Test Report

Prepared for:
Borg Locks (UK) Ltd
Unit 9
Upminster Trading Park
Warley Street
Upminster
RM14 3PJ

CONFIDENTIAL

Report: Chilt/RF13246

A fire resistance test performed on two single leaf single acting doorsets

Test conducted in accordance with BSEN 1634-1: 2008 and BSEN 1363-1: 1999

Test date: 20th November 2013

UKAS TESTING 1762

BM TRADA – the new name for Chiltern International Fire Ltd

From July 1st 2013, Chiltern International Fire Ltd commenced trading under the name of its parent company BM TRADA and at the same time adopted a brand new visual identity.

Historically, the group has delivered its services through a number of individual companies: BM TRADA Certification Ltd, TRADA Technology Ltd, Chiltern International Fire Ltd (including Chiltern Dynamics) and a network of international offices. Both BM TRADA Group and these individual companies will now trade under the same name - BM TRADA - and adopt the new visual identity.

To coincide with this change, our Technical Reports, Test Reports, Products Assessments, company stationery and marketing collateral have been re-designed to carry the new branding and visual identity.

The validity of all documents previously issued by the individual companies including certificates, test reports and product assessments is unaffected by this change and a letter to this effect will be available to download from our website www.bmtradagroup.com.

About BM TRADA.

With origins dating back to 1934, we have a deep history and services which are highly valued by our customers. We offer independent certification, testing, inspection, training and technical services around the world. In all these areas we continue to use industry-leading experts in their chosen fields to develop and deliver services – an ethos that has been at the heart of our approach since we began.

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A recent review of our businesses and customers revealed that the individual identities sometimes make communications confusing, and that in an already complex business area, clarity and simplicity in communications is rare, but valued. It also revealed that a single identity and combined offer would help us strengthen our appeal.

With this in mind, we brought the companies together under the name BM TRADA and took the opportunity to create a fresh new visual identity.

We have modernised our image and combined our strengths. However, our values, our people and the integrity of our services remain the same. I hope you will welcome these changes and the improvements they will bring.

Jon Osborn
Chief Operating Officer

Contents

1 Summary of performance

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

Results:

Fire resistance test in accordance with BSEN 1634-1: 2008 and BSEN 1363-1: 1999

Doorset A

Integrity	
Cotton pad	69 (sixty nine) minutes*
Continuous flaming	66 (sixty six) minutes
Gap gauges	69 (sixty nine) minutes*
Insulation - 1 discrete area	
Discrete area 1 - timber	
Average set	66 (sixty six) minutes **
Maximum ≥ 100mm in from leaf edge	66 (sixty six) minutes **
Maximum ≥ 25mm in from leaf edge	65 (sixty five) minutes
Door frame ≥ 180ºc temp rise	66 (sixty six) minutes **
Door frame ≥ 360ºc temp rise	66 (sixty six) minutes **
Radiation – time to 15kW/m^2	69 (sixty nine) minutes*

* No failure of the test criteria had occurred at termination of the test at 69 minutes
** Failure by virtue of integrity failure at 66 minutes

Doorset B

Integrity	
Cotton pad	41 (forty one) minutes
Continuous flaming	42 (forty two) minutes
Gap gauges	46 (forty six) minutes*
Insulation – 1 discrete area	
Discrete area - timber	
Average set	41 (forty one) minutes**
Maximum ≥ 100mm in from leaf edge	41 (forty one) minutes**
Maximum ≥ 25mm in from leaf edge	39 (thirty nine) minutes
Door frame ≥ 180ºc temp rise	41 (forty one) minutes**
Door frame ≥ 360ºc temp rise	41 (forty one) minutes**
Radiation – time to 15kW/m^2	46 (forty six) minutes*

* No failure of the test criteria had occurred at termination of the test on this specimen at 46 minutes
** Failure by virtue of integrity failure at 41 minutes

Summary of specimens:

Two latched single leaf single acting doorsets

Doorset A - leaf size:
2135mm high x 928mm wide x 54mm thick

Doorset B - leaf size:
2135mm high x 928mm wide x 44mm thick

2 Introduction

The doorsets were installed into a flexible supporting construction. In accordance with BS EN 14600: 2005 the leaves were pre-cycled before the fire test. The doorsets were instrumented with the standard and supplementary sets of thermocouples and installed opening in towards the furnace.

3 Specimen verification

The door locks were delivered to BM TRADA on the 6th November 2013, BM TRADA sourced the door blanks from commercially available stock and produced the specimens with respect to the following:

Doorset A	Doorset B
Hardwood lippings	Hardwood lippings
Hardwood door frame	Softwood door frame
Intumescent materials	Intumescent materials
Hardware	Hardware
Overhead closer	Overhead closer

The component parts of the doorset were identified and, where appropriate, moisture content readings 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.

3.1 Conditioning

BM TRADA stored the specimens in climatic conditions approximate to those in normal service.

3.2 Sampling

BM TRADA 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 built in accordance with Clause 7.2.2.4 of BSEN 1363: Part 1, for a flexible supporting construction. The vertical studs surrounding the apertures created for the doorsets incorporated a 67mm x 29mm softwood timber infill to facilitate the fixings for the specimens. The specimens tested are 30 and 60 minute products with an anticipated Category B performance, therefore intended fire resistance is 36 and 68 minutes and three layers of Gypsum plasterboard type F layers of Gypsum plasterboard type F are required. The supporting construction was only fixed on the horizontal edges, the vertical edges remained free.

5 Description of specimens

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

5.1 Door leaves

The left doorset was designated doorset A and the leaf measured 2135mm high x 928mm wide x 54mm thick; the right doorset was designated doorset B and the leaf measured 2135mm high x 928mm wide x 44mm thick.

6 Description of construction (refers to Figures 1 to 6 of Appendix 1)

Leaf – doorset A

		Species/type	Dimensions (mm)	Density (kg/m³)	Moisture (% w/w)	Key to figures
Stiles and rails		None fitted	-	-	-	-
Core		Falcon Panel Products Ltd graduated density particleboard	54 thick	540-635*	8.7	1
Facings		None fitted	-	-	-	-
Lippings – vertical edges only		Sapele	6 thick	746**	9.6	2
Adhesives	Lippings	PU	-	-	-	-

* Stated by door blank manufacturer, accuracy agreed by the laboratory
** Measured by laboratory at 11% m.c.

Leaf – doorset A

		Species/type	Dimensions (mm)	Density (kg/m³)	Moisture (% w/w)	Key to figures
Stiles and rails		None fitted	-	-	-	-
Core		Falcon Panel Products Ltd graduated density particleboard	54 thick	540-635*	9.8	3
Facings		None fitted	-	-	-	-
Lippings – vertical edges only		Sapele	6 thick	746**	10.8	4
Adhesives	Lippings	PU	-	-	-	-

* Stated by door blank manufacturer, accuracy agreed by the laboratory

Door frame – doorset A

	Species/type	Dimensions (mm)	Density (kg/m³)	Moisture (% w/w)	Key to figures
Head and jambs	Sapele	32 thick x 90 deep	746	10.6	5
Stop – planted (pinned)	Sapele	12 thick x 20 wide	746	12.7	6
Frame jointing detail	Mortice and tenon - screwed	-	-	-	-
Architrave	MDF	18 thick x 45 wide	700**	8.4	-
Threshold	Non combustible	-	-	-	-
Frame fixings	4 No masonry fixings per jamb	No 10 x 80 long at nominally 600-800 centres	-	-	-
Frame fire stopping	Mineral fibre capped with intumescent acrylic mastic on both faces	Nominally 5-10mm wide x 20-30 deep	-	-	-

** Nominal density

Door frame – doorset B

	Species/type	Dimensions (mm)	Density (kg/m³)	Moisture (% w/w)	Key to figures
Head and jambs	European Redwood	32 thick x 90 deep	578*	11.0	7
Stop – planted (pinned)	European Redwood	12 thick x 20 wide	578*	10.9	8
Frame jointing detail	Mortice and tenon - screwed	-	-	-	-
Architrave	MDF	18 thick x 45 wide	700**	8.9	-
Threshold	Non combustible	-	-	-	-
Frame fixings	4 No masonry fixings per jamb	No 10 x 80 long at nominally 600-800 centres	-	-	-
Frame fire stopping	Mineral fibre capped with intumescent acrylic mastic on both faces	Nominally 5-10mm wide x 20-30 deep	-	-	-

** Nominal density

Intumescent and sealing materials – doorset A

	Make/type	Size (mm)	Location	Key to figures
Leaf edge	None fitted	-	-	-
Frame reveal – head and jambs	2No. Pyroplex Rigid Box Seals FO8700	15 x 4	Fitted 10mm apart, 7mm from the exposed face in the frame reveal	9

Intumescent and sealing materials – doorset B

	Make/type	Size (mm)	Location	Key to figures
Leaf edge	None fitted	-	-	-
Frame reveal – head and jambs	Pyroplex Rigid Box Seals FO8700	15 x 4	Fitted centrally in the frame reveal	10

Intumescent interruptions and additional protection – doorset A

	Make/type	Size (mm)	Location
Around hinge blade	Partially interrupted	-	Hinge blade fully interrupts 1st seal and partially interrupts 2nd seal with 11mm remaining continuous
Under hinge blade	Interdens	2 thick	Fitted under hinge blade on frame and leaf
Encasing latch body	Interdens	1 thick	Fitted around the body of all the lock bodies
Under latch forend	Interdens	1 thick	Fitted under the latch forend
Around latch keep with Borg Locks - type 7001	Partially interrupted	-	Latch keep partially interrupts both seals in frame reveal with 3mm of 1st seal and 8mm of 2nd seal remaining continuous
Around latch keep with Borg Locks type 6000	Partially interrupted	-	Latch keep partially interrupts both seals in frame reveal with 8mm of 1st seal and 7mm of 2nd seal remaining continuous
Around latch keep – Borg Locks - type 5401	Partially interrupted	-	Latch keep partially interrupts both seals in frame reveal with 3mm of 1st seal and 8mm of 2nd seal remaining continuous
Around latch keep with Borg Locks - type 2501	Partially interrupted	-	Latch keep partially interrupts both seals in frame reveal with 6mm of 1st seal and 7mm of 2nd seal remaining continuous
Under latch keep	Interdens	1 thick	Fitted under all latch keeps

Intumescent interruptions and additional protection – doorset B

	Make/type	Size (mm)	Location
Around hinge blade	Fully interrupted	-	Hinge blade fully interrupts seal in frame reveal
Under hinge blade	Interdens	1 thick	Fitted under hinge blade on frame and leaf
Encasing latch bodies	Interdens	1 thick	Fitted around the body of all the lock bodies
Under latch forends	Interdens	1 thick	Fitted under all latch forends
Around latch keep with Borg Locks - type 7001	Fully interrupted	-	Latch keep fully interrupts seal in frame reveal
Around latch keep with Borg Locks type 6000	Fully interrupted	-	Latch keep fully interrupts seal in frame reveal
Around latch keep – Borg Locks - type 5401	Fully interrupted	-	Latch keep fully interrupts seal in frame reveal
Around latch keep with Borg Locks - type 2501	Fully interrupted	-	Latch keep fully interrupts seal in frame reveal
Under latch keep	Interdens	1 thick	Fitted under all latch keeps

