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Testing, calibrating, advising.

Title:

The fire resistance performance of a double leaf single acting doorset with glazing when tested in accordance with BS EN 1634-1: 2014 and BS EN 1363-1: 2012

WF Report No:

BMT/FEP/F16079



Prepared for:

Acoustic & Fire Door Solutions Ltd

3 Esplanade
Broughty Ferry
Dundee, DD5 2EL

Test date:

31st March 2016

Notified Body No:

1314



1762

Exova Warringtonfire – the new name for BM TRADA

On December 1st 2015, Chiltern International Fire Limited (trading as BM TRADA) commenced trading under the name Exova Warringtonfire.

To coincide with this change, our Technical Reports, Test Reports, Product Assessments, company stationery and marketing collateral have been updated to reflect the Exova Warringtonfire branding.

The validity of all documents previously issued by Chiltern International Fire Limited including certificates, test reports and product assessments is unaffected by this change. A letter to this effect is available upon request by e-mailing globalfire@exova.com

About Exova Warringtonfire

Exova Warringtonfire is part of the Exova Group one of the world's leading laboratory-based testing groups, trusted by organisations to test and advise on the safety, quality and performance of their products and operations. Headquartered in Edinburgh, UK, Exova operates 143 laboratories and offices in 32 countries and employs around 4,500 people throughout Europe, the Americas, the Middle East and Asia/Asia Pacific. With over 90 years' experience, Exova specialises in testing across a number of key sectors from health sciences to aerospace, transportation, oil and gas, fire and construction.

Be assured that whilst the name will change, your service provision and primary contacts have not. What will be available to you is a wider team of testing experts and an extended range of testing capabilities including structural steelwork testing, ventilation duct and damper testing, ASTM testing, water mist system testing and smoke toxicity testing and covering additionally both the rail and marine sectors.

If you have any questions, please do not hesitate to contact a member of the team and we will do our best to answer them. We appreciate your business to date and we look forward to working with you in the future.

Kind regards

Exova Warringtonfire

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1 Summary of Performance

The following performance was achieved from the specimen tested. Full details of the testing and specimen construction are described in the report.

Results: Fire resistance test in accordance with BS EN 1364-1: 2014 and BS EN 1363-1: 2012	<table border="1"> <tr> <td colspan="2">Integrity</td></tr> <tr> <td>Cotton pad</td><td>31 (thirty one) minutes</td></tr> <tr> <td>Continuous flaming</td><td>31 (thirty one) minutes</td></tr> <tr> <td>Gap gauges</td><td>31 (thirty one) minutes</td></tr> <tr> <td colspan="2">Insulation - 2 discrete areas</td></tr> <tr> <td>Discrete area – timber</td><td></td></tr> <tr> <td>Average set</td><td>31 (thirty one) minutes</td></tr> <tr> <td>Maximum $\geq 100\text{mm}$ in from leaf edge</td><td>31 (thirty one) minutes</td></tr> <tr> <td>Door frame $\geq 180^\circ\text{C}$ temp rise</td><td>31 (thirty one) minutes</td></tr> <tr> <td>Door frame $\geq 360^\circ\text{C}$ temp rise</td><td>31 (thirty one) minutes</td></tr> <tr> <td colspan="2">Discrete area 2 - glass</td></tr> <tr> <td></td><td>4 (four) minutes</td></tr> <tr> <td>Radiation – time to 15kW/m^2</td><td>32 (thirty two) minutes*</td></tr> </table> <p>* No failure of the test criterion at termination of the test at 32 minutes</p>	Integrity		Cotton pad	31 (thirty one) minutes	Continuous flaming	31 (thirty one) minutes	Gap gauges	31 (thirty one) minutes	Insulation - 2 discrete areas		Discrete area – timber		Average set	31 (thirty one) minutes	Maximum $\geq 100\text{mm}$ in from leaf edge	31 (thirty one) minutes	Door frame $\geq 180^\circ\text{C}$ temp rise	31 (thirty one) minutes	Door frame $\geq 360^\circ\text{C}$ temp rise	31 (thirty one) minutes	Discrete area 2 - glass			4 (four) minutes	Radiation – time to 15kW/m^2	32 (thirty two) minutes*
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Exposed face – pre test



Summary of specimen:

A double leaf single acting doorset with glazing opening in towards the furnace

Leaf size – both leaves: 2132mm high x 947mm wide x 54mm thick

2 Introduction

The doorset was installed into a flexible supporting construction. In accordance with BS EN 14600: 2005 the leaf was pre-cycled before the fire test. The doorset was instrumented with the standard set of thermocouples. The doorset was installed opening in towards the furnace.

3 Specimen verification

The doorset was supplied for testing and delivered to Exova Warringtonfire during March 2016. The component parts of the doorset were identified based on nominal information provided by the client. The conformity of the specimen against these nominal values has been verified and agreed by the laboratory insofar as the structure of the specimen allowed verification to take place. If possible, additional moisture content readings, species verification and density checks were performed on either the original specimen, or, samples provided by the sponsor. These details are outlined in the construction section of this report (section 6).

3.1 Conditioning

Exova Warringtonfire stored the specimens in climatic conditions approximate to those in normal service.

3.2 Sampling

Exova Warringtonfire was not involved in factory sampling of the components used for the specimen subject to this report.

4 Description of supporting construction

The supporting construction comprised a British Gypsum steel stud partition with 50mm thick 33kg/m³ density insulation fitted between the studs, built in accordance with Clause 7.2.2.4 of BSEN 1363: Part 1, for a flexible supporting construction (table 1 group A). The vertical studs surrounding the apertures created for the doorsets incorporated a 45mm x 28mm softwood timber infill to facilitate the fixings for the specimens. The specimen tested is a 30 minute product with an anticipated Category B performance, therefore intended fire resistance is 36 minutes and one layer of 12.5mm thick Gypsum plasterboard type F was fitted on each face. The supporting construction was only fixed on the horizontal edges, the vertical edges remained free.

5 Description of specimens

Details of the specimen are shown in Figures 1 to 6 of Appendix 1.

5.1 Door leaf

Both leaves measured 2132mm high x 947mm wide x 54mm thick.

6 Description of Construction (Refers to Figures 1 to 6 of the Appendix)

Leaf

		Species/type	Dimensions (mm)		Density (kg/m³)	Moisture (% w/w)	Key to figures
Stiles and rails		2No. Finnish Redwood*	32 wide x 46 thick		510*	10.8-11.6	1
Core – constructed from 3 sections (see figure 1 of Appendix 1)	Section A	Sauerland S3K Core - 3No layers of extruded particlboard with cork facings	3 x 13 thick (particleboard) 3 thick cork facings (see figures 2+3)	1850 high x 700 wide x 45 thick	550* overall	-	2
	Section B			2000 high x 88 wide x 45 thick			3
	Section C			148 high x 700 wide x 45 thick			4
Facings		MDF	4 thick		700*	8.5-9.7	5
Glazing aperture lining		American White Oak	6 thick		740**	-	6
Adhesive	Facings	PVA D3	-		-	-	-
	Lippings	M/s - Apollo A9331 H/s - Apollo A3727	-		-	-	-
	Glazing lining	Pinned through with the beading fixing (see appendix 3 - client drawings)	50 long		-	-	-
Lippings	Hanging edges	American White Oak	6 thick		740**	8.4-8.8	7
	Closing edge – left leaf	American White Oak	22 thick including an 18 wide x 12 deep rebate		740**	8.4-8.8	8
	Closing edge – right leaf	American White Oak	22 thick with including a 35 wide x 12 deep rebate		740**	8.4-8.8	9

* Manufacturers stated density, not verified by laboratory

** Nominal density not checked by laboratory

Door frame

	Species/type	Dimensions (mm)	Density (kg/m ³)	Moisture (% w/w)	Key to figures
Head and jambs	Finnish Redwood	76 deep x 32 thick	510*	11.2-11.3	10
Head to jamb jointing detail	Half lapped – screwed	-	-	-	-
Stops - planted (pinned)	Finnish Redwood	12 thick x 20 wide	510*	11.1-11.2	11
Frame to supporting construction fire stopping detail	Tightly packed mineral fibre capped with intumescent acrylic mastic	Nominally 10mm wide x full depth of frame	-	-	-
Frame to supporting construction fixing detail	4No steel woodscrews per jamb	80 long x 6 diameter	-	-	-
Architrave	European Redwood	44 wide x 18 thick	510**	10.7-11.6	-
Threshold	Non combustible	-	-	-	-

