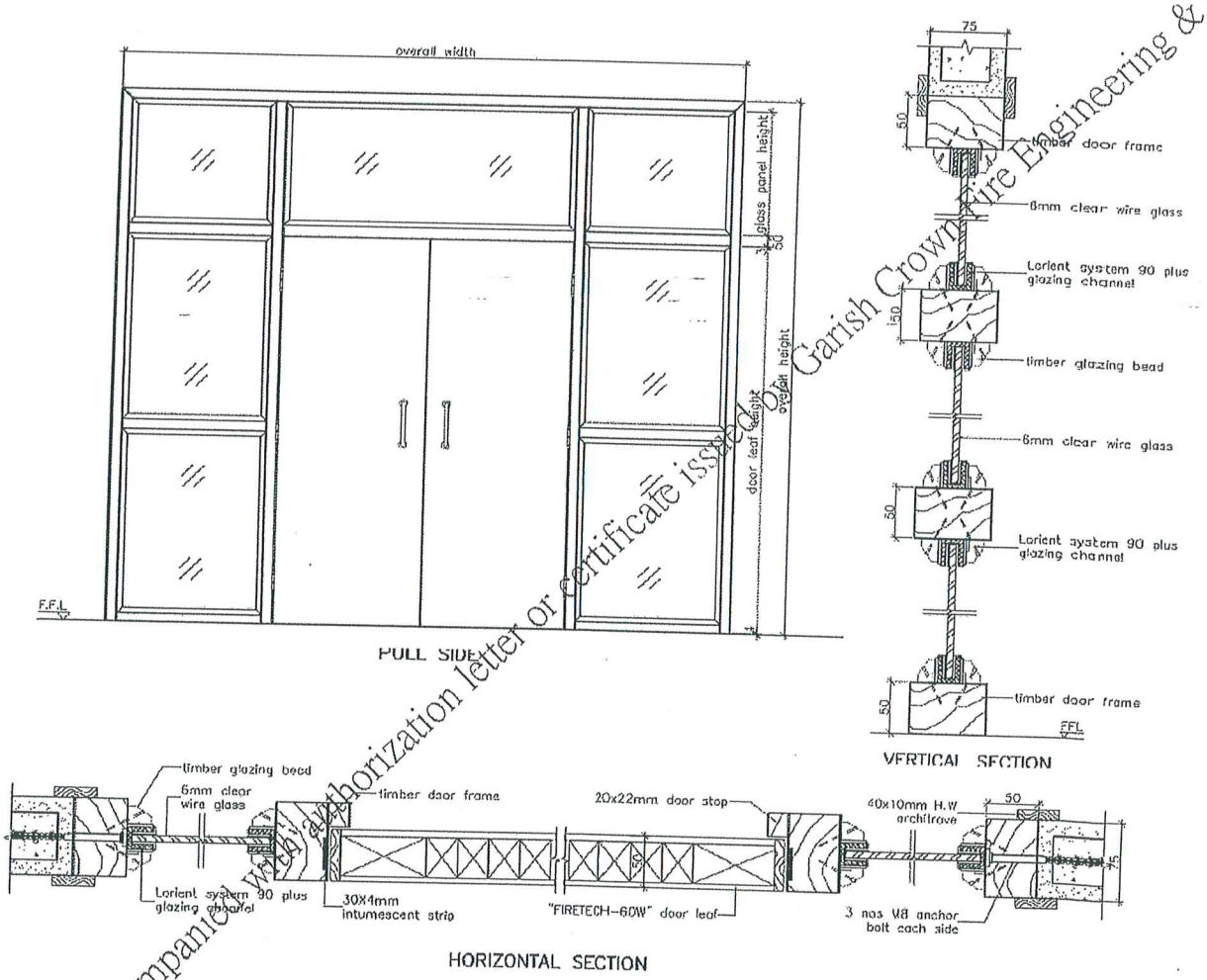


Figure 30 **System 90 Plus glass types and sizes for screen installations, reproduced from CF185.**

Table 1 - Acceptable glass sizes for screens

Glass	Maximum Pane dimension (mm) at any aspect ratio less than 1:1	Maximum Pane dimension (mm) at an aspect ratio of 1:1	Maximum Pane Area (m^2)
Firelite	2420 or 1077	1460 by 1460	2.15
Pyroshield Safety	1000 by 1000	1000 by 1000	1.00
Pyran S	2420 or 1077	1460 by 1460	2.15

Figure 31 Typical configuration of System 90 Plus glazed side and transom lights. Not to scale, dimensions in mm.