Hardware – both doorsets

	Make/type	Size (mm)	Location	Key to figures
Hinges	Royde and Tucker H101 lift off type hinge	101 x 32 x 3 (blade size)	Fitted 150mm, 1000mm and 1855mm from the head of the leaf, fixed with 5No. M5 x 32mm long screws per blade	11
Closer	Rutland TS3204 overhead type closer	220 x 59 (footprint size)	Fitted on the exposed face as per the manufacturer's instructions	12
Lock/latch – disengaged	Borg Locks key pad handle product reference 7001 (stainless steel) acting on a tubular steel mortice latch	58 x 30 x 3 (forend size) 60 backset	Latch nib fitted 1635mm from the threshold of the leaf fixed with 2No. M4 x 15mm long screws	13
		70 x 28 x 1 (keep size)	Fixed with 2No. M4 x 15 screws	
Lock/latch – disengaged	Borg Locks key pad handle product reference 6000 (satin chrome) acting on a brass mortice latch product reference S509	225 x 22 x 3 (forend size) 160 x 85 x 14 (case size) 60 backset	Latch nib fitted 1345mm from the threshold of the leaf fixed with 2No. M4 x 15mm long screws	14
		180 x 24 x 1 (keep size)	Fixed with 3No. M4 x 15 screws	
Lock/latch – engaged	Borg Locks key pad handle product reference 5401 (satin stainless steel) acting on a tubular steel mortice latch	58 x 30 x 3 (forend size) 60 backset	Latch nib fitted 1000mm from the threshold of the leaf fixed with 2No. M4 x 15mm long screws	15
		70 x 28 x 1 (keep size)	Fixed with 2No. M4 x 15 screws	
Lock/latch – disengaged	Borg Locks key pad handle product reference 2501 (super stainless steel) acting on a tubular steel mortice latch	58 x 30 x 3 (forend size) 60 backset	Latch nib fitted 775mm from the threshold of the leaf fixed with 2No. M4 x 15mm long screws	16
		70 x 28 x 1 (keep size)	Fixed with 2No. M4 x 15 screws	

7 Pre-test measurements

7.1 Pre-cycling

Operability test of 25 manual cycles was completed on each doorset in accordance with BSEN 14600, section 5.1.1.1.

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

Specimen self closing of doorsets, in accordance with BSEN 14600, section 5.1.1.3. was completed prior to test.

Angle of measurement	10º ± 2º
Closing speed doorset A	2.28 - 2.65 seconds
Closing speed doorset B	0.68 – 0.84 seconds

7.2 Door perimeter gaps

The manufacturer did not declare a working range so the doors were 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 doors and frame were measured prior to test. A total of 24 readings were taken. The measurements (in mm) are given in Figure 5 of Appendix 1.

7.3 Closer forces

Measured in accordance with BSEN 1634-1: 2008 Section 10.1.3.

	Opening Force (Nm)
Doorset A	73 @ handle position
Doorset B	65 @ handle position

7.4 Method of installation

The doorsets were 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.

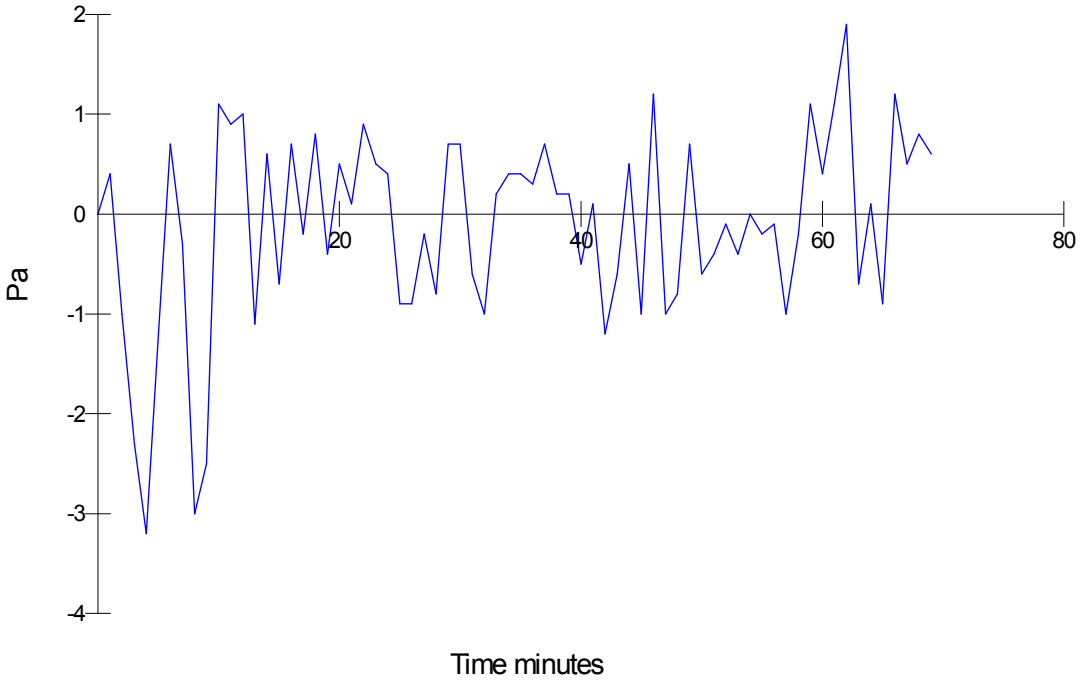
8 Test conditions

8.1 Ambient temperature

The ambient temperature of the test area at commencement of test was 12°C.

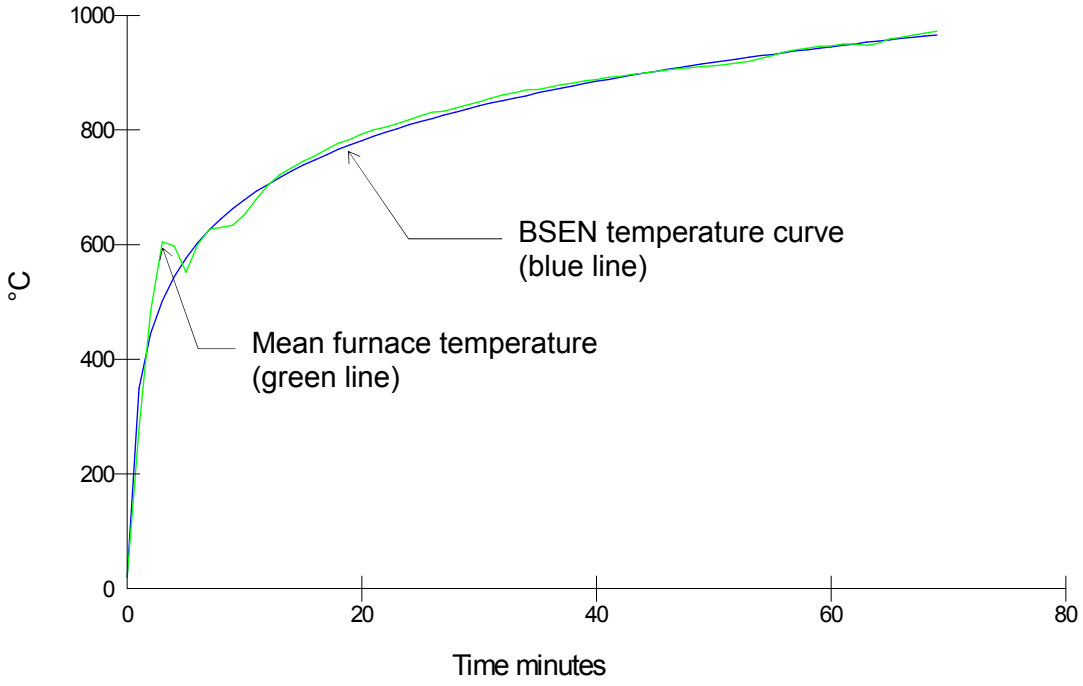
8.2 Pressure readings

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 tabulated in Appendix 2 and are shown graphically below:



8.3 Furnace temperature

The furnace was controlled to follow the temperature/time relationship specified in BSEN 1363: Part 1: 1999 Section 5.1.1 as closely as possible, using the average of nine plate thermometers suitably distributed within the furnace. The temperatures were recorded and are tabulated in Appendix 2 and are shown graphically below:



8.4 Unexposed face temperatures

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

Doorset A

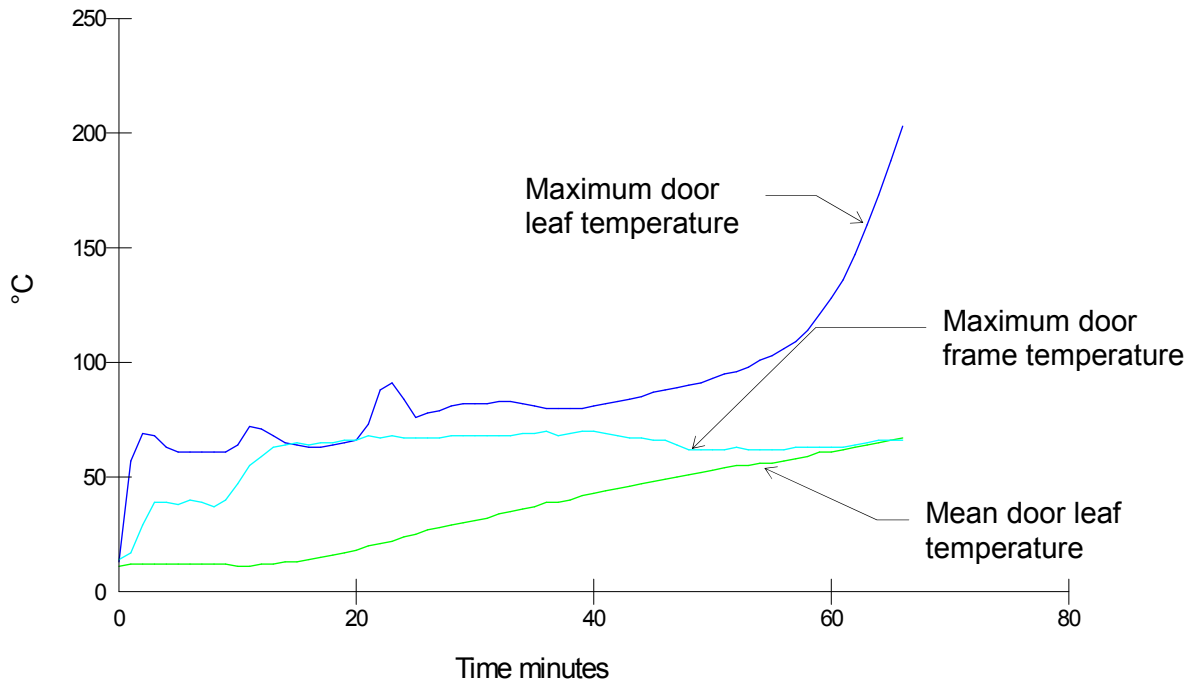
	1 discrete area	
Leaf	Discrete area - timber	5 measuring mean temperature rise.
		4 measuring maximum temperature rise, standard set 100mm in from the door leaf edges.
		4 measuring maximum temperature rise, supplementary set 25mm in from the door leaf edges.
Frame		5 measuring maximum temperature rise.