* Stated density not checked by laboratory

** Nominal density not checked by laboratory

Intumescent and sealing materials

		Make/type	Size (mm)	Location	Key to figures
Door edges - left leaf closing edge only		2No. STS 104FS brush seal	10 x 4	Fitted 6mm apart, 31mm from the exposed face	12
Frame reveal	Head	2No. STS 154FO plain seal	15 x 4	Fitted 10mm apart, 7mm from the exposed face	13
	Jambs	1No. STS 154FO plain seal	15 x 4	Fitted 19mm from the exposed face in the frame reveal	14
Smoke seal	Frame	Lorient IS1212 batwing type seal	12 x 12	Fitted in the frame reveal up to the upstand of the stop	15
	Leaf threshold	Lorient Polyproducts Ltd IS8010 Drop seal	56 x 120 (cut out size)	Fitted centrally in the threshold of both leaves	16
Leaf core		Intumescent Seals Ltd Therm -A- Line	2 thick x 45 wide	Fitted between the core sections, and between the core section joints to stiles and rail junction	17
Glazing perimeter	Left leaf	STS ST105GT glazing system*	10 x 5	Fitted between the glass and bead on both faces	18
	Right leaf	Intumescent Seals Ltd Therm-A-Glaze 45*	10 x 2	Fitted between the glass and bead on both faces	19
		Fireglaze mastic*	-	Fitted around the perimeter of the glass	20

* Stated by the client, not checked by laboratory

Intumescent interruptions and additional protection

	Make/type	Size (mm)	Location
Around hinge blade	Partially interrupted	-	Hinge blade partially interrupts seal in frame reveal with 2mm remaining continuous
Under hinge blades	STS ST100X30R Interdens	1 thick	Fitted under hinge blade on frame and leaf
Encasing latch body	STS ST100X30R Interdens	1 thick	Fitted around the body of the latch
Under latch forend	STS ST100X30R Interdens	1 thick	Fitted under the latch forend
Around latch keep	Fully interrupted	-	Latch keep fully interrupts both seals in leaf edge
Under latch keep	STS ST100X30R Interdens	1 thick	Fitted under the latch keep
Around drop down seal	Partially interrupted	-	Drop down seal fully interrupts 1 st seal in left leaf edge leaving 2 nd seal continuous
Under drop down seal	None fitted	-	-
Around flush bolt keep	Partially interrupted	-	Flush bolt keep partially interrupts 2 nd seal in frame reveal with 1mm remaining continuous, 1 st seal is continuous
Under flush bolt keep	None fitted	-	-

Hardware

	Make/type	Size (mm)	Location	Key to figures
Hinges	3No. Royde and Tucker Hi Load 105 lift off type hinge	98 x 22 (blade size)	Fitted 160mm, 990mm and 1880mm from the head of the leaf	21
Closer	Dorma (UK) Ltd TS72 overhead type closer	235 x 70 (footprint)	Surface fixed, fitted on the exposed face as per the manufacturers' instructions	22
Latch - disengaged	Zoo Hardware steel mortice latch	235 x 24 (forend size) 75 x 25 (keep size)	Latch nib fitted 1000mm from the threshold of the leaf	23
Furniture	Aluminium lever type handle	175 x 44 (footprint)	Fitted appropriate to the latch	24
Flush bolts - engaged	Tayside Ironmongery FBAA81003	200 x 20 (footprint)	Grooved into the unexposed face of the left leaf	25

Glazing – both leaves

	Make/type	Size (mm)	Location	Key to figures
Glass type – all apertures	Promat Securiglass Pyrobelite	7 thick	Fitted 145mm from the leaf head, 470mm from the hanging edge and 240mm apart (see figure 1)	26
Glass size	Upper aperture	-	916 high x 334 wide	-
	Lower aperture	-	484 high x 334 wide	-
Sight size	Upper aperture	-	885 high x 305 wide	-
	Lower aperture	-	455 high x 305 wide	-
Expansion allowance	-	2-3 on all edges		-
Beading	American White Oak (630kg/m ³ density, m.c. 9.7-9.9 %)	26 high x 24.5 deep including a 5 x 11 bolection return with a 12° chamfer	-	27
Beading fixings	Steel pins	Ø2 x 50 long	Fitted 50mm from corners at 110mm centres on horizontal edges and 70mm from corners at 150mm centres on vertical edges	28

7 Pre-test measurements and mechanical conditioning

Pre test measurements and mechanical conditioning were conducted on the sample in the order detailed below.

7.1 Method of installation

The doorset was fixed into a pre-prepared opening. The details of the fixings and fire stopping between frame and supporting construction are outlined in the construction section and Figure 4 of Appendix 1. The exposed face of the doorset was flush with the exposed face of the supporting construction.

7.2 Pre-cycling operability

Operability test of 25 manual cycles was completed on each leaf in accordance with BS EN 14600, section 5.1.1.1.

Minimum angle of opening	90°
Number of operation cycles completed	25

7.3 Specimen self closing

Specimen self closing was completed on the leaf in accordance with BS EN 14600, section 5.1.1.2 / 5.1.1.3.

	Left leaf	Right leaf
Angle of measurement	10° ± 2°	
Closing speed	1.6 seconds	1.16 seconds

7.4 Door perimeter gaps

The manufacturer did not declare a working range so the door was installed to open and close freely, maintaining gaps, where possible, to a range of 2-4mm along all edges except the threshold, and 3-8mm along the threshold. The gaps between the edge of the leaf and frame were measured prior to test in accordance with BS EN 1634-1 2014, section 10.1.2. A total of 12 readings were recorded. The measurements (in mm) are detailed in Figure 5 of Appendix 1.

7.5 Closer forces

Measured in accordance with BS EN 1634-1: 2014 Section 10.1.3.

	Opening Force (Nm)
Left leaf	32 @ handle position
Right leaf	29 @ handle position

7.6 Final setting

Final setting of the specimens were conducted in accordance with BS EN 1634-1 2014, section 10.1.4.

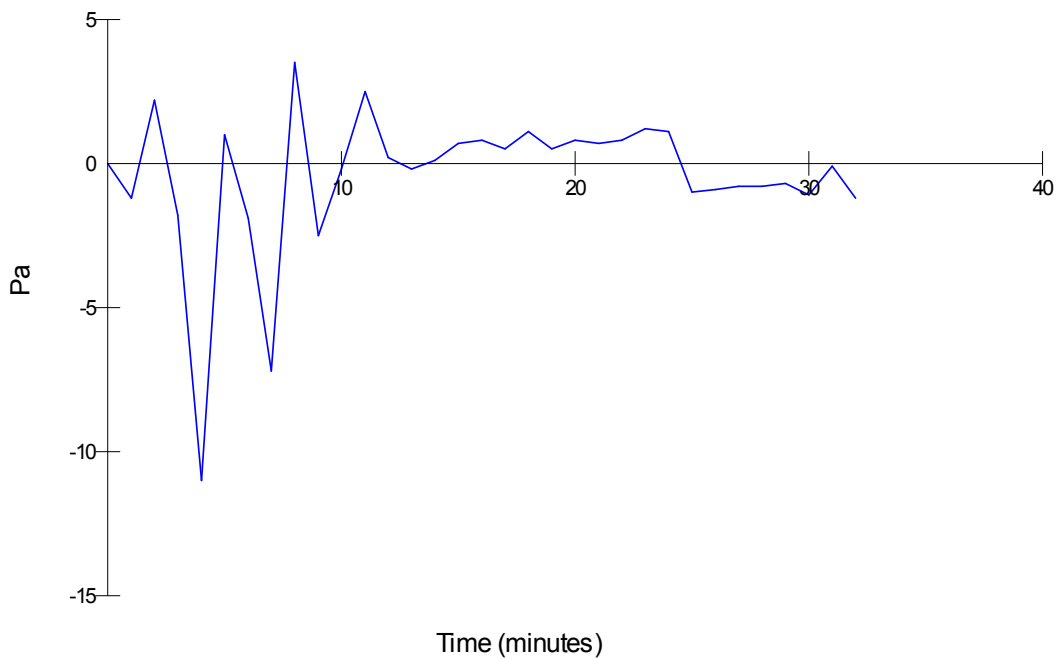
8 Test Conditions

8.1 Ambient temperature

The ambient temperature of the test area at commencement of test was 11°C. The temperatures recorded during the test are tabulated in Appendix 2.