A18 APPENDIX 18 SOSS hinges

A18.1 Proposal

A18.1.1 It is proposed that the doorsets may be fitted with SOSS 216, 218 or, 418 hinges within the scope of BWA 23487-01, as follows:

A18.1.2 **SOSS hinges - general**

i) the number and location of SOSS hinges shall replicate the number and location specifications of the butt hinges described in the fire test report supporting the doorset,

ii) adjustable versions of the proposed hinge models may be fitted; when fitted to timber substrates all voids at the edges of the hinge blades shall be filled with intumescent sealant after final adjustment of the hinges,

iii) the SOSS hinges shall be capable of supporting the weight of the door leaf; if necessary, additional SOSS hinges may be fitted providing the distance between hinge centres is at least 300mm,

iv) SOSS closer hinges shall be capable of closing the target leaf from any angle and overcoming the latch,

v) if the supporting test evidence for timber-based doorsets or, doorsets having leaves with timber leaf edges, describes minimum timber densities greater than indicated below, then the higher density value shall be adopted.

A18.1.3 **SOSS hinges - models 216, 218, and 418**

i) SOSS hinge models 216, 218, and 418 shall be entirely of carbon or stainless steel (SS) or, die cast Mazak construction, without any combustible materials present,

ii) the maximum leaf edge clearance gap shall be 3mm,

iii) the hinge components mortised into the leaf edges and the frame reveals shall both be fully bedded on Lorient intumescent mastic, as tested,

iv) timber leaf edge lippings shall have an absolute minimum density of 650kg/m^3,

v) timber stiles at the hanging edges of leaves shall be solid timber having an absolute minimum density of 450kg/m^3, or timber-based material having an absolute minimum density of 650kg/m^3

vi) timber door frame shall have an absolute minimum density of 550kg/m^3.

A18.2 Discussion

A18.2.1 The proposed installation conditions are derived from the test data provided by BWA 23487-01.

A18.2.2 Where corresponding critical specifications in the test data supporting the proposed doorsets and BWA 23487-01 differ, the higher specification has been adopted, e.g. timber density.

A18.2.3 The proposed absolute minimum values of 650kg/m^3 for leaf edge components, and 550kg/m^3 for door frame is based on assessed details elsewhere in this report and are also consistent with the values given in BWA 23487-01.

A18.2.4 The proposed conditions are considered to reproduce, or exceed, the critical specifications given in BWA 23487-00 necessary to achieve a performance of at least 30 minutes integrity.

A18.2.5 The proposal is positively assessed for the required period of 30 minutes.

A19 APPENDIX 19
Melamine laminates, wood veneers, mouldings

A19.1 Proposal

A19.1.1 Decorative melamine laminates or wood veneers, up to 2mm thickness, may be applied to the faces of the door leaf.

A19.1.2 The total decorative materials applied to a leaf shall not increase its weight by more than nominally 10%. The mouldings may be of any design, and may be bonded or, mechanically fixed in place.

A19.1.3 The laminates, veneers, and mouldings will be additional to the specification of the door leaf as tested or otherwise appraised,

A19.1.4 The laminates, veneers, and mouldings may either finish at the lippings or, extend right up to the leaf edge, but shall not extend onto the leaf edges.

A19.2 Discussion

A19.2.1 Decorative melamine laminates on the exposed face of a door leaf are likely to be consumed after a few minutes exposure in a Standard fire test without adversely affecting the overall fire resistance performance of the doorset.

A19.2.2 The tested door leaves maintained insulation performance, which indicates that combustible materials on the unexposed face of the leaf are not expected to spontaneously ignite. The proposed use of melamine laminates is therefore considered acceptable for the required period of 60 minutes.