Doorset B

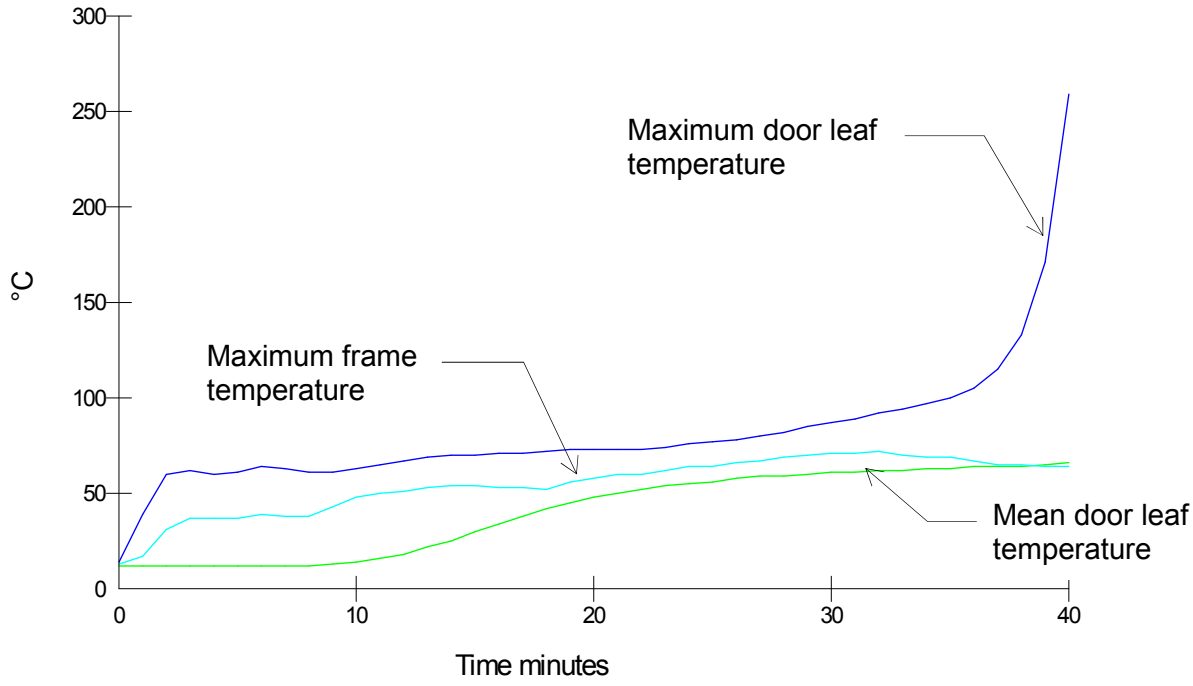
	1 discrete area	
Leaf	Discrete area - tuimber	5 measuring mean temperature rise.
		4 measuring maximum temperature rise, standard set 100mm in from the door leaf edges.
		4 measuring maximum temperature rise, supplementary set 25mm in from the door leaf edges.
Frame		5 measuring maximum temperature rise.

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

Doorset A



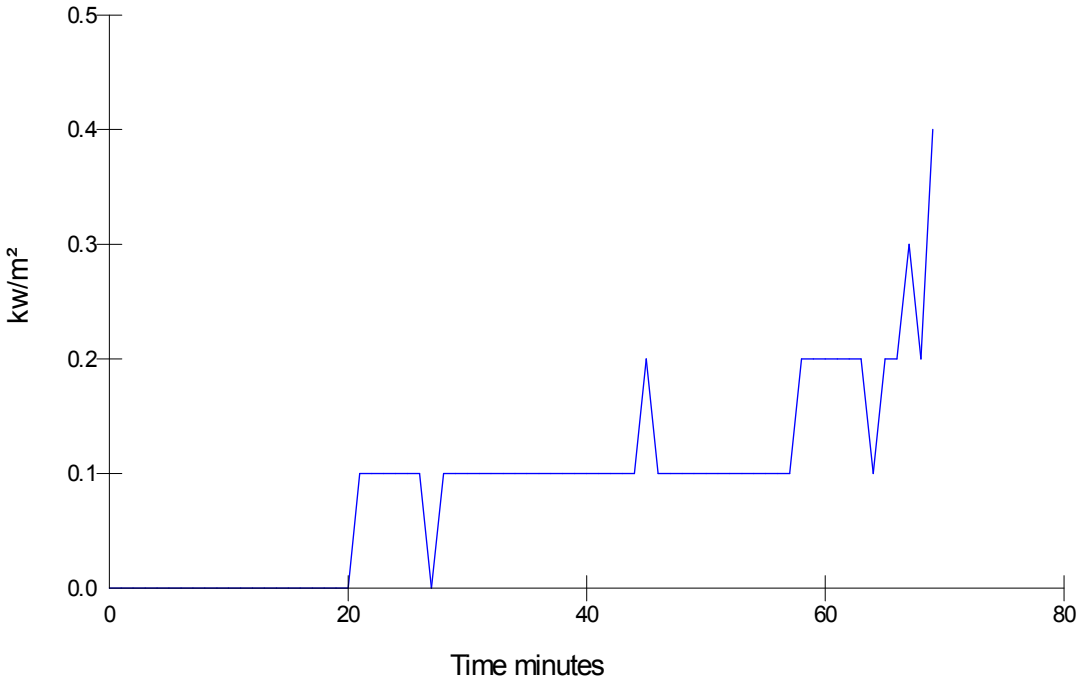
Doorset B



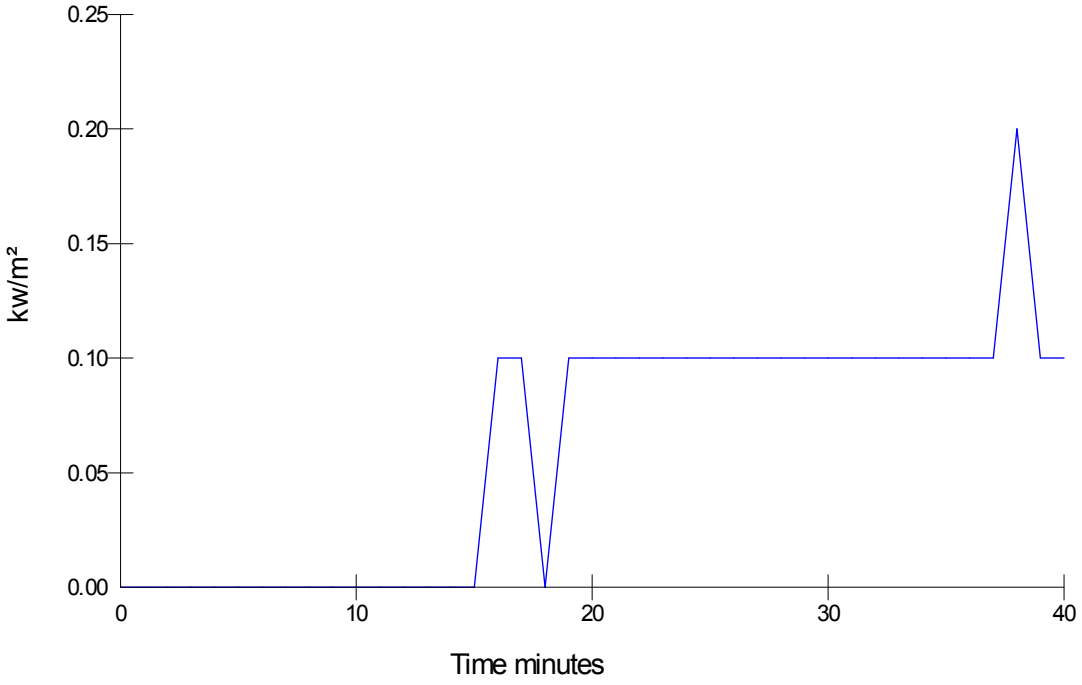
8.5 Radiation

A radiometer was used to measure the radiation 1m away from the specimens. The results of the radiometer were recorded and tabulated in Appendix 2 and are shown graphically below:

Doorset A

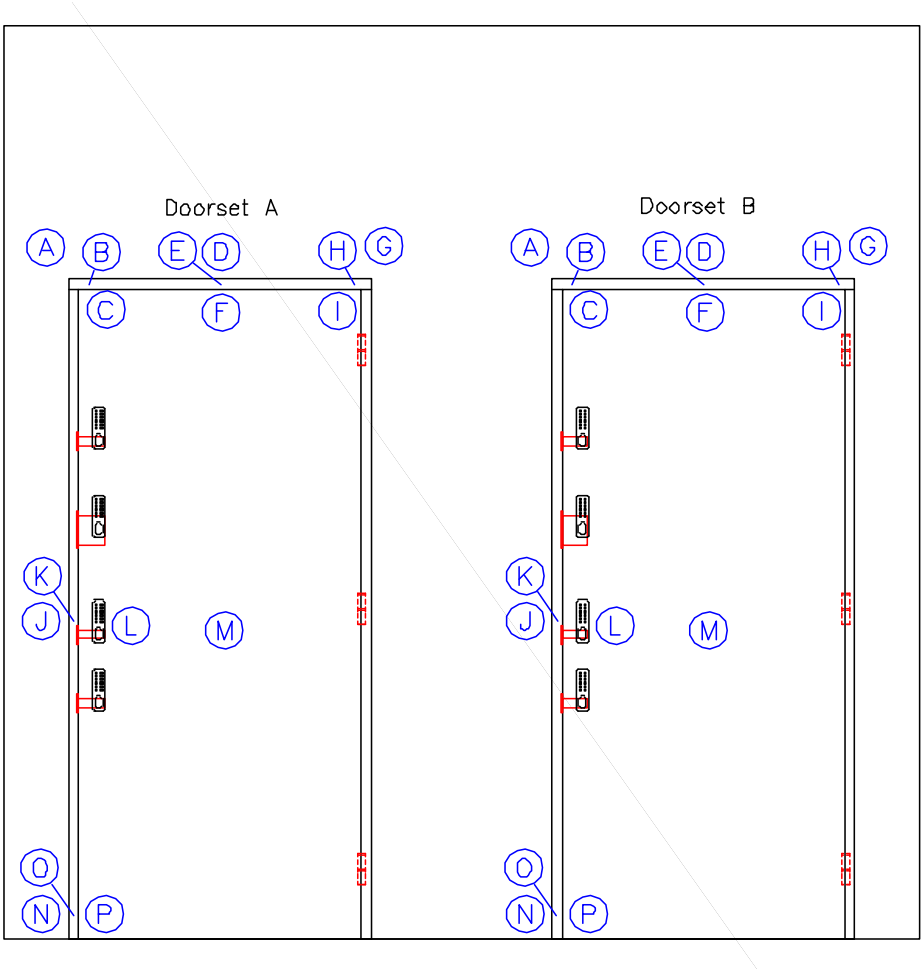


Doorset B



8.6 Leaf and frame distortion data

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



Doorset A - leaf (hung on the right)

Time	A	B	C	D	E	F	G	H	I	J	K	L
15	1	4	8	2	3	6	1	6	-2	2	1	1
30	-1	2	-2	-1	0	2	1	2	3	-2	-2	-2
45	-4	-1	1	-4	-0	-3	-2	-2	0	-4	-4	-6
60	-6	-3	0	-6	-6	-9	-4	-2	-2	-5	-6	-10

Time	M	N	O	P
15	1	3	0	0
30	-6	-1	0	0
45	-11	-1	0	1
60	-24	-1	0	0

Doorset B - leaf (hung on the right)

Time	A	B	C	D	E	F	G	H	I	J	K	L
10	1	5	11	3	4	5	1	1	3	4	4	3
20	3	4	11	1	1	3	0	0	2	3	3	-1
30	1	1	11	-1	-1	-1	-1	-2	2	0	1	-6
40	-1	-1	19	-2	-2	-7	-3	-3	0	0	1	-12

Time	M	N	O	P
10	-2	-1	1	0
20	-11	-1	1	19
30	-21	-1	2	25
40	-39	-1	2	30

9 Observations

All comments relate to the unexposed face unless otherwise specified.