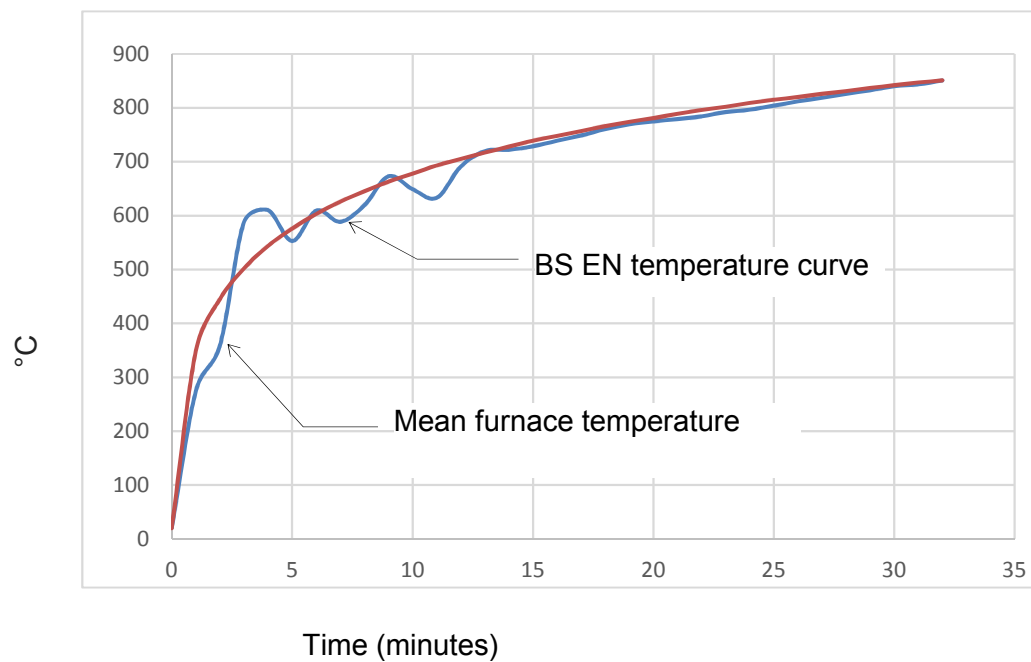
8.2 Pressure readings

After the first 5 minutes of the test, the furnace pressure was maintained at 0 ± 5 Pa and after 10 minutes was maintained at 0 ± 3 Pa with respect to atmosphere, at a point 0.5m from the notional floor level. The pressure readings were recorded and are tabulated in Appendix 2 and shown graphically below:



8.3 Furnace temperature

The furnace was controlled to follow the temperature/time relationship specified in BS EN 1363: Part 1: 2012 Section 5.1.1 as closely as possible, using the average of eight plate thermometers suitably distributed within the furnace. The temperatures were recorded and are tabulated in Appendix 2 and shown graphically below:

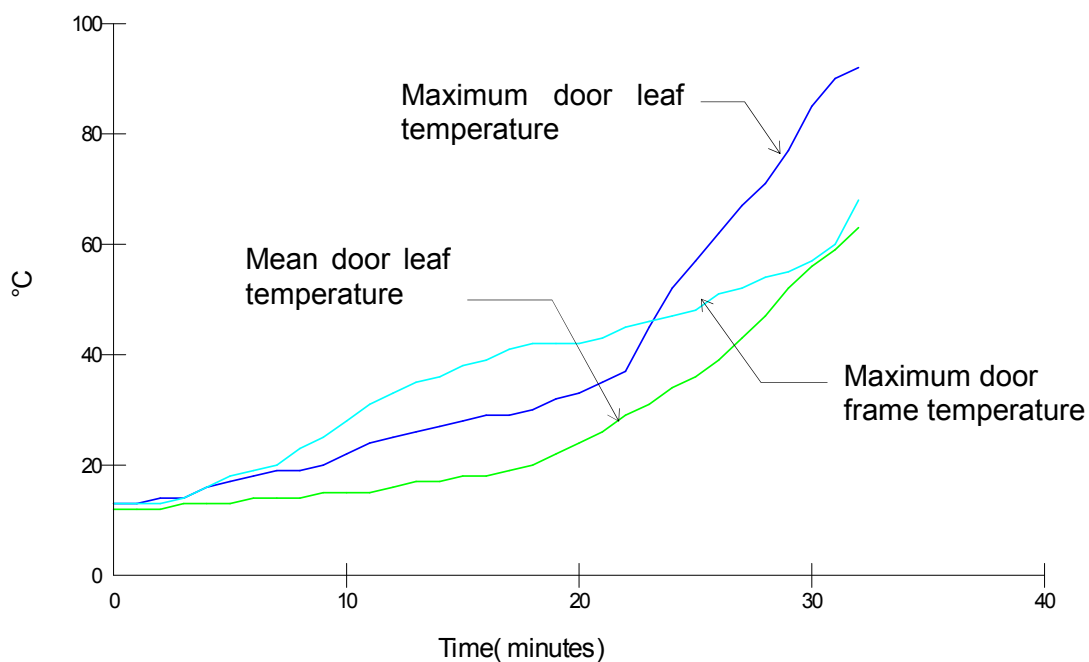


8.4 Unexposed face temperatures

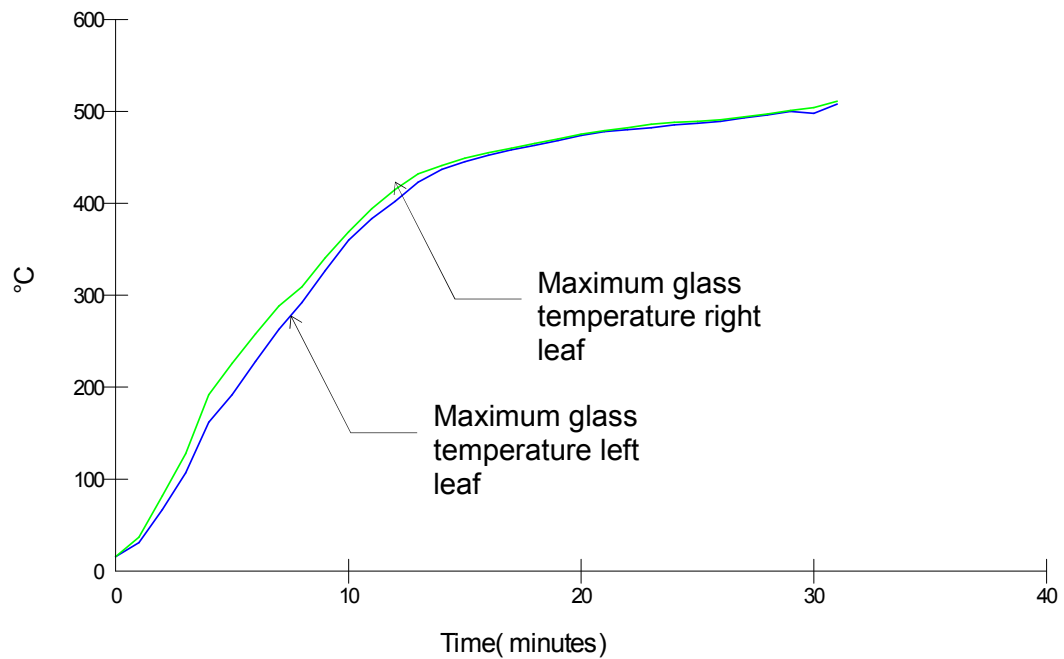
The temperature of the unexposed face was monitored by means of the following thermocouples:

	2 discrete areas	
Leaf	Discrete area 1 (timber)	5 measuring mean temperature rise. 8 measuring maximum temperature rise, standard set 100mm in from the door leaf edges.
Frame		6 measuring maximum temperature rise
Glass	Discrete area 2	8 measuring maximum temperature rise

The locations of the thermocouples are shown in Figure 6 of Appendix 1. The temperatures were recorded and tabulated in Appendix 2 and are shown graphically below:

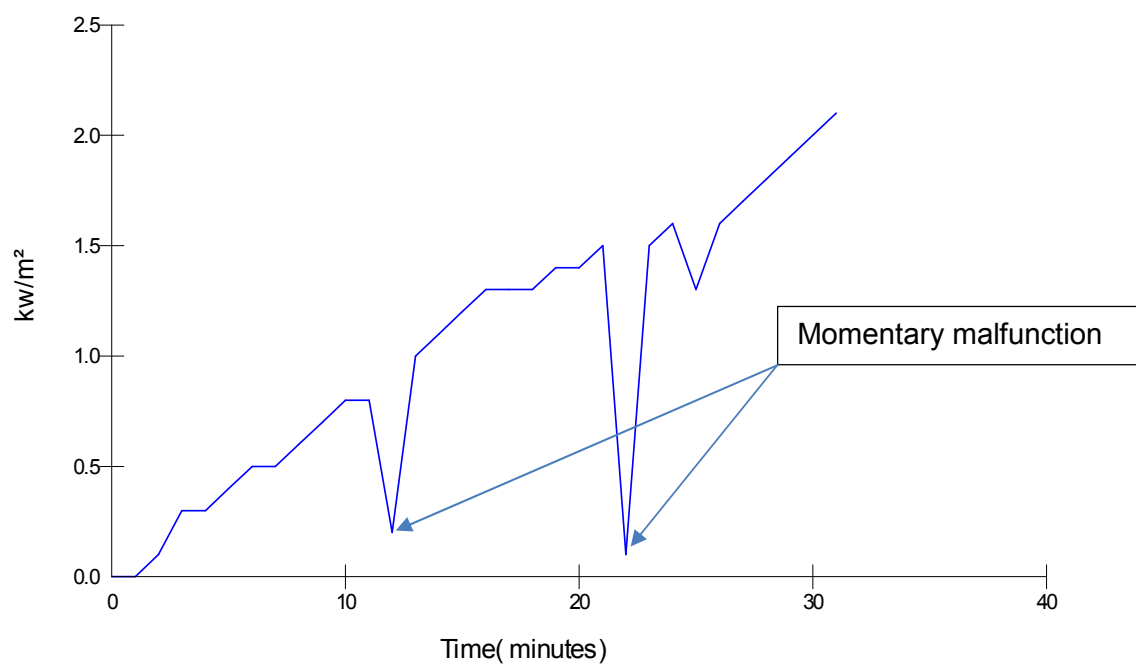


Glazing



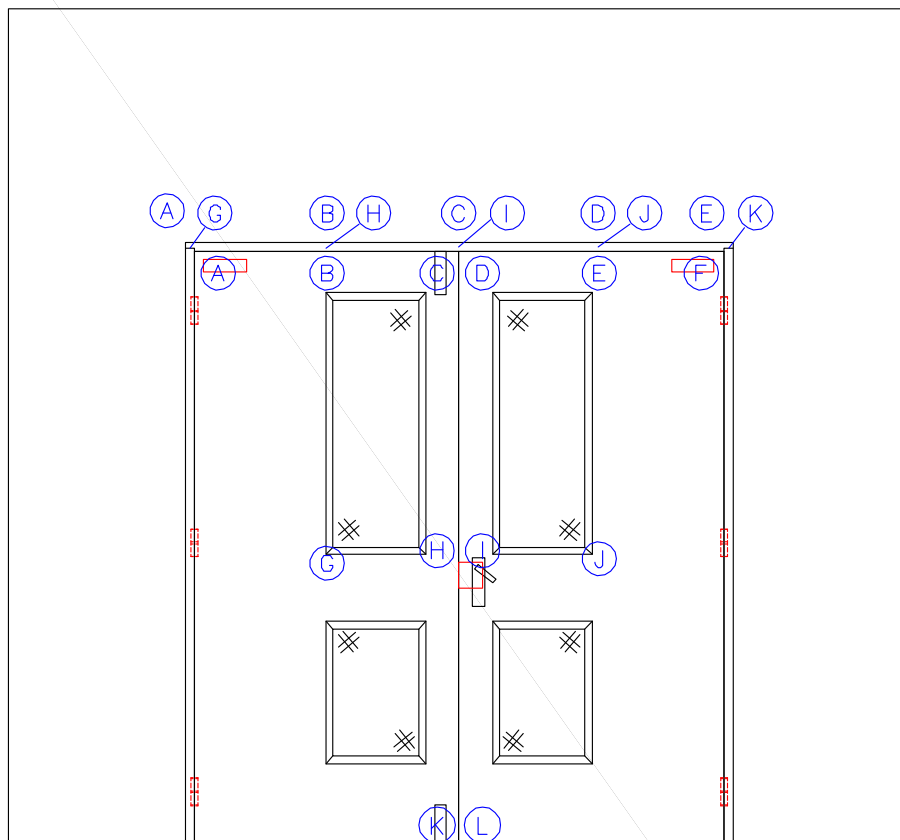
Radiation

A medtherm heat flux radiometer was used to measure the radiant heat 1m away from the centre of the specimen. The readings recorded are tabulated in Appendix 2 and are shown graphically below:



8.5 Leaf and frame distortion data

The following tables show the distortion in mm with an accuracy of ± 1 mm.
A positive measurement indicates distortion towards the furnace.
A negative measurement indicates distortion away from the furnace.



Partition and door frame

Time	A	B	C	D	E	G	H	I	J	K
10	1	-1	-3	1	-1	1	3	1	1	-3
20	6	9	10	12	6	9	10	9	11	8
30	24	32	35	-	-	31	34	33	-	-

Door leaves

Time	A	B	C	D	E	F	G	H	I	J	K	L
10	3	2	1	1	2	0	9	0	-2	-9	-7	-7
20	11	14	11	14	14	11	27	5	2	28	-8	-7
30	37	37	32	-	-	-	-	-	-	-	-	-

* Where a dash (-) applies, a distortion measurement could not be taken

9 Observations

All comments relate to the unexposed face unless otherwise specified.

Time (minutes)	Comments
00.00	Test started
01.28	All glazing panels cracking
02.00	There is smoke issue at the meeting edge at the latch position and top of the meeting edge
02.46	Both leaves, there smoke issue at the top hanging corners
03.54	All glazing panels are reacting
04.30	There is smoke issuing at the left leaf top flush bolt
06.21	There is smoke issue from the glazing panels at several places
08.25	Left and right glazing reacted and discolouring
10.30	Exposed face both leaves, the MDF facing layer has fallen away
13.17	Right leaf, upper glazing, the intumescent is reacting out around the glazing
14.24	Right leaf, lower glazing, the intumescent is reacting out around the glazing
15.19	Left leaf, there is discoloration on the leaf above the lower glazing and on the beading
17.29	Left leaf, there is discoloration above the upper glazing on the leaf and on the beading
20.36	There is discoloration at the top of the meeting edge
24.28	Both leaves, the reacting seals down the meeting edge are causing the meeting edge to push outwards
27.15	Left leaf discoloration at flush bolt
28.09	There is smoke issuing around the perimeter of all glazing
30.50	Right leaf, there is discoloration of the upper glazing half way up the right side beading
31.30	There is continuous flaming from the top left leaf glazing where the glass has fallen away, also 6mm and 25mm gap gauge failures were recorded, thereby constituting to integrity failure
32.30	Test Terminated

10 Expression of results

Integrity	
Cotton pad	31 (thirty one) minutes
Continuous flaming	31 (thirty one) minutes
Gap gauges	31 (thirty one) minutes
Insulation - 2 discrete areas	
Discrete area 1 – timber	
Average set	31 (thirty one) minutes
Maximum $\geq 100\text{mm}$ in from leaf edge	31 (thirty one) minutes
Door frame $\geq 180^\circ\text{C}$ temp rise	31 (thirty one) minutes
Door frame $\geq 360^\circ\text{C}$ temp rise	31 (thirty one) minutes
Discrete area 2 - glass	
	4 (four) minutes
Radiation – time to 15kW/m^2	32 (thirty two) minutes*

* No failure of the test criteria at termination of the test at 32 minutes



11 Limitations

This report details the method of construction, the test conditions and the results obtained when the specific element of construction described herein was tested following the procedure outline in EN 1363-1, and where appropriate EN 1363-2. Any significant deviation with respect to size, construction details, loads, stresses, edge or end conditions other than those allowed under the field of direct application in the relevant test method is not covered by this report.

The results only relate to the behaviour of the element of construction under the particular conditions of test; they are not intended to be the sole criteria for assessing the potential fire performance of the element in use nor do they reflect the actual behaviour in fires. The results of this test were obtained using the leaf to frame gaps recorded in Figure 5 of Appendix 1. The fire resistance performance of doors of this design may change if substantially different gaps are employed.

The specification and interpretation of fire test methods are the subject of ongoing development and refinement. Changes in associated legislation may also occur. For these reasons it is recommended that the relevance of test reports over 5 years old should be considered by the user. Exova Warringtonfire will be able to offer, on behalf of the legal owner, a review of the procedures adopted for a particular test to ensure that they are consistent with current practices, and if required may endorse the test report.

Because of the nature of fire resistance testing and the consequent difficulty in quantifying the uncertainty of measurement of fire resistance, it is not possible to provide a stated degree of accuracy of the result.

	Written and checked by:	Authorised by:
Signature:		
Name:	Adam Scott	Mark Cummings
Title:	Technical Officer	Deputy Technical Head
Date of issue:	16 August 2016	16 August 2016

12 Field of direct application of test results

The results of the test are directly applicable to similar constructions where one or more of the changes listed in BS EN 1634-1: 2014, Clause 13, are made and the construction continues to comply with that appropriate design code for its stiffness and stability. Other changes are not permitted by the document. A copy of the field of direct application is available from Exova warringtonfire upon request.