A19.2.3 The proposed decorative wood veneers up to 2mm thick do not materially or, structurally alter the surface or construction of the tested doorset. The presence of such veneers is therefore not associated with any foreseeable increase in risk for the required period of 60 minutes.

A19.2.4 Timber mouldings are considered similarly of neutral significance. However, as a precaution, the total weight of the applied material has been limited to nominally 10% of the leaf as a reasonable measure to prevent excessive additional stresses being generated in the supporting ironmongery and door closers.

A20 APPENDIX 20
Trimec strikes for doorsets with timber frames

A20.1 Proposal

A20.1.1 It is proposed that single-acting doorsets may be fitted with Trimec ES3100/ES310 'power to open' electrically operated strikes, see Figures 32 to 34. The proposed strike shall be fitted as follows:

Door frame installation, for single-leaf doorsets

i) a Palusol, Intumex, or Thermaflex based intumescent seal shall be fitted adjacent to the long edge of the strike, see Figure 33,

ii) the side and bottom of the strike rebate shall be lined with nominally 2mm thick Palusol, Intumex, or Thermaflex intumescent sheet material, see Figure 33,

Leaf edge installation, for double-leaf doorsets

iii) meeting edges shall be square,

iv) there shall be an intumescent seal at least 10mm wide adjacent to the long edge of the strike and the strike rebate shall be fully lined with nominally 2mm thick Palusol, Intumex, or Thermaflex intumescent sheet material, see Figure 34,

All installations

v) the strike shall not be fitted higher than 1100mm above the threshold,

vi) electrical cables shall be fitted in the bottom of the grooves housing the leaf edge seals or, shall pass through the leaf via a groove of nominally 6mm by 6mm filled with intumescent sealant,

vii) alternatively, cables may pass through a hole in the frame section; the hole shall not exceed 8mm in diameter, and both ends of the hole shall be filled with intumescent mastic for a depth of at least 10mm.

A20.2 Discussion

General

A20.2.1 The proposed strike is fail-safe such that in case of failure of the electrical supply the strike remains static and does not release the leaves.

A20.2.2 Doorsets, therefore, remain in the locked condition. This ensures that should the power supply be compromised during fire exposure, doorsets will be closed and capable of providing their intended fire resisting function.

A20.2.3 Additional intumescent material was fitted at the hinge blade and latch strike positions. The proposal extends this principle, and the Trimec strikes are to be bedded on intumescent material as shown in Figures 33 and 34.

A20.2.4 In view of the greater mass of the proposed strikes compared with the strikes and hinge blades as tested, an increased specification of intumescent material is used. This is expected to thermally isolate the proposed strike and protect the leaf edge and frame reveal from the risk of significant erosion by charring.

A20.2.5 The strike will occur no higher than 1100mm from the threshold. At this location, the strike does not coincide with a significant furnace overpressure, as specified in the testing standard.

A20.2.6 The lack of a pronounced pressure differential relative to the unexposed face will assist in reducing the tendency for furnace gases to pass into the leaf edge gap, which may otherwise promote heat conduction and exploitation by charring.

A20.2.7 Electrical cables providing power to the strikes are either fully bedded in intumescent sealant within the leaf core or, are located along the base of grooves in the leaf edges that accommodate intumescent seals. The heat activated swelling of intumescent materials is expected to compensate for the relatively small section of timber removed to house the cables.

A20.2.8 The proposed strike is relatively more massive than the strikes and hinge blades as tested, which will tend to conduct heat into the relatively vulnerable leaf edge clearance gap.

A20.2.9 An additional length of intumescent seal is to be fitted adjacent to the strike, in order to reinstate the continuity of the main leaf edge seals. This is based on the principle of continuous intumescent seals by-passing the hinge positions as tested.

A20.2.10 From whichever direction fire exposure occurs, the additional seal is expected to maintain integrity at the strike position.

A20.2.11 Combustible materials associated with the strike are expected to be protected by the inherent insulating properties of the timber frame profile, which itself is combustible and has proven acceptable by testing.

A20.2.12 In the case of doorsets opening towards the heating conditions, heat conduction into leaf edge clearance gap is considered especially onerous. In addition to the effects of conducted heat, charring of the frame profile will tend to undercut the strike body.