Time (minutes)	
00.00	Test started.
00.28	Both doorsets, there is smoke issuing from the top half of the closing edges.
02.53	Both doorsets, there is smoke issuing from the top half leaf/frame gaps.
10.00	Both doorsets, there is smoke issuing from the perimeter of all handle and lock positions.
12.00	Doorset A, the top of the third handle down has deflected away from the leaf by approximately 15mm.
13.51	Doorset A, the top of the second handle down has deflected away from the leaf by approximately 5mm.
14.00	Both doorsets, all handles have fallen away on the exposed face.
16.18	Both doorsets, there is smoke issuing from across the head of the leaves.
17.07	Both doorsets, there is discolouration and smoke issuing from all latch positions and the perimeter of all handles.
24.29	Both doorsets, there is an increase in the discolouration and level of smoke issuing from the perimeter of the first handle and lock positions.
32.50	Both doorsets, the first handle and lock positions have deflected away from the leaves by approximately 10mm. Doorset A, the third lock has deflected away from the leaf by approximately 20mm with a glow visible through the fixing hole.
35.28	Doorset B, the bottom closing corner of the leaf has distorted away from the stop by approximately 25mm and the intumescent is expanding out.
36.54	Doorset B, there is intermittent flaming at the bottom closing corner of the leaf.
38.03	Doorset B, there is a glow visible at the top closing corner of the leaf.
39.23	Doorset B, a cotton pad integrity test was performed at the top closing corner of the leaf, no failure.
39.44	Doorset B, there is a glow visible at the left quarter of the head of the leaf.
40.36	Doorset B, there is a glow visible at the top latch position.

41.27 Doorset B, a cotton pad integrity test was performed at the top closing corner of the leaf which resulted in ignition of the cotton pad thereby constituting **integrity failure.**

42.16 Doorset B, there is a glow visible at the second and third latch positions.

42.50 Doorset B, there is continuous flaming at the left half of the head igniting the top hanging corner of the leaf thereby constituting **further integrity failure.**

44.37 Doorset B, there is a glow visible at the top hanging corner of the leaf.

45.45 Doorset B, there is continuous flaming at the top hanging corner of the leaf thereby constituting **further integrity failure.**

46.00 Doorset B, sealed off.

52.12 Doorset A, there is an increase in the discolouration and level of smoke issuing from all lock and latch positions, the top hanging corner and the top closing corner of the leaf.

54.18 Doorset A, all handles have deflected away from the leaf by approximately 10mm except the third which is approximately 30mm away at the top.

55.17 Doorset A, there is erosion of the threshold at the right quarter.

56.50 Doorset A, there is discolouration and smoke issuing from the middle hinge position.

60.00 Doorset A, there is an increase in the erosion of the threshold.

62.23 Doorset A, there is a glow visible at the first latch position.

63.03 Doorset A, there is a glow visible at the second and third latch position. There is an increase in the discolouration and smoke issuing from all previous positions.

64.06 Doorset A, there is discolouration and smoke issuing from the top hinge position.

66.28 Doorset A, there is continuous flaming at the first latch position igniting the top closing corner of the leaf thereby constituting **integrity failure.**

69.00 Test terminated.

10 Expression of results

Doorset A

Integrity	
Cotton pad	69 (sixty nine) minutes*
Continuous flaming	66 (sixty six) minutes
Gap gauges	69 (sixty nine) minutes*
Insulation - 1 discrete area	
Discrete area 1 - timber	
Average set	66 (sixty six) minutes **
Maximum ≥ 100mm in from leaf edge	66 (sixty six) minutes **
Maximum ≥ 25mm in from leaf edge	65 (sixty five) minutes
Door frame ≥ 180ºc temp rise	66 (sixty six) minutes **
Door frame ≥ 360ºc temp rise	66 (sixty six) minutes **
Radiation – time to 15kW/m^2	69 (sixty nine) minutes*

* No failure of the test criteria had occurred at termination of the test at 69 minutes
** Failure by virtue of integrity failure at 66 minutes

Doorset B

Integrity	
Cotton pad	41 (forty one) minutes
Continuous flaming	42 (forty two) minutes
Gap gauges	46 (forty six) minutes*
Insulation – 1 discrete area	
Discrete area - timber	
Average set	41 (forty one) minutes**
Maximum ≥ 100mm in from leaf edge	41 (forty one) minutes**
Maximum ≥ 25mm in from leaf edge	39 (thirty nine) minutes
Door frame ≥ 180ºc temp rise	41 (forty one) minutes**
Door frame ≥ 360ºc temp rise	41 (forty one) minutes**
Radiation – time to 15kW/m^2	46 (forty six) minutes*

* No failure of the test criteria had occurred at termination of the test on this specimen at 46 minutes
** Failure by virtue of integrity failure at 41 minutes

11 Limitations

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 door 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. BM TRADA 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.

Signature:		
Name:	Mark Cummings	Vincent Kerrigan
Title:	Deputy Technical Manager	Technical Manager
Date of issue:	14/1/14	15-01-2014

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 BSEN 1634-1: 2008, 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 BM TRADA