Photographs

Intumescent interruptions by hardware

Around hinge blade



Around latch forend



Around latch keep



Around drop seal forend



At start of test



At 10 minutes



At 20 minutes



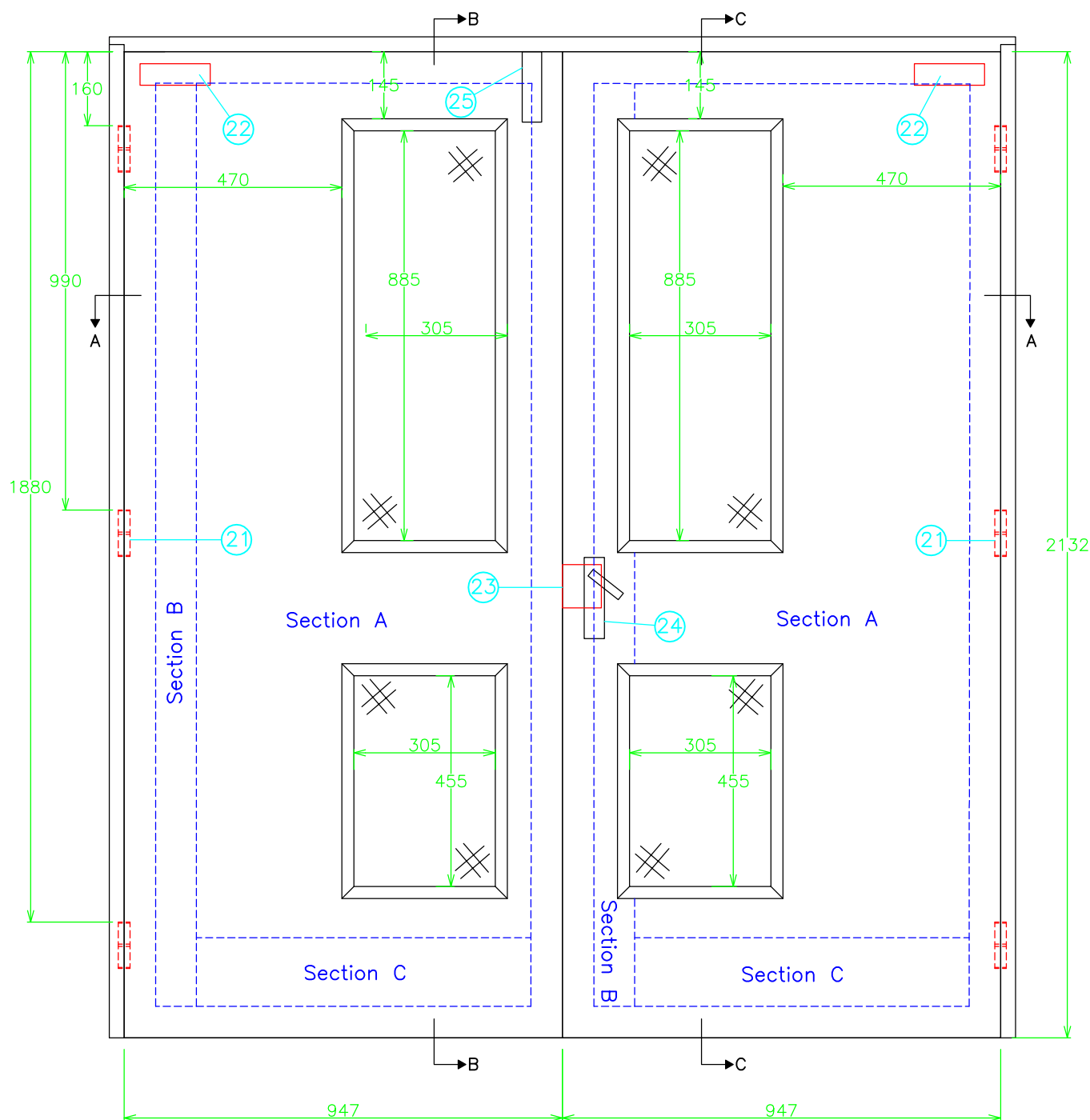
At 30 minutes



Exposed face post test



Appendix 1 – figures 1 to 6



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Tel: +44 (0)1494 569800
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Title Unexposed face elevation
showing hardware positions
(All dimensions in mm)

Date Drawn
08/04/16

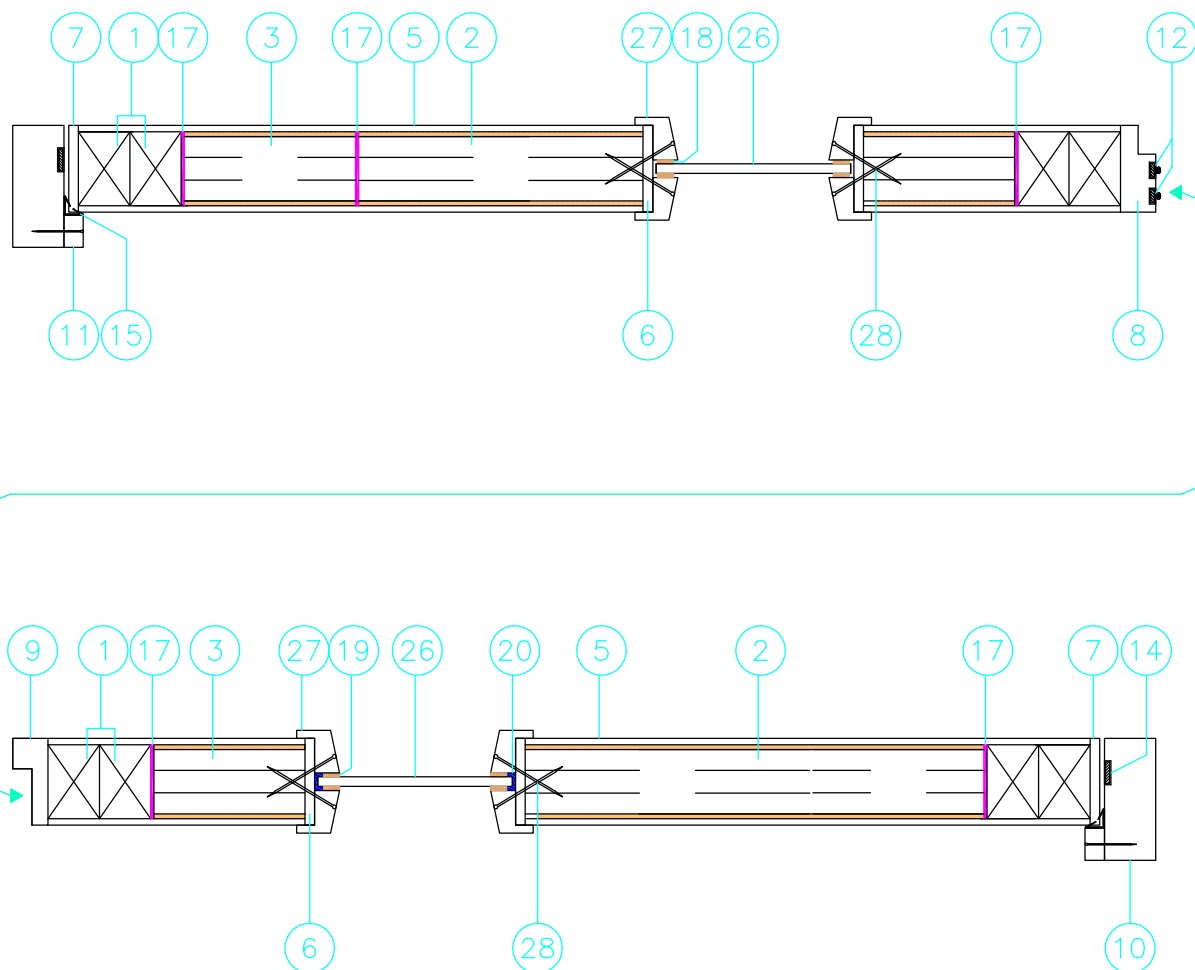
Drawn By
ARD

Scale
NTS

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Appendix 1

Section A-A



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Tel: +44 (0)1494 569800
Fax: +44 (0)1494 564895

Title

Horizontal cross sections
(All dimensions in mm)