A20.2.13 Figure 33 shows that, as well as the intumescent seal adjacent to the strike, the side and bottom of mortice for the strike body will be lined with intumescent sheet material.

A20.2.14 The additional intumescent material lining the proposed strike mortice is a reasonable measure to compensate for loss of frame material caused increased charring and undercutting of the strike body. This is considered adequate an adequate precaution to support a positive assessment for the required period of 30 minutes.

Leaf edge installation

A20.2.15 The comments relating to frame installation generally apply. However, the reduced overall thickness of the leaf compared with the frame profile produces a more onerous condition. Accordingly, Figure 34 requires the mortice for the strike to be fully lined. This represents a significant increase in the use of intumescent sheet material, which is intended to isolate the strike body and reduce the risks associated with conducted heat and loss of leaf material cause by charring.

A20.2.16 Figure 33 shows that the forend of the strike is to be bedded on intumescent material. This measure is derived from the tested doorset, in which the hinge blades were similarly prepared.

A20.2.17 The bedding of intumescent material will assist in isolating the strike forend and thereby reduce the effects of aggravated charring caused by conducted heat.

Overall performances

A20.2.18 The timber door frame profiles remain as tested or, as otherwise assessed by Exova Warringtonfire as suitable for the required period of 30 minutes.

A20.2.19 The proposed details the strike positions are generally extrapolated from the available test data, which indicates that additional intumescent materials can maintain integrity at locations where metal components are incorporated at the leaf edges.

A1.2.20 The conservative application of intumescent materials as shown in Figures 33 and 34 is considered adequate to contribute to the required performance of 30 minutes integrity.

Figure 32 Trimec ES3100 strike.

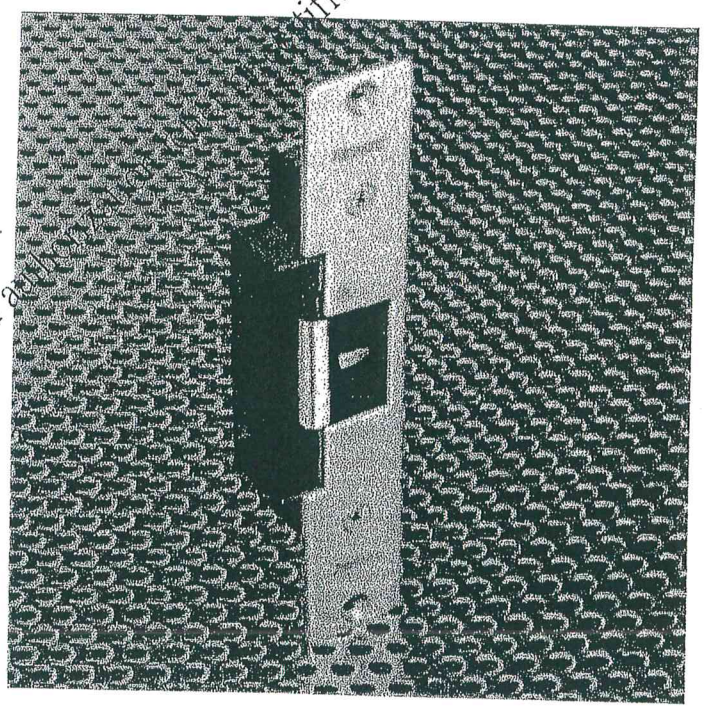


Figure 33 Frame preparation for the installation of Trimec ES3100/ES310 strikes, for 30 minutes integrity. Not to scale, dimensions in mm.