Photographs

Intumescent interruptions by hardware – both doorsets

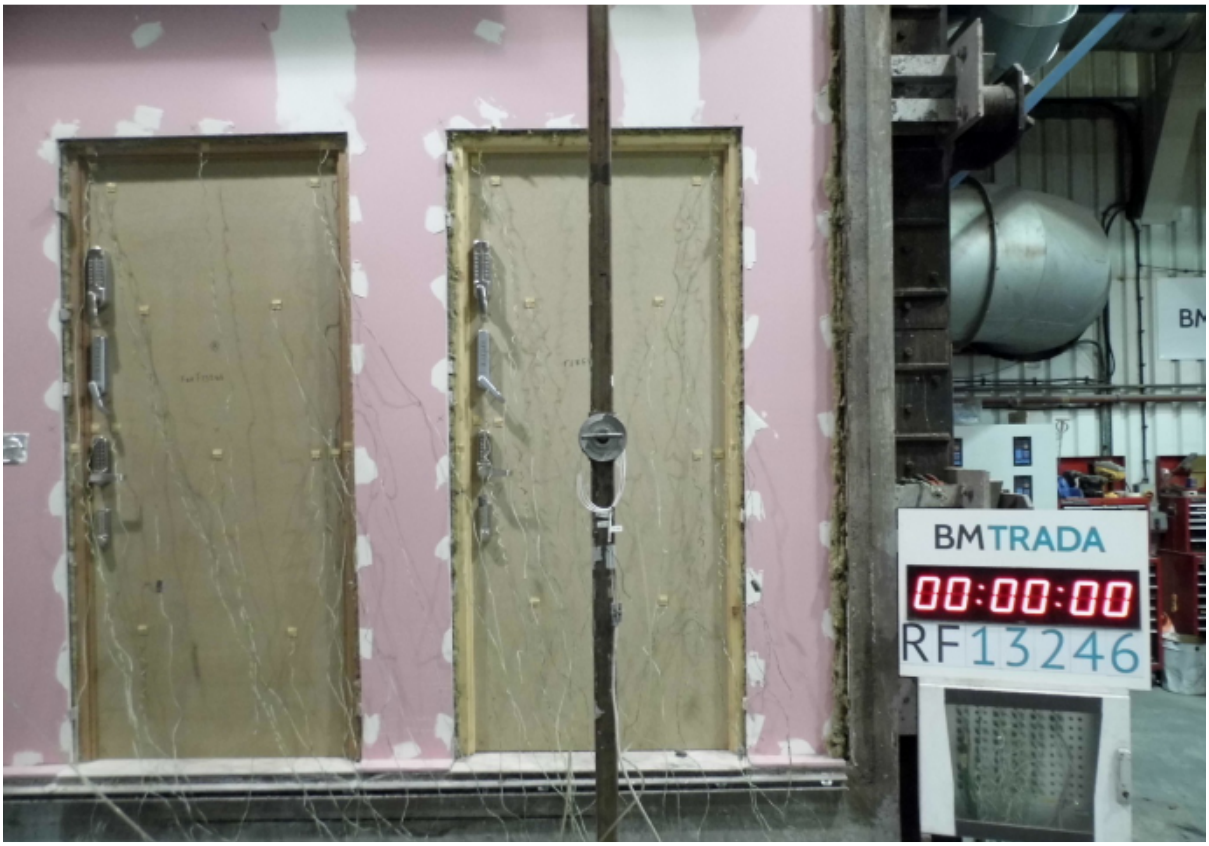
Doorset A – latch keeps

Doorset B – latch keeps

Doorset A – hinge

Doorset B – hinge

At start of test



Doorset B at 10 minutes

At 15 minutes

Doorset B at 20 minutes

At 30 minutes

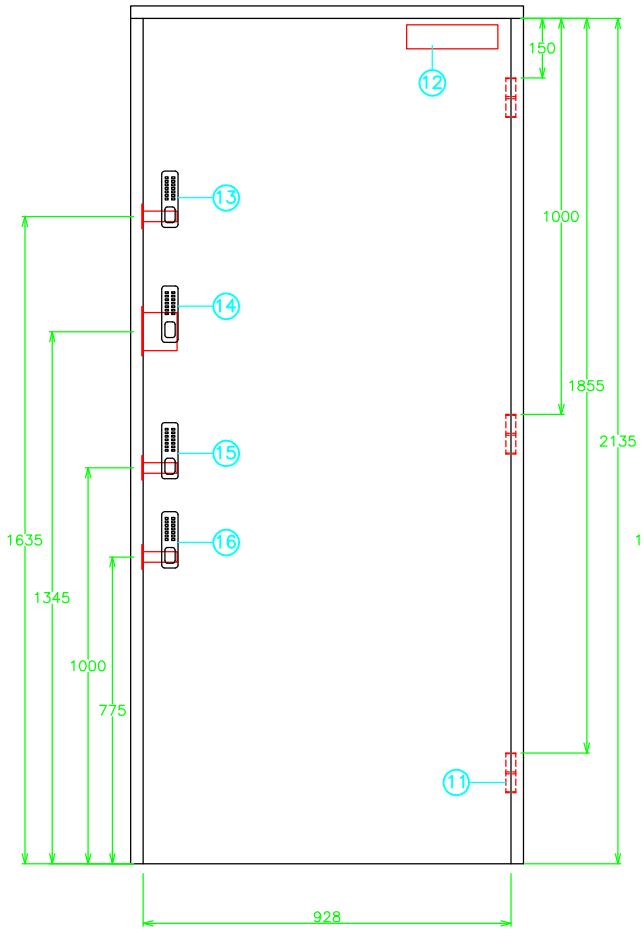
Doorset B after 40 minutes

At 60 minutes

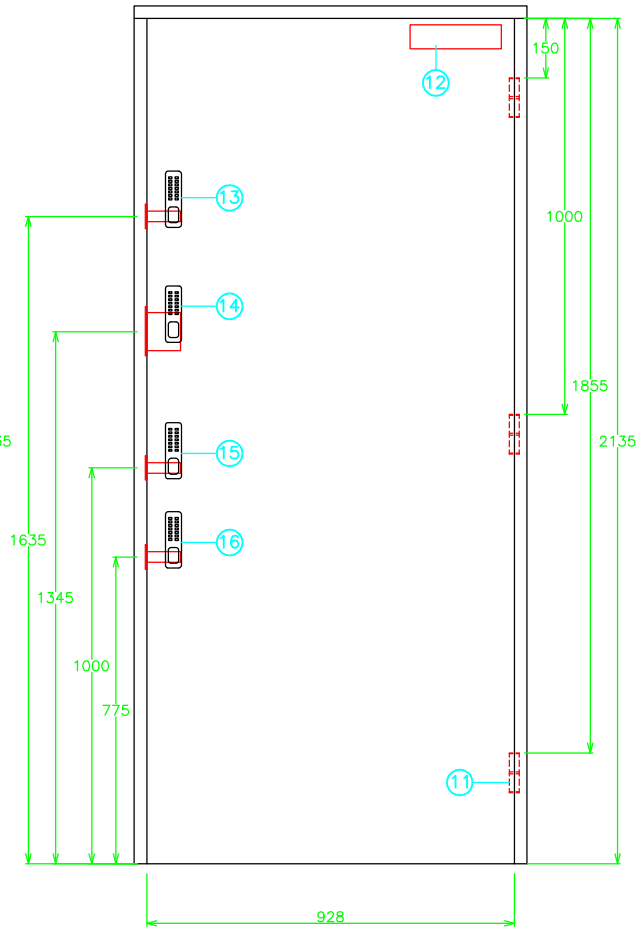
After 66 minutes

Appendix 1 – figures 1 to 6

Doorset A



Doorset B



BM TRADA

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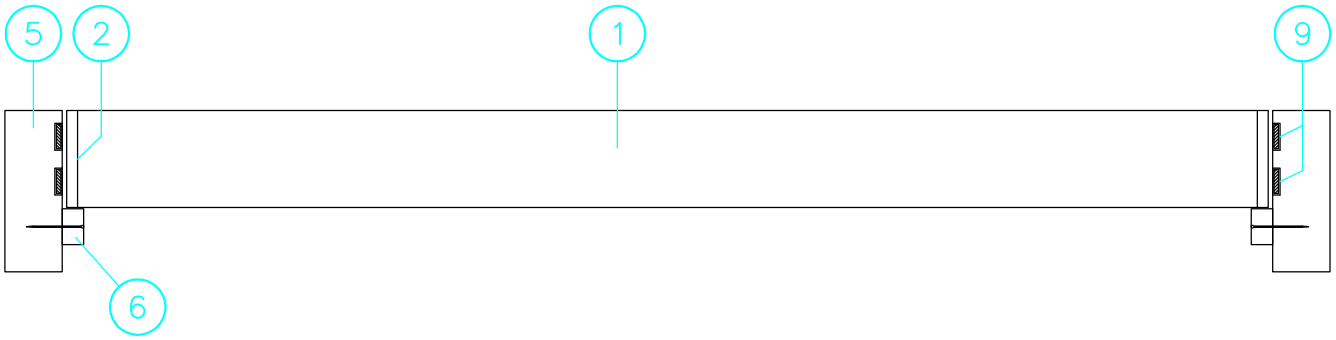
Title: Unexposed face elevation showing hardware positions (All dimensions in mm)

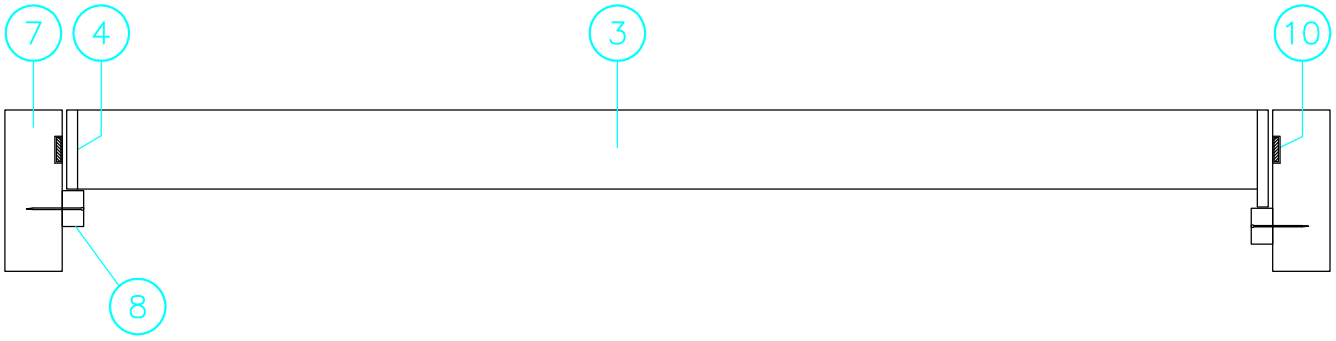
Date Drawn	Drawn By	Scale
09/12/13	ARD	NTS

Project No.	
Chilt/RF13246	Appendix 1

Section A–A



Section B–B



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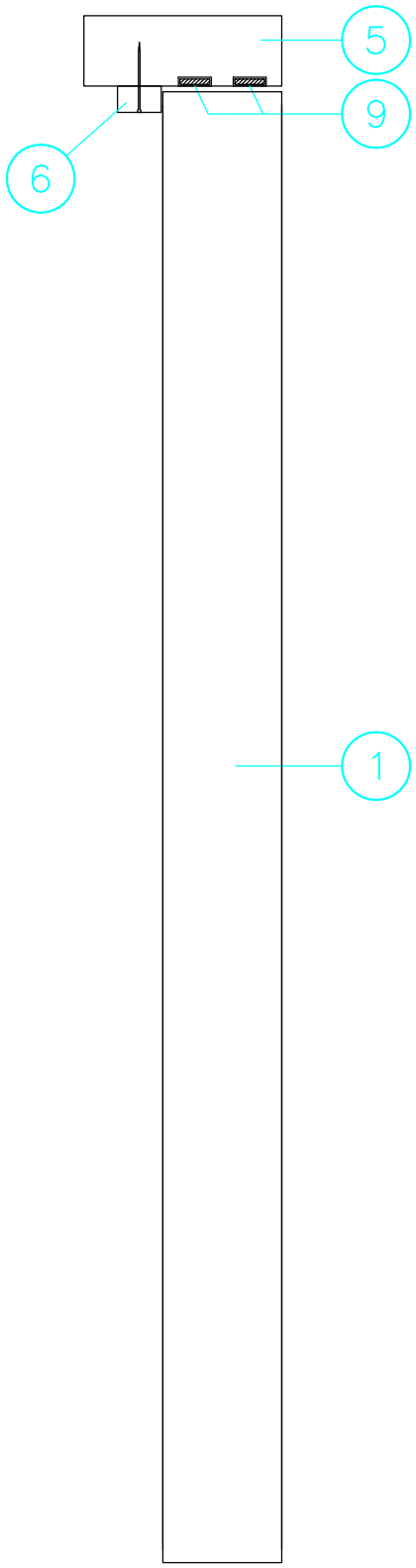
Title
Horizontal cross sections
(All dimensions in mm)

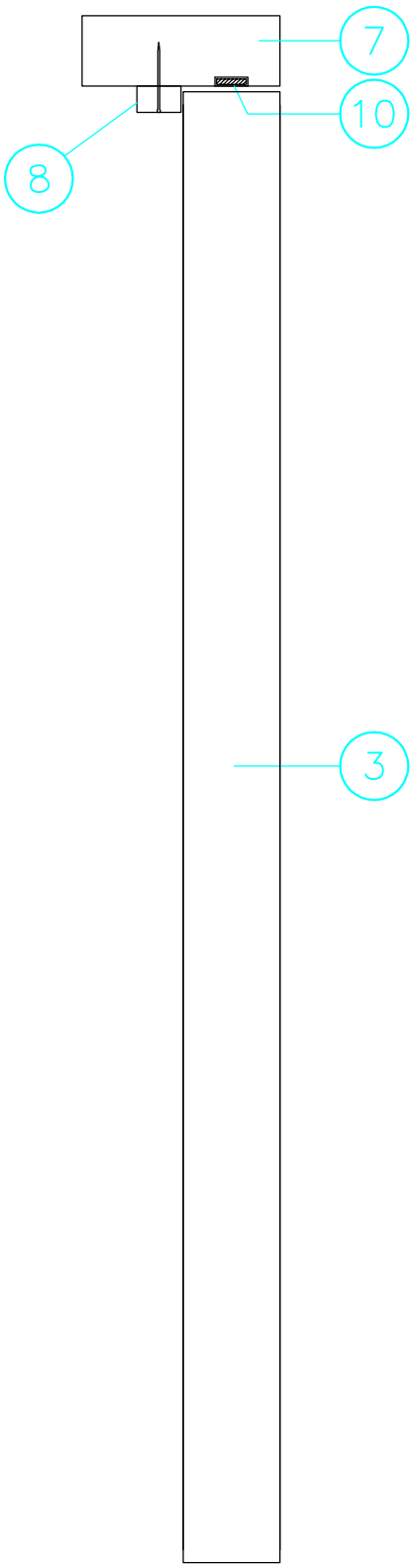
Date Drawn	Drawn By	Scale
09/12/13	ARD	NTS