Date Drawn

08/04/16

Drawn By

ARD

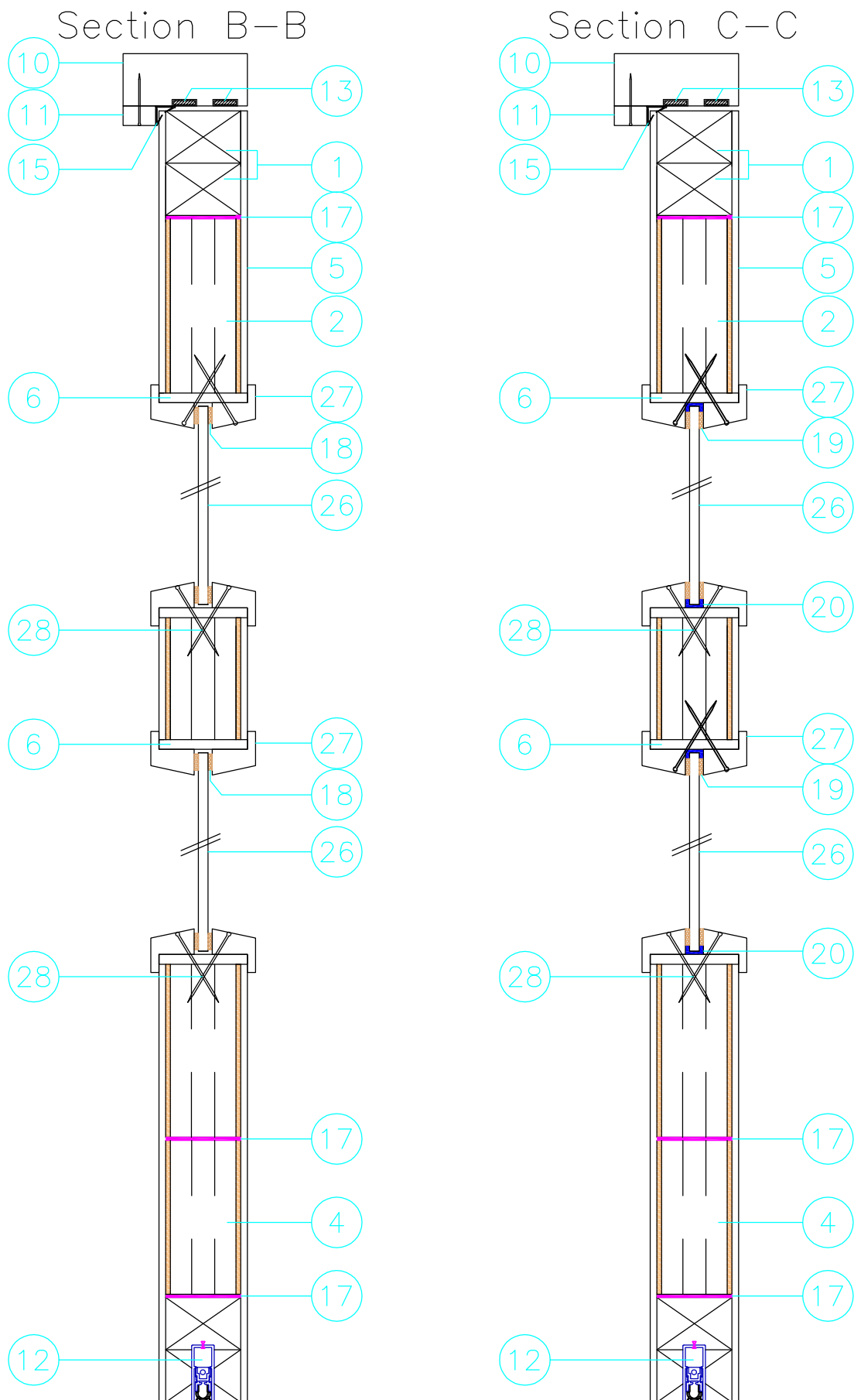
Scale

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Appendix 1



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Buckinghamshire, HP14 4ND, UK.

Tel: +44 (0)1494 569800
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Title

Vertical cross section

(All dimensions in mm)

Date Drawn

08/04/16

Drawn By

ARD

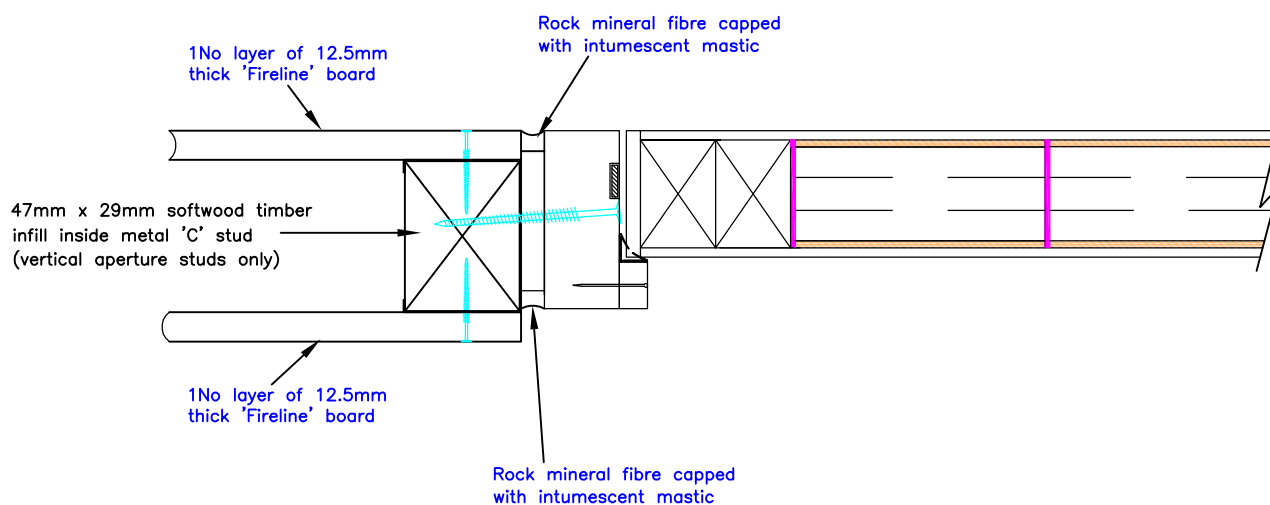
Scale

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Appendix 1



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Tel: +44 (0)1494 569800
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Title
Frame to supporting construction
fixing detail
(All dimensions in mm)

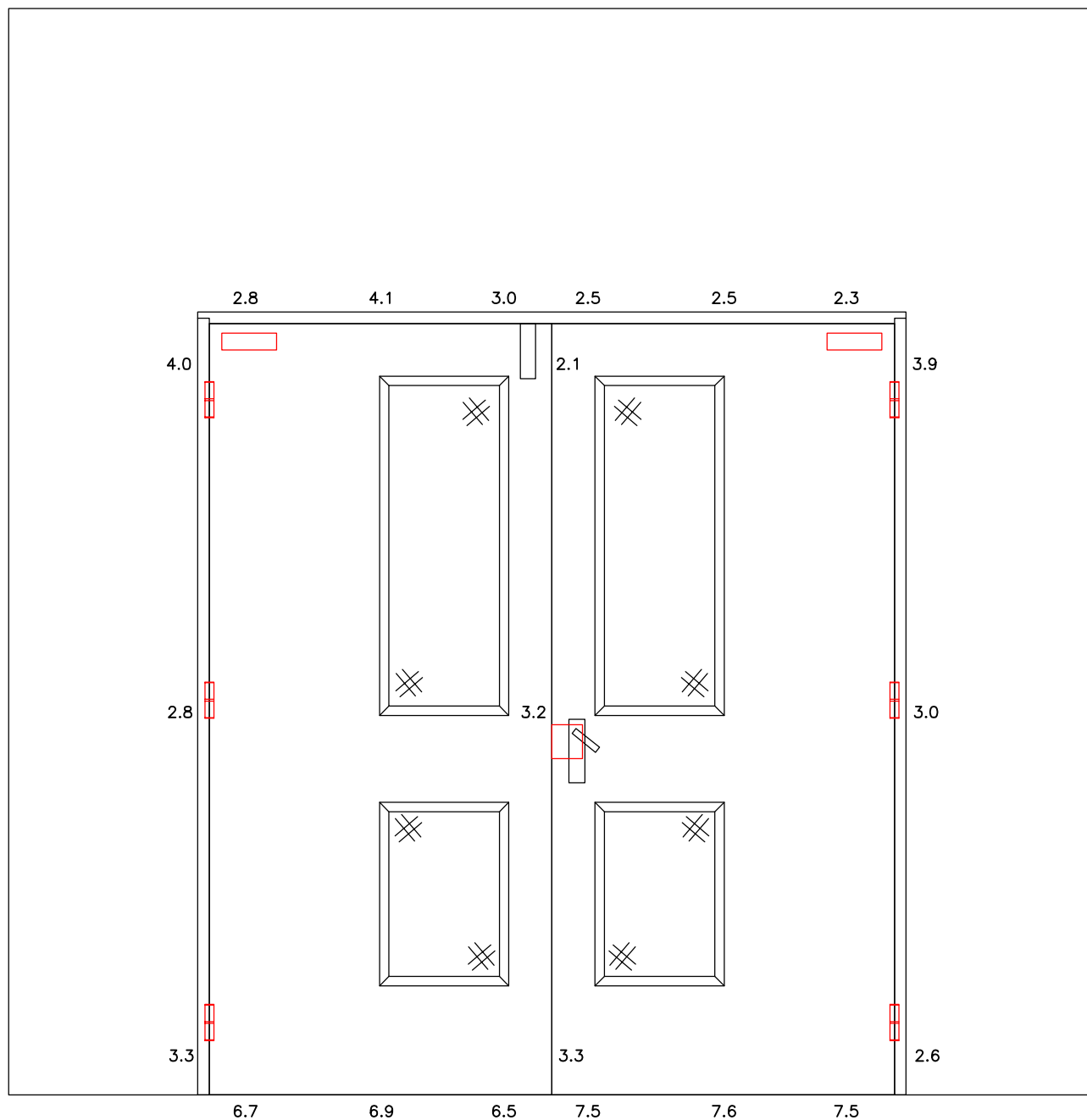
Date Drawn
08/04/16

Drawn By
ARD

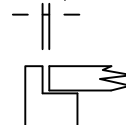
Scale
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FEP/F16079