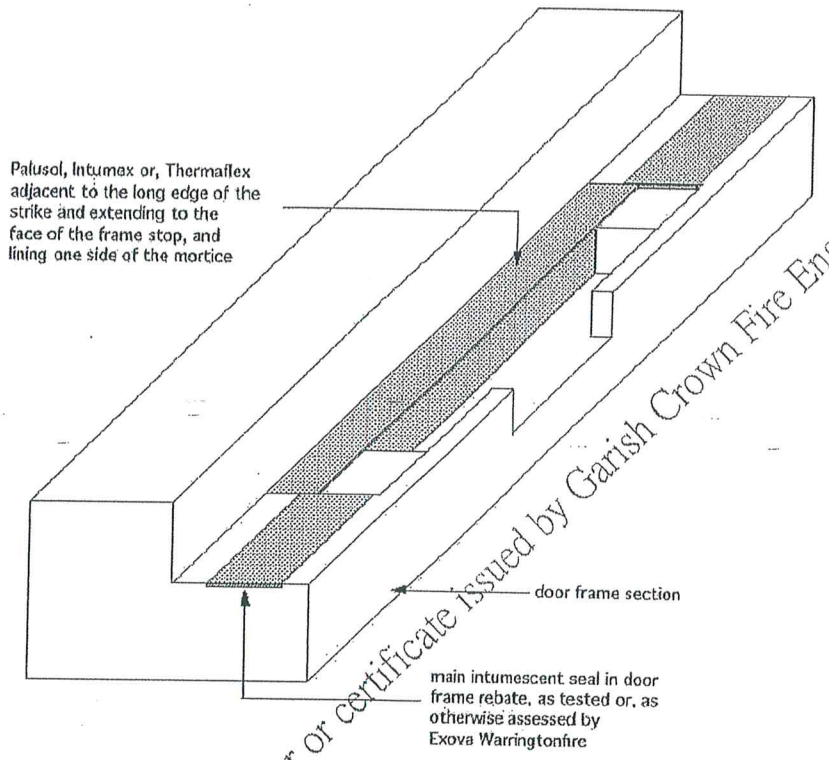
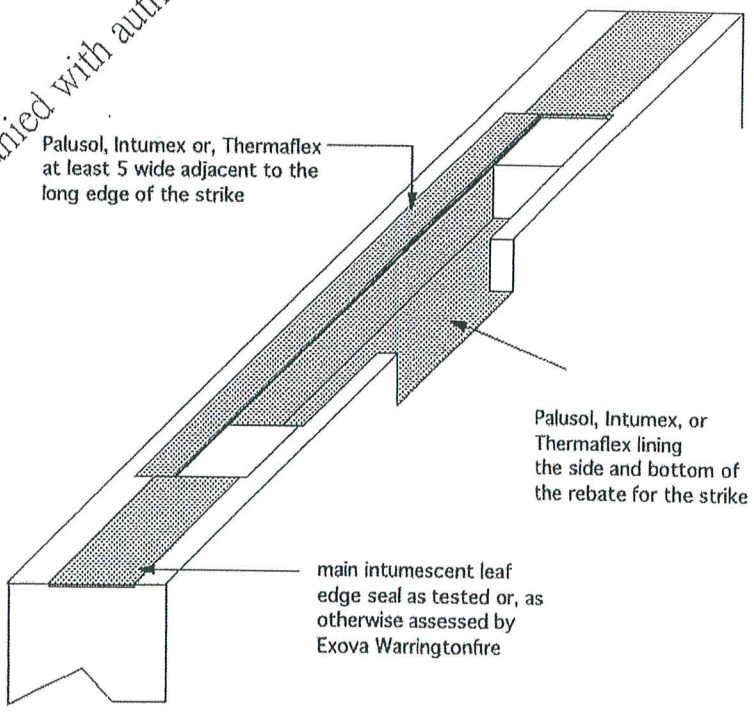


Figure 34 Leaf edge preparation for the installation of Trimec ES3100/ES310 strikes, for 30 minutes integrity. Not to scale, dimensions in mm.



A21 APPENDIX 21
Alternative intumescent seals

A21.1 **Proposal**

A21.1.1 It is proposed that alternative intumescent leaf edge seals may replace the original seals as tested, as follows:

i) the proposed alternative seals may be one of the following:

By Reddiplex Ltd:
Pyroplex Rigid seals contained in G-Lex carriers
Pyroplex Flexible variants
Pyroplex seals that include integral smoke seal profiles

ii) alternative seals shall be centrally fitted at the leaf edges, as described in R08K13,

iii) at the top, hanging and meeting edge the proposed seals shall be of similar width to the seals as originally tested,

iv) seals at hinge blades shall fitted as shown on Page 24 of R08K13.