Project No.	
Chilt/RF13246	Appendix 1

Section C–C



Section D–D



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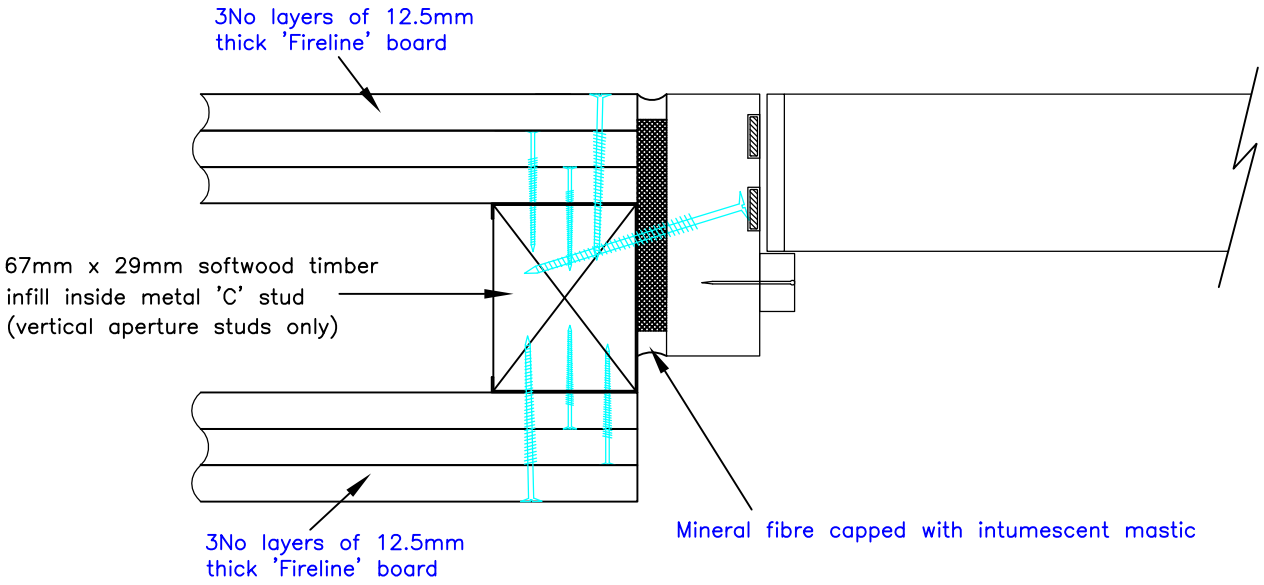
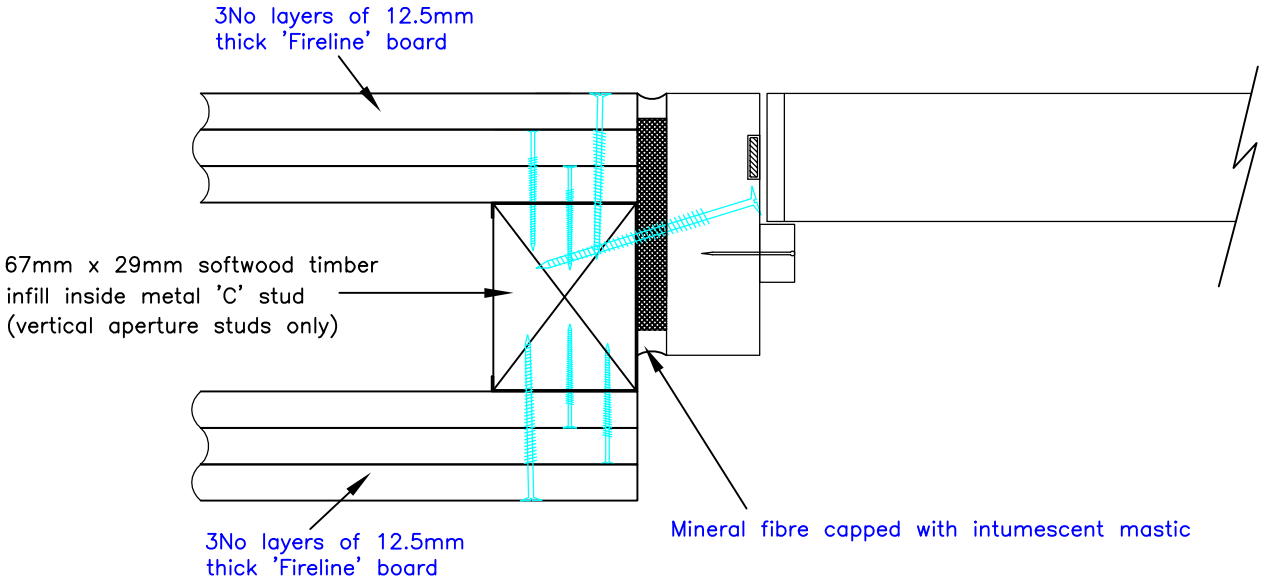
Title		
Vertical cross section (All dimensions in mm)		
Date Drawn 09/12/13	Drawn By ARD	Scale NTS
Project No. Chilt/RF13246		Appendix 1

Doorset A



Doorset B



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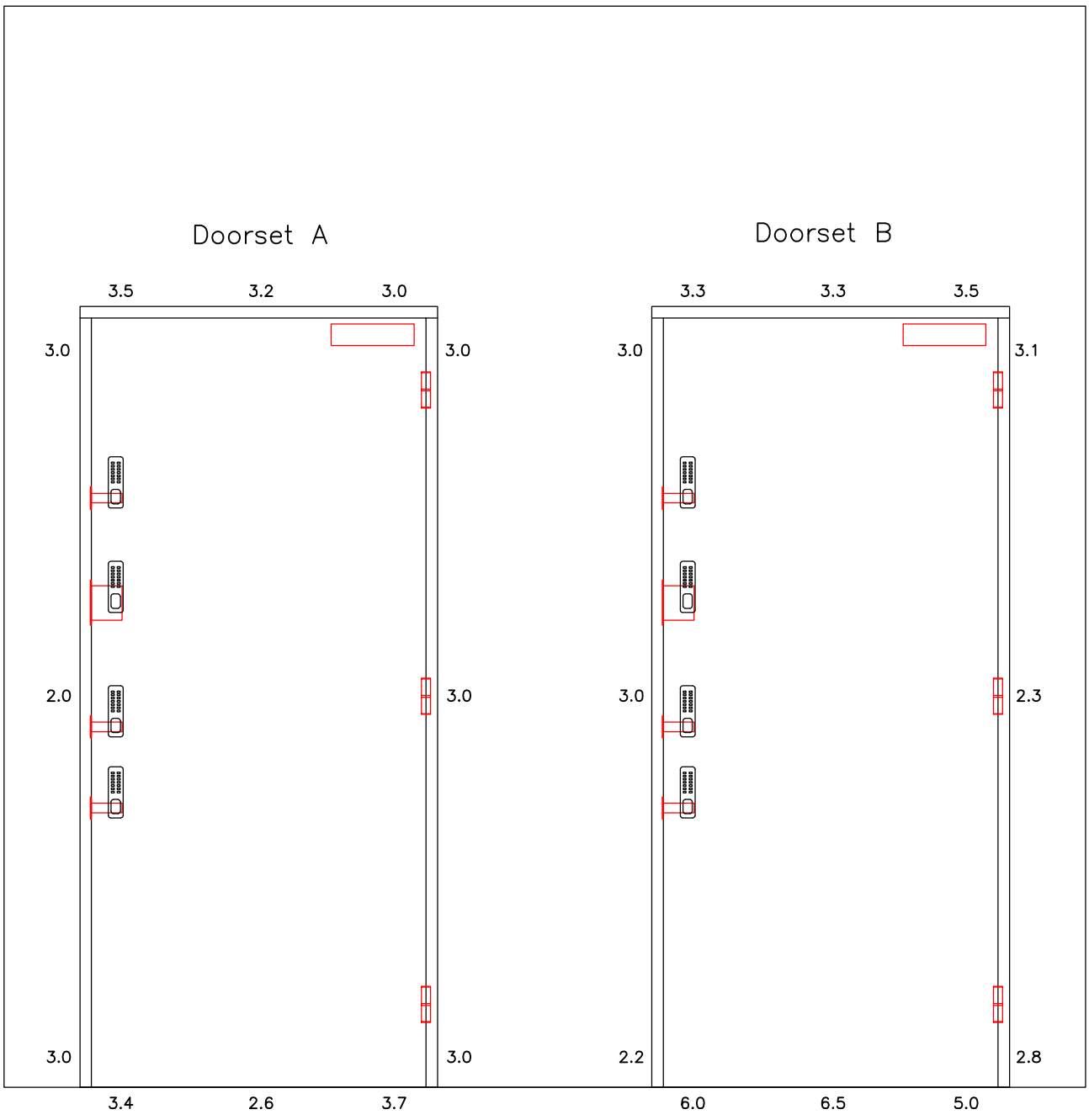
Title
Frame to supporting construction fixing detail
(All dimensions in mm)

Date Drawn	Drawn By	Scale
09/12/13	ARD	NTS

Project No.	
Chilt/RF13246	Appendix 1



Viewed From Unexposed Face

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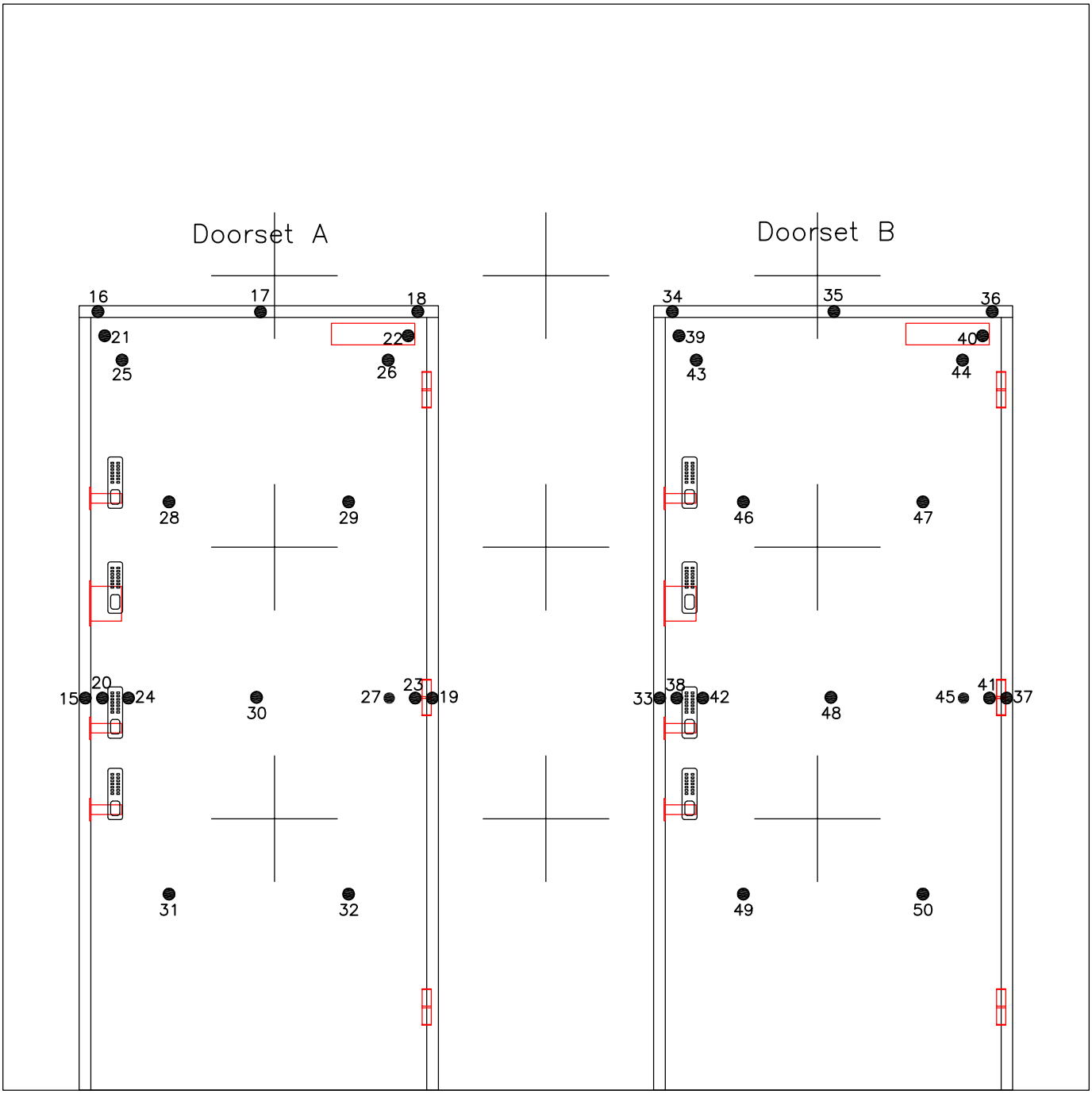
Title		
Door leaves/frame gaps (All dimensions in mm)		
Date Drawn 09/12/13	Drawn By ARD	Scale NTS
Project No. Chilt/RF13246		Appendix 1