Appendix 1



Gaps shown



Viewed From Unexposed Face



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Tel: +44 (0)1494 569800
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Title

Door leaves/frame gaps
(All dimensions in mm)

Date Drawn

08/04/16

Drawn By

ARD

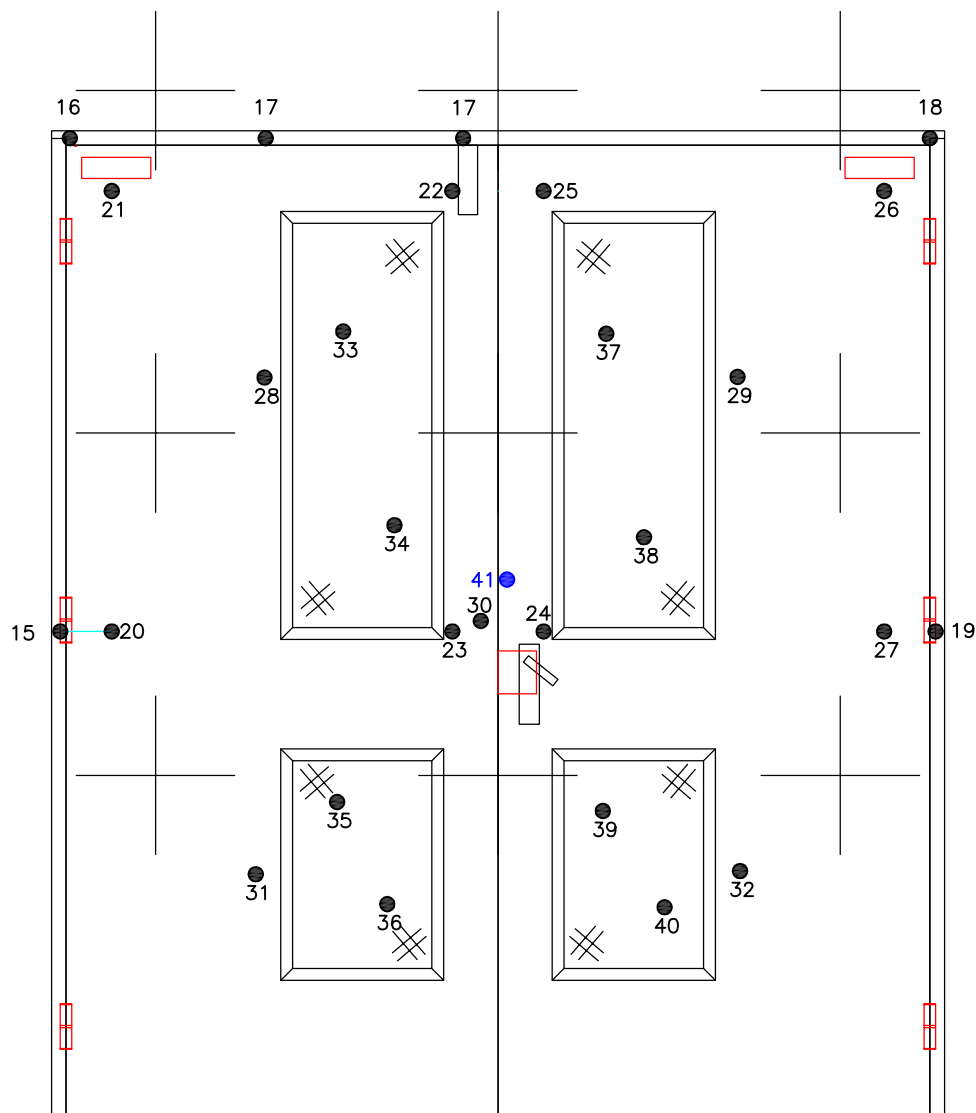
Scale

NTS

Project No.

BMT/FEP/F16079

Appendix 1



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Title

Thermocouple positions
(All dimensions in mm)

Date Drawn

08/04/16

Drawn By

ARD

Scale

NTS

Project No.

BMT/FEP/F16079

Appendix 1

Appendix 2 - raw test data

(see Figure 6 of Appendix 1 for channel locations)

Furnace thermocouples

Time	Chan 0	Chan 1	Chan 2	Chan 3	Chan 4	Chan 5	Chan 6	Chan 7	Chan 8	Chan 9	Chan 11	Chan 15	Chan 16	Chan 17	Chan 18	Chan 19	Chan 20	Chan 21	Chan 22
min	Pa	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C
0	0	20	20	20	21	20	14	21	21	21	11	11	13	13	13	12	12	13	13
1	-1.2	171	271	256	212	243	15	296	280	342	11	11	13	13	13	12	12	13	13
2	2.2	262	302	306	304	343	15	389	381	434	11	11	13	13	13	12	12	13	13
3	-1.8	449	522	478	544	600	15	604	618	640	11	12	14	14	13	12	12	13	14
4	-11.2	504	517	508	595	622	15	620	643	663	11	12	14	16	14	12	12	13	15
5	1	452	441	437	564	555	15	560	580	617	11	12	14	18	14	13	13	13	17
6	-1.9	525	485	477	623	623	15	614	628	683	11	12	15	19	15	13	13	13	18
7	-7.2	514	463	485	601	600	15	595	612	660	11	12	15	20	17	13	13	13	19
8	3.5	549	535	514	629	633	15	610	636	673	11	13	16	23	18	13	13	14	19
9	-2.5	596	593	564	675	681	15	679	691	719	11	13	17	25	19	14	13	14	20
10	-0.2	589	564	554	657	657	15	648	671	697	11	15	18	28	20	14	13	14	22
11	2.5	586	559	541	642	640	15	629	654	674	11	17	20	31	21	15	14	15	24
12	0.2	629	643	605	694	710	15	676	705	718	11	18	21	33	22	15	14	15	25
13	-0.2	657	676	634	720	739	15	707	736	740	11	20	23	35	24	17	15	16	26
14	0.1	666	687	644	723	739	15	705	733	746	11	21	24	36	25	18	15	16	27
15	0.7	674	689	652	732	746	15	710	743	752	11	23	26	38	26	20	15	16	28
16	0.8	683	688	658	742	754	15	725	756	768	11	23	26	39	27	20	16	16	29
17	0.5	684	688	670	750	759	15	740	773	783	11	23	26	41	28	23	16	17	29
18	1.1	692	697	677	761	766	15	758	789	792	11	23	27	42	29	24	16	18	30
19	0.5	697	700	675	767	769	15	774	800	806	11	23	28	42	31	24	17	19	32
20	0.8	701	696	678	769	771	15	789	811	814	11	24	29	42	32	24	18	20	33
21	0.7	707	696	685	772	777	15	796	817	817	11	25	30	43	34	25	19	21	35

Time	Chan 0	Chan 1	Chan 2	Chan 3	Chan 4	Chan 5	Chan 6	Chan 7	Chan 8	Chan 9	Chan 11	Chan 15	Chan 16	Chan 17	Chan 18	Chan 19	Chan 20	Chan 21	Chan 22
min	Pa	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C
22	0.8	714	703	697	777	784	16	797	821	823	11	25	30	45	36	27	20	23	36
23	1.2	716	711	711	783	787	16	816	828	828	11	26	32	46	37	27	21	24	38
24	1.1	723	719	717	783	791	16	821	834	831	11	26	33	47	39	28	22	25	39
25	-1	731	727	722	792	799	16	825	841	840	11	26	34	48	41	28	24	27	41
26	-0.9	741	741	736	800	806	16	834	847	844	11	27	36	51	43	29	26	29	44
27	-0.8	754	757	748	806	813	16	833	854	849	11	28	39	52	44	30	28	31	46
28	-0.8	765	770	756	812	822	16	836	859	855	11	28	42	54	45	30	30	33	49
29	-0.7	775	782	766	822	832	16	838	864	858	11	30	44	55	46	31	32	34	52
30	-1.1	788	796	778	823	837	16	846	871	868	11	30	45	57	48	32	34	36	55
31	-0.1	796	803	787	830	842	16	844	873	869	11	31	48	60	49	33	37	38	58
32	-1.2	808	819	798	839	849	16	849	877	872	11	32	49	68	52	35	42	41	65