A21.2 **Discussion**

General

A21.2.1 Intumescent seal types can vary in terms of chemical formulation, activation temperature, activation pressure, physical nature of the activated intumesced seal, and thermal degradation characteristics.

A21.2.2 The tested doorsets were fitted with Pyroplex intumescent seals, which produce a rigid The proposed Pyroplex seals are presented if different carriers but rely on the same active component of simialr cross-section.

A21.2.3 The charring rate of timber is closely associated with its density, as a function of mass to be consumed per unit volume. As a contributory factor, the density of timber door frames and leaf edges must be also considered in combination with the contribution made by intumescent seals.

A21.2.4 The doorset described in WF No. 167746 used to demonstrate the performance of Pyroplex seals was intentionally designed to avoid high timber density values. To this end, the frame was of 420kg/m^3 and the leaf edge lippings were of nominally 650/kg/m^3.

A21.2.5 The integrity performance at the leaf edges described in WF No. 167746 did not, therefore, rely unduly on slower charring rates typical of dense timber and confirmed the ability of Pyroplex seals to perform similarly, despite the type of carrier used to present the Pyroplex intumescent component.

A21.2.6 The proposal is considered supported by the data provided by the target doorset as tested and described in R08K13 and the confirmatory data provided by WF No. 167746. The proposal is therefore positively assessed for the required period of 30 minutes.

A22 APPENDIX 22
E.Bon concealed hinges

A22.1 Proposal

A22.1.1 It is proposed that for applications requiring 30 minutes integrity the target doorsets may hung on E.Bon CH-201 (mild steel) and CH-202 (stainless steel) concealed hinges with die-cast alloy bodies, instead of steel butt hinges as tested. The hinges are shown in Figure 35 and shall be fitted as follows:

i) CH-201 and CH-202 hinges shall only be fitted when the risk fire exposure can be identified as uni-directional, and the door leaves open away from the direction of exposure,

i) CH-201 and CH-202 hinges shall be installed at similar positions to the butt hinges as tested,

iii) the hinge components mortised into the leaf edge and the frame reveal shall both be fully bedded on intumescent mastic at least 2mm thick,

iv) the timber stile and leaf edge lipping at the hanging edges of leaves shall have an absolute minimum density of 550kg/m^3,

v) the timber door frame shall have an absolute minimum density of 550kg/m^3,

vi) an additional 100mm length of intumescent leaf edge seal, at least 10mm wide, shall be fitted between the hinge forends and the face of the doorstop, see Figure 31,

vii) iii) and iv) indicate minimum density requirements; if other design modifications are to be applied as assessed elsewhere that require a minimum timber density, then the higher density value shall be adopted.

A22.1.2 In all other respects, doorsets shall be as tested or, as assessed by Exova Warringtonfire.

A22.2 Discussion

A22.2.1 The proposed hinges are mortised in to the leaf edges and the frame reveal. The articulated hinge components are of steel while the forends are of die-cast metal and 20mm wide, as shown in Figure 35.

A22.2.2 In principle, it can be argued that the hinges do not represent a more onerous case that butt hinges as tested that have wider forends or, mortice locks.

A22.2.3 However, this type of hinge is not commonly fitted to doorset designs offered for fire resistance testing and there is no specific test data supporting the proposed E.Bon hinges, which incorporate low melting point die-cast bodies and forends.

A22.2.4 Consequently, a conservative approach has been taken and the proposal limits the installation of the hinges to outward opening doorsets for applications requiring 30 minutes integrity.

A22.2.5 In the case of outward opening doorsets, the presence of the doorstop section of the frame profile will provide additional timber material to be eroded by charring before the hinge position is eventually exploited.

A22.2.6 In addition, the hinges are to be bedded on intumescent mastic, an additional length of intumescent seal is fitted adjacent to the hinge forends, and the density of the leaf edge and frame profiles are controlled to ensure the hinge mortices are not significantly eroded by charring.

A22.2.7 The intumescent mastic is intended to ensure the hinge mortices, once exposed by charring, are not significantly exploited.

A22.2.8 Furthermore, the activated additional length of seal, between the hinge forends and the face of the doorstop, occurs between the direction of fire exposure and the hinges. Its location is expected to reduce heating of the die-cast forends of the hinges by furnace gases flowing with the leaf edge clearance gap.