: Furnace Thermocouples

: Unexposed Face Thermocouples

Viewed From Unexposed Face

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Title: Thermocouple positions

(All dimensions in mm)

Date Drawn	Drawn By	Scale
09/12/13	ARD	NTS

Project No.	
Chilt/RF13246	Appendix 1

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Appendix 2 - raw test data (8 pages)

(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	Chan 23	Chan 24	Chan 25
min	Pa	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C
0	0	15	15	15	16	12	16	17	17	17	12	12	13	13	14	12	12	13	13	11	12	13
1	0.4	341	223	299	321	12	384	354	275	305	12	13	17	15	14	12	44	57	13	11	13	20
2	-1	509	492	489	563	12	572	571	558	586	12	13	29	16	14	12	54	69	13	11	13	27
3	-2.3	562	562	545	620	617	627	633	627	658	12	13	39	16	14	12	50	68	14	11	12	23
4	-9.2	580	533	553	611	599	629	620	621	641	11	13	39	17	14	12	41	63	14	11	12	21
5	-1.2	526	475	503	570	563	586	575	581	594	11	13	38	19	14	12	36	61	15	11	12	19
6	0.7	588	518	551	615	611	638	624	620	643	11	13	40	21	14	12	38	61	16	12	12	19
7	-0.3	600	554	582	648	624	652	657	651	675	11	13	39	26	14	12	37	61	16	11	13	19
8	-3	617	557	591	646	629	662	654	651	667	11	13	37	34	15	12	36	61	18	11	13	19
9	-2.5	628	558	603	644	634	673	655	651	662	11	13	36	40	16	12	36	61	21	12	13	19
10	1.1	640	580	615	665	654	685	675	671	687	11	13	39	47	17	12	38	64	22	12	13	19
11	0.9	656	616	632	702	683	698	704	707	718	11	13	48	55	19	12	43	72	23	12	13	19
12	1	675	651	659	728	715	717	725	734	739	11	13	47	59	22	12	43	71	24	13	13	20
13	-1.1	692	674	683	747	732	733	741	752	752	11	15	49	63	26	13	43	68	25	14	14	21
14	0.6	705	691	699	755	744	744	749	763	759	11	16	50	64	30	13	43	65	27	15	15	22
15	-0.7	719	704	721	766	751	755	759	774	767	11	18	52	65	33	14	46	64	30	16	17	24
16	0.7	731	718	733	773	762	764	763	782	775	11	20	51	64	36	15	49	63	33	17	19	26
17	-0.2	741	730	744	783	771	774	774	794	784	11	23	50	65	39	17	51	63	36	19	21	28
18	0.8	754	741	758	793	782	784	783	803	795	11	27	49	65	42	18	50	64	40	21	23	30
19	-0.4	761	752	768	798	788	792	788	808	801	11	29	49	66	45	21	49	65	45	23	26	32

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	Chan 23	Chan 24	Chan 25
min	Pa	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C
20	0.5	774	764	782	803	795	801	796	815	807	11	32	48	66	49	23	50	66	52	25	29	34
21	0.1	781	774	791	809	801	807	803	821	814	11	34	49	68	53	27	51	68	73	27	31	36
22	0.9	786	781	799	813	807	814	808	825	818	10	36	49	67	56	29	51	70	88	29	34	40
23	0.5	794	788	805	821	813	819	814	830	823	11	38	51	68	60	32	50	72	91	32	36	44
24	0.4	802	796	812	827	820	828	819	836	829	10	40	52	67	60	34	49	74	84	34	39	46
25	-0.9	808	803	819	834	826	835	826	844	836	10	41	52	67	60	36	49	76	75	36	41	48
26	-0.9	815	812	829	838	830	841	831	849	840	10	42	53	67	60	37	49	78	71	39	43	50
27	-0.2	820	815	831	839	831	842	834	850	843	10	44	54	67	61	38	48	79	70	40	45	52
28	-0.8	824	820	834	844	837	845	841	855	848	10	44	54	68	62	38	49	81	72	42	47	52
29	0.7	831	826	839	850	843	852	845	859	852	10	44	55	68	63	39	49	82	74	44	48	53
30	0.7	837	833	844	855	848	855	850	866	857	10	45	55	68	63	39	49	82	74	45	49	54
31	-0.6	845	840	852	860	854	862	856	871	864	10	45	54	68	63	39	48	82	76	47	50	55
32	-1	850	846	860	866	860	869	861	876	869	10	46	54	68	63	40	48	83	76	49	52	56
33	0.2	856	852	865	869	861	875	864	879	871	10	46	54	68	64	41	48	83	78	50	53	57
34	0.4	861	858	872	874	867	878	868	883	876	10	46	54	69	64	40	48	82	78	51	54	59
35	0.4	862	861	874	874	868	880	870	883	875	10	47	53	69	65	40	48	81	78	52	55	59
36	0.3	868	866	879	877	872	885	870	886	876	10	47	53	70	64	41	48	80	79	53	56	61
37	0.7	873	870	885	880	877	889	873	888	881	10	47	53	68	64	40	48	80	78	53	56	61
38	0.2	876	875	889	882	881	894	872	889	885	10	47	53	69	63	40	49	80	78	54	57	62
39	0.2	881	880	893	887	885	898	874	891	889	10	48	53	70	63	41	49	80	78	55	58	62
40	-0.5	884	883	894	890	887	900	877	894	891	10	48	53	70	63	41	50	81	77	57	58	63
41	0.1	887	886	897	892	892	904	878	896	896	10	47	53	69	63	40	49	82	76	57	58	64
42	-1.2	889	891	900	896	896	907	879	899	897	10	48	54	68	63	41	50	83	77	59	59	65
43	-0.6	893	893	903	898	899	910	882	902	900	10	47	54	67	64	41	51	84	76	59	59	66
44	0.5	896	896	907	901	901	912	882	903	899	10	48	54	67	63	41	53	85	77	60	60	67
45	-1	898	897	909	903	904	916	885	905	904	10	48	54	66	64	42	55	87	77	61	60	68

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	Chan 23	Chan 24	Chan 25
min	Pa	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C
46	1.2	900	900	913	906	908	919	888	908	908	10	48	54	66	63	42	56	88	76	61	61	69
47	-1	903	901	916	908	911	920	892	910	910	10	49	53	64	62	43	57	89	78	62	61	70
48	-0.8	903	902	918	910	913	923	893	911	911	10	48	53	62	62	43	58	90	77	63	61	71
49	0.7	906	905	921	913	915	923	898	913	912	10	50	53	60	62	45	60	91	77	63	62	72
50	-0.6	907	906	924	915	916	926	896	914	910	10	51	53	60	62	47	60	93	77	64	62	73
51	-0.4	911	909	923	917	919	929	897	916	912	10	52	53	60	62	47	62	95	77	65	63	74
52	-0.1	914	912	924	919	921	929	903	919	916	10	53	54	60	63	47	62	96	78	66	63	75
53	-0.4	918	917	926	921	921	931	906	925	919	10	54	54	59	62	48	63	98	80	66	64	76
54	0	926	922	928	926	926	936	911	930	923	10	54	55	59	62	49	65	101	80	68	64	78
55	-0.2	929	927	928	932	927	940	923	940	932	10	54	55	58	62	47	64	103	81	67	64	79
56	-0.1	935	932	930	937	932	942	932	946	939	10	54	55	57	62	46	66	106	82	68	65	80
57	-1	938	935	930	942	933	943	940	953	949	10	55	56	56	63	49	66	109	85	69	65	81
58	-0.2	942	938	931	949	936	941	945	958	955	10	55	58	55	63	50	66	114	86	70	66	82
59	1.1	944	941	934	954	936	939	952	964	957	10	56	59	55	63	51	67	121	89	71	67	83
60	0.4	947	941	933	957	935	933	952	965	966	10	56	60	54	63	51	69	128	90	72	68	85
61	1.1	950	942	931	958	943	939	954	967	967	10	56	61	55	63	51	69	136	93	72	69	88
62	1.9	952	941	927	961	948	938	959	966	958	10	57	62	54	64	51	70	147	94	73	70	90
63	-0.7	950	940	909	966	944	934	970	966	960	10	56	63	55	65	50	72	160	95	75	71	92
64	0.1	953	951	901	963	949	941	967	971	963	10	57	64	55	66	50	73	173	96	75	71	93
65	-0.9	958	959	926	967	958	953	973	976	966	10	57	64	55	66	50	74	188	96	77	72	94
66	1.2	965	965	931	969	963	959	968	978	967	10	57	65	56	66	50	75	203	99	79	73	95
67	0.5	972	972	945	974	972	963	961	975	968	10	58	77	57	65	50	75	168	101	81	75	125
68	0.8	974	974	955	978	978	967	960	975	967	10	54	145	58	65	50	77	184	104	85	76	99
69	0.6	977	974	969	976	980	976	960	974	966	10	17	15	29	58	29	36	9	111	63	46	7