Time	Chan 23	Chan 24	Chan 25	Chan 26	Chan 27	Chan 28	Chan 29	Chan 30	Chan 31	Chan 32
min	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C
0	12	12	13	13	12	13	13	12	11	12
1	12	12	13	13	12	13	13	12	11	12
2	12	12	14	13	12	13	13	12	11	12
3	13	13	14	13	13	13	14	13	11	12
4	14	13	16	13	13	14	14	13	11	13
5	14	14	16	14	13	14	15	13	12	13
6	15	14	17	14	13	15	15	13	12	13
7	15	15	18	14	13	15	15	14	12	13
8	16	15	19	14	13	15	16	15	12	13
9	17	16	20	14	13	16	16	15	12	14
10	19	16	20	14	13	16	17	16	12	14
11	20	16	21	14	13	16	18	16	12	14
12	20	17	21	15	14	17	18	17	13	15
13	23	18	22	15	14	17	19	19	13	16

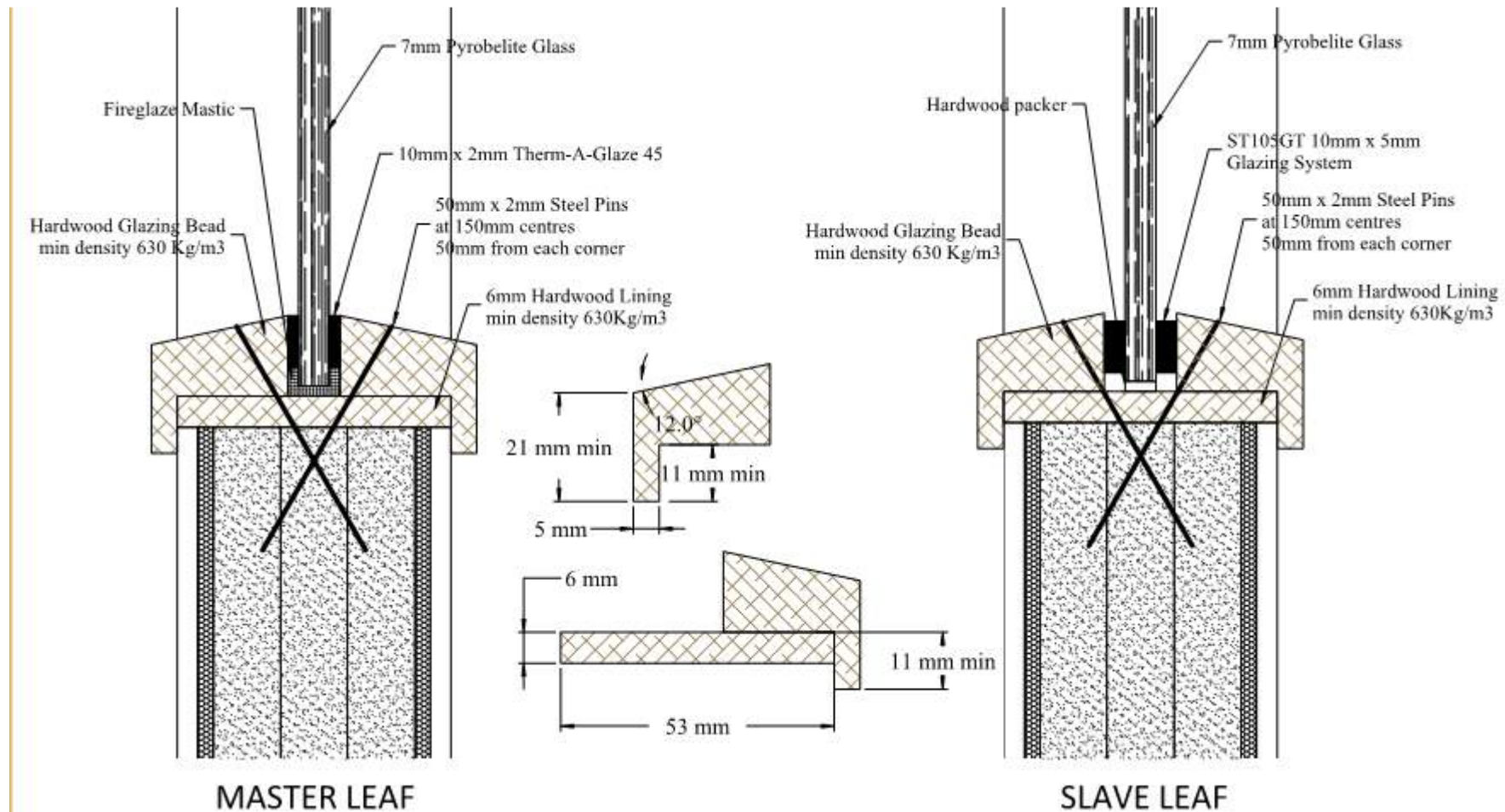
Time	Chan 23	Chan 24	Chan 25	Chan 26	Chan 27	Chan 28	Chan 29	Chan 30	Chan 31	Chan 32
min	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C
14	23	18	23	15	14	17	20	19	14	16
15	24	19	25	16	15	18	20	19	14	17
16	25	19	25	17	15	19	21	20	14	17
17	25	21	28	18	16	20	21	20	15	18
18	26	24	30	19	17	21	22	21	17	19
19	28	25	29	22	18	22	25	23	19	22
20	29	27	30	25	20	24	27	24	21	24
21	31	30	33	30	22	28	29	24	24	26
22	32	34	36	37	24	31	32	26	27	28
23	34	38	39	45	26	34	34	28	30	31
24	35	40	41	52	28	38	36	30	32	33
25	36	43	43	57	31	42	39	31	34	35
26	38	46	45	62	33	45	42	33	38	37
27	39	48	47	67	36	50	47	35	42	39
28	42	49	48	71	39	54	56	38	47	41
29	44	51	50	77	42	57	65	40	52	45
30	47	53	52	85	45	60	71	42	55	50
31	49	55	54	90	50	62	75	44	59	54
32	51	57	59	92	55	72	79	45	63	58

Time	Chan 33	Chan 34	Chan 35	Chan 36	Chan 37	Chan 38	Chan 39	Chan 40	Chan 41
min	°C	°C	°C	°C	°C	°C	°C	°C	kw/m ²
0	16	14	16	16	16	16	16	15	0
1	31	21	29	29	32	37	35	29	0
2	67	37	63	62	72	82	75	56	0.1
3	105	26	107	106	110	128	108	86	0.3
4	135	24	162	149	149	192	141	105	0.3
5	188	18	190	192	198	226	177	131	0.4

Time	Chan 33	Chan 34	Chan 35	Chan 36	Chan 37	Chan 38	Chan 39	Chan 40	Chan 41
min	°C	°C	°C	°C	°C	°C	°C	°C	kw/m ²
6	228	15	218	223	240	258	214	172	0.5
7	263	13	246	249	279	288	246	201	0.5
8	292	12	267	263	309	309	268	217	0.6
9	327	12	293	291	341	333	303	237	0.7
10	360	11	310	314	369	354	329	249	0.8
11	383	11	325	329	394	369	344	260	0.8
12	402	11	341	344	415	388	360	271	0.2
13	423	12	368	369	432	417	386	290	1
14	437	11	404	399	441	439	417	312	1.1
15	445	11	437	430	446	449	444	339	1.2
16	452	11	441	447	447	455	454	368	1.3
17	458	11	439	454	450	459	460	397	1.3
18	463	11	441	460	453	465	465	415	1.3
19	468	11	439	461	455	470	465	388	1.4
20	474	11	443	464	469	475	467	390	1.4
21	478	11	446	467	474	479	470	399	1.5
22	480	11	448	467	477	482	472	398	0.1
23	482	12	452	468	479	486	474	405	1.5
24	485	12	455	471	479	488	476	404	1.6
25	487	13	459	472	481	489	478	396	1.3
26	489	13	463	472	483	491	481	401	1.6
27	493	14	470	476	486	494	485	392	1.7
28	496	14	478	482	489	497	489	394	1.8
29	500	15	488	491	488	501	496	398	1.9
30	299	15	496	498	488	504	504	391	2
31	253	15	505	508	491	505	511	402	2.1
32	222	15	313	359	494	505	518	411	8.7

Appendix 3 – client drawings

Glazing bead detail



Horizontal cross section