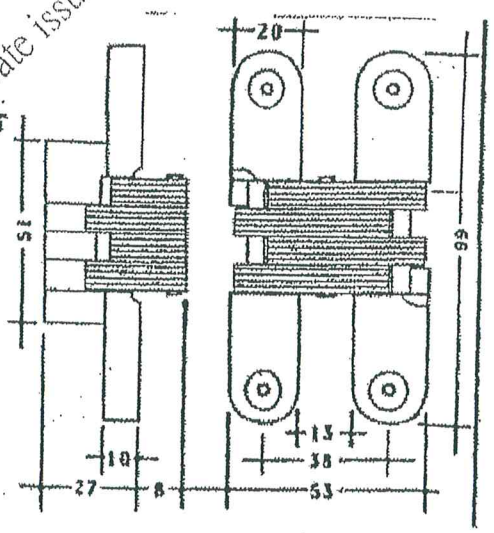
A22.2.9 The relatively small size of the proposed hinges and the conservative conditions of the proposal are considered adequate to justify a positive assessment for the required period of 30 minutes.

Figure 35 E.Bon CH-201 and CH-202 hinges. Dimensions in mm, not to scale.

CH-201 :STEEL JOINT
CH-202 :STAINLESS STEEL JOINT
MATERIAL:ZINC DIE-CAST BODY
CONCEAL HINGE
暗藏鉸鏈

FINISH

C	AB	MC	BL	SZ	CP	MG	SCP
					*		



A23 APPENDIX 23
Bonco steel concealed hinges

A23.1 Proposal

A23.1.1 It is proposed that door leaves may be hung on CH202 and CH203 steel concealed hinges by Bonco for applications requiring 60 minuets integrity, instead of steel butt hinges as originally tested. In which case the following conditions shall apply:

i) concealed hinges shall be entirely of mild or stainless steel construction, including the chassis, forends, articulated plates, and pivot pins; the proposed hinge models are shown in Figures 36 and 37,

i) Bonco concealed hinges shall be installed at similar positions to the butt hinges as tested,

iii) the hinge components mortised into the leaf edge and the frame reveal shall both be fully bedded on intumescent sheet material at least 2mm thick, see Figure 37,

iv) the timber stile and leaf edge lipping at the hanging edges of leaves, and the timber door frame, shall have an absolute minimum density of 550kg/m^3,

v) an additional length of intumescent leaf edge seal, at least 10mm wide, shall be fitted between the hinge forends and the face of the doorstop, see Figure 37,

vi) iv) and v) indicate minimum density requirements; if other design modifications are to be applied as assessed in elsewhere in this report that require a minimum timber density, then the higher density value shall be adopted.

vii) hinges shall not be either fitted in a manner or, be of a design, that causes or requires larger leaf edge clearance gaps than as tested, and shall be selected to ensure they are capable of supporting the weight of the proposed door leaves.

A23.1.2 In all other respects, doorsets shall be as tested or, as assessed by Exova Warringtonfire.

A23.2 Discussion

Bonco CH-202 and CH-203 concealed hinges and available doorset test data

A23.2.1 The proposed Bonco CH202 and CH203 concealed hinges comprise components that are mortised into the frame reveal and in the leaf edge.

A23.2.2 In principle, the mortised items ironmongery that were fitted to the tested doorsets supports the acceptability of the mortised components proposed concealed hinges.

A23.2.3 The forends of the proposed hinges are centrally located in the leaf edge, and do not extend to the leaf face. The risk of heat conduction into the relatively vulnerable leaf edge clearance gap is therefore reduced compared with the wider blades of the tested butt hinges.

Supporting test data for hinges

A23.2.4 The proposed Bonco hinge models are not supported by specific test data.

A23.2.5 In the absence of specific test data, and to avoid compromising actual proprietary test data relating to concealed hinges as assessed elsewhere in this report, a conservative approach has been taken in developing an installation technique for the proposed hinges.

Proposed installation technique

A23.2.6 The proposed installation technique is derived largely from the method of fitting the butt hinges as described in R0&L06A, which were bedded on intumescent sheet material, with a portion of the main leaf edge seals by-passing the hinge positions.