Time	Chan 26	Chan 27	Chan 28	Chan 29	Chan 30	Chan 31	Chan 32	Chan 33	Chan 34	Chan 35	Chan 36	Chan 37	Chan 38	Chan 39	Chan 40	Chan 41	Chan 42	Chan 43	Chan 44	Chan 45
min	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C
0	13	12	13	14	11	9	10	12	13	0	13	12	13	14	13	11	12	13	14	12
1	13	12	14	14	11	9	10	12	17	-1	13	12	32	39	13	11	13	21	14	12
2	13	12	14	14	11	9	10	12	31	-2	14	12	47	60	13	11	13	25	14	12
3	14	12	14	14	11	9	10	12	37	-3	16	11	49	62	14	11	13	23	14	12
4	14	12	14	14	11	9	10	12	37	-5	20	11	40	60	14	11	12	21	14	12
5	14	12	14	14	11	9	10	12	37	-6	23	11	39	61	14	11	12	20	14	12
6	14	12	14	14	11	9	10	12	39	21	29	11	49	64	15	12	12	21	14	12
7	14	12	14	14	11	9	10	12	38	32	37	11	53	63	16	12	12	20	14	12
8	13	12	14	14	11	9	10	12	37	38	38	11	52	61	17	12	13	20	15	12
9	14	12	14	14	11	9	10	12	37	43	43	11	54	61	19	14	13	21	16	12
10	13	12	14	14	11	9	9	12	37	48	46	11	58	63	22	15	15	23	17	13
11	13	12	14	14	11	9	9	13	38	50	48	12	59	65	26	18	17	25	20	15
12	14	12	15	14	11	9	10	13	40	51	49	12	60	67	32	22	20	29	24	17
13	14	12	15	14	11	10	10	13	43	53	51	13	59	69	38	28	23	35	29	20
14	15	12	16	15	12	10	10	14	45	54	52	15	58	70	44	34	27	43	35	24
15	16	13	16	15	12	11	11	15	46	54	53	19	60	70	50	40	31	49	41	28
16	18	13	18	16	12	11	12	16	47	53	53	25	63	71	55	45	35	52	46	32
17	20	14	19	17	13	12	13	18	47	52	53	31	64	71	59	50	39	55	51	36
18	22	15	21	18	14	13	13	21	48	52	52	34	64	72	61	54	42	57	54	40
19	24	16	23	20	14	14	14	25	50	56	52	36	66	73	62	57	45	60	58	44
20	27	17	25	21	15	15	16	29	52	58	52	36	66	73	64	60	48	62	60	47
21	29	18	27	23	16	16	17	34	53	60	52	37	66	73	65	62	50	65	62	50
22	31	19	28	24	17	17	18	38	54	60	54	38	66	73	65	64	52	67	64	52
23	34	20	30	26	19	18	19	42	54	62	54	39	67	74	66	65	54	70	65	54
24	36	21	32	27	20	19	20	44	56	64	53	40	67	76	66	66	56	69	66	55
25	38	23	34	29	21	20	21	46	57	64	53	41	68	77	67	68	57	71	66	57

Time	Chan 26	Chan 27	Chan 28	Chan 29	Chan 30	Chan 31	Chan 32	Chan 33	Chan 34	Chan 35	Chan 36	Chan 37	Chan 38	Chan 39	Chan 40	Chan 41	Chan 42	Chan 43	Chan 44	Chan 45
min	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C
26	39	25	36	30	23	21	23	48	58	66	53	41	69	78	67	69	58	72	67	58
27	41	26	37	32	24	22	24	48	58	67	54	41	70	80	68	70	60	72	67	59
28	43	27	39	33	25	23	25	47	59	69	54	41	71	82	68	70	61	73	68	60
29	44	29	40	34	27	24	26	46	59	70	54	41	72	85	69	70	61	74	68	61
30	45	30	42	36	28	25	26	46	58	71	54	40	73	87	69	70	62	75	68	62
31	47	31	43	37	29	26	27	48	59	71	54	39	74	89	70	70	63	75	69	62
32	48	33	44	38	30	27	29	49	59	72	54	39	75	92	70	71	63	78	69	63
33	49	34	45	39	32	28	30	48	58	70	54	39	76	94	71	71	63	79	70	63
34	50	36	46	41	33	29	31	48	57	69	53	40	77	97	71	72	64	81	70	64
35	51	37	47	42	34	30	33	48	57	69	54	40	78	100	72	72	64	84	70	64
36	52	38	49	43	36	32	34	47	57	67	53	40	79	105	73	72	65	85	71	65
37	53	40	49	44	36	31	34	47	57	65	54	39	79	115	73	72	65	86	71	65
38	54	41	50	45	38	33	36	47	58	65	53	39	81	133	74	73	65	85	72	65
39	55	42	51	47	39	34	37	47	60	64	52	39	84	171	75	74	66	84	72	66
40	56	44	52	48	41	36	38	48	62	64	52	39	87	259	76	74	66	86	73	66
41	57	45	53	49	41	36	39	46	65	64	52	38	89	340	77	74	67	89	73	67
42	57	46	54	50	43	38	40	48	67	64	52	38	92	420	78	75	68	103	74	68
43	58	47	54	51	43	38	42	47	433	69	53	38	94	455	80	76	68	115	75	68
44	59	49	55	52	45	39	43	47	81	68	53	38	99	385	83	77	69	95	76	69
45	60	49	56	53	46	40	44	46	85	66	55	38	107	438	87	77	70	94	77	70
46	60	51	57	54	47	41	45	46	39	32	57	39	115	395	98	78	71	93	72	71
47	61	52	57	55	48	43	47	23	8	10	10	8	63	133	22	31	17	46	16	11
48	62	53	58	56	49	43	48	10	6	7	8	7	27	42	11	11	11	24	11	8
49	62	54	59	57	50	45	49	7	6	8	7	7	12	17	9	8	9	15	9	8
50	63	56	60	58	51	47	51	6	7	8	9	7	11	12	9	9	10	11	9	9
51	64	57	60	59	52	47	52	6	6	8	11	7	10	11	9	11	8	9	9	9

Time	Chan 26	Chan 27	Chan 28	Chan 29	Chan 30	Chan 31	Chan 32	Chan 33	Chan 34	Chan 35	Chan 36	Chan 37	Chan 38	Chan 39	Chan 40	Chan 41	Chan 42	Chan 43	Chan 44	Chan 45
min	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C
52	64	58	61	60	53	47	52	6	6	8	12	7	10	10	9	10	9	8	9	8
53	65	59	61	60	53	48	53	6	6	8	12	7	10	11	9	9	9	8	9	8
54	65	60	62	61	54	49	54	6	6	7	13	7	10	11	9	8	8	8	9	8
55	66	61	63	61	55	48	54	6	6	7	13	7	9	11	8	8	8	8	9	8
56	67	62	63	62	56	49	55	6	6	7	13	7	10	11	8	9	8	8	9	8
57	67	63	64	63	57	51	57	6	6	7	13	7	10	11	8	8	9	8	9	8
58	68	64	65	64	58	52	58	6	6	8	13	8	10	11	8	9	9	8	9	8
59	68	65	66	65	59	54	59	6	6	8	13	8	10	11	8	9	9	8	9	8
60	69	66	67	66	60	54	60	6	6	7	13	7	9	11	8	8	9	8	8	7
61	69	67	68	67	60	55	61	6	6	8	13	8	9	11	8	9	9	8	9	8
62	70	68	68	68	61	56	63	6	6	8	13	8	10	11	8	9	9	8	9	8
63	71	69	69	69	62	57	64	6	6	8	13	8	10	11	9	9	9	8	9	8
64	71	70	70	70	63	57	64	6	6	8	13	8	9	11	9	9	9	8	9	8
65	72	71	71	71	64	58	65	6	6	8	13	8	10	11	9	9	9	8	10	8
66	73	72	72	72	64	59	66	6	6	8	13	8	10	11	9	9	9	8	10	8
67	74	73	72	73	64	57	67	6	6	8	13	8	9	10	9	9	9	8	10	8
68	74	74	72	74	65	58	68	6	6	8	13	8	10	10	9	9	9	8	10	8
69	76	67	46	66	45	60	69	6	6	8	13	8	10	11	9	9	9	8	10	8

Time	Chan 46	Chan 47	Chan 48	Chan 49	Chan 50	Chan 51	Chan 52
min	°C	°C	°C	°C	°C	kw/m²	kw/m²
0	14	13	13	11	10	0	0
1	14	13	13	11	11	0	0
2	14	13	12	11	11	0	0
3	14	13	12	11	10	0	0
4	14	13	12	11	10	0	0

Time	Chan 46	Chan 47	Chan 48	Chan 49	Chan 50	Chan 51	Chan 52
min	°C	°C	°C	°C	°C	kw/m²	kw/m²
5	14	13	12	11	10	0	0
6	14	13	13	11	10	0	0
7	14	13	13	11	10	0	0
8	14	13	13	11	10	0	0
9	15	14	13	12	11	0	0

Time	Chan 46	Chan 47	Chan 48	Chan 49	Chan 50	Chan 51	Chan 52
min	°C	°C	°C	°C	°C	kw/m²	kw/m²
10	16	15	14	12	12	0	0
11	18	16	16	14	14	0	0
12	21	19	19	16	16	0	0
13	25	22	22	20	19	0	0
14	29	26	26	23	23	0	0
15	34	30	30	27	27	0	0
16	39	35	34	31	32	0	0.1
17	43	38	38	35	36	0	0.1
18	47	42	42	38	39	0	0
19	50	45	45	41	42	0	0.1
20	53	48	48	44	45	0	0.1
21	55	51	51	47	47	0.1	0.1
22	57	53	53	49	49	0.1	0.1
23	58	54	55	50	51	0.1	0.1
24	59	55	56	51	52	0.1	0.1
25	61	57	58	53	53	0.1	0.1
26	62	58	59	54	55	0.1	0.1
27	63	59	61	55	56	0	0.1
28	63	60	61	56	56	0.1	0.1
29	64	60	62	57	57	0.1	0.1
30	64	61	63	58	58	0.1	0.1
31	64	61	63	58	58	0.1	0.1
32	65	62	64	59	59	0.1	0.1
33	65	62	64	60	60	0.1	0.1
34	66	62	65	61	61	0.1	0.1
35	66	63	65	62	61	0.1	0.1

Time	Chan 46	Chan 47	Chan 48	Chan 49	Chan 50	Chan 51	Chan 52
min	°C	°C	°C	°C	°C	kw/m²	kw/m²
36	66	63	65	62	62	0.1	0.1
37	67	63	65	62	62	0.1	0.1
38	67	64	64	63	63	0.1	0.2
39	68	64	64	64	64	0.1	0.1
40	69	65	65	65	65	0.1	0.1
41	69	65	64	65	65	0.1	0.1
42	70	67	66	67	66	0.1	0.2
43	71	67	67	68	67	0.1	0
44	71	68	67	69	68	0.1	0.2
45	71	68	68	69	69	0.2	0.3
46	66	58	72	70	70	0.1	0.1
47	29	27	13	20	35	0.1	0
48	18	15	12	11	17	0.1	0
49	13	11	12	8	13	0.1	0
50	11	10	431	8	11	0.1	0.1
51	11	10	389	9	9	0.1	0.1
52	11	11	10	8	9	0.1	0.1
53	11	11	9	7	9	0.1	0.1
54	10	11	9	7	10	0.1	0.1
55	10	11	9	7	10	0.1	0.1
56	10	11	9	7	10	0.1	0.2
57	10	11	9	7	10	0.1	0.2
58	10	11	9	7	10	0.2	0.2
59	10	11	9	7	10	0.2	0.2
60	10	11	9	7	9	0.2	0.2
61	10	11	9	7	9	0.2	0.2

Time	Chan 46	Chan 47	Chan 48	Chan 49	Chan 50	Chan 51	Chan 52
min	°C	°C	°C	°C	°C	kw/m²	kw/m²
62	10	11	9	7	9	0.2	0.3
63	10	11	9	7	10	0.2	0.3
64	10	11	9	7	10	0.1	0.3
65	10	12	9	7	10	0.2	0.4
66	10	12	9	7	10	0.2	0.4
67	10	12	9	7	10	0.3	0.5
68	10	12	9	7	10	0.2	0.7
69	10	13	10	7	10	0.4	0