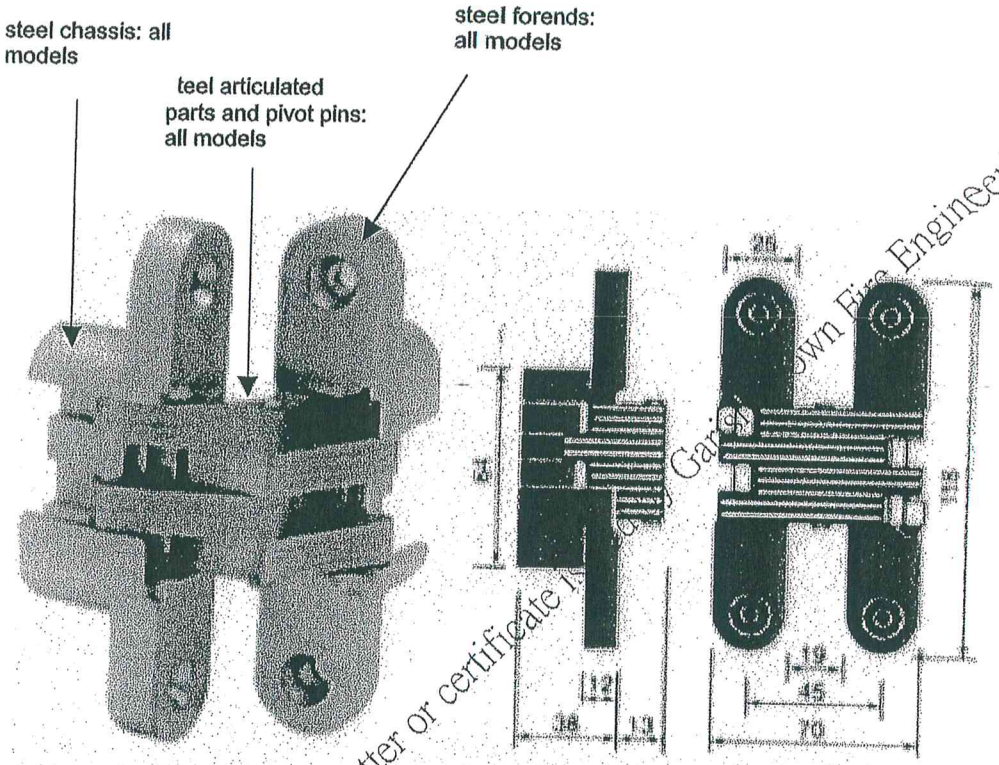
A23.2.7 The proposed method of installation as shown in Figure 37 relies on intumescent sheet material to fully line the hinge mortices to ensure a consistent level protection at all locations around the hinge parts.

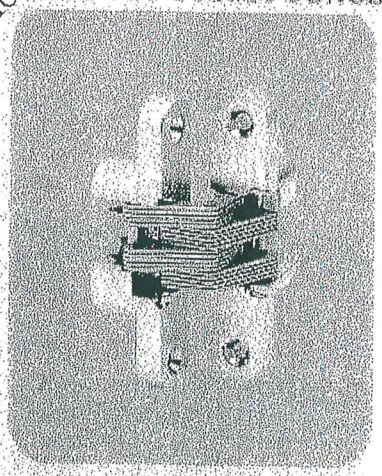
A23.2.8 Furthermore, an additional length of intumescent seal is to be fitted in the frame reveal, adjacent to the hinge forend. This is expected to compensate for the interruption of the main leaf edge seal at the hinge positions.

Overall performance

A23.2.9 Bonco CH-202 and CH-203 concealed hinges when installed as proposed are considered adequately supported by test data relating to other forms of ironmongery and the conservative use of intumescent material at the hinge positions, and are positively assessed for the required period of 30 minutes.

Figure 36 **Bonco CH-202 and CH-203 steel concealed hinges.**





CH-202
(Concealed Hinge)
99(H) x 53(W) x 35(D)

Figure 37 General installation requirements for Bonco CH202 and CH203 concealed hinges. Dimensions in mm, not to scale.