

FIRE RESISTANCE TEST REPORT

DOUBLE LEAF COMPOSITE TIMBER DOOR with GLAZED ELEMENT

in accordance with **BS EN 1634-1: 2008**

Test Sponsor: Garish Crown Fire Engineering & Consultancy
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HOKLAS Approved Signatory:



Ir. Dr Chan Yuk Kit

1. Scope of Test

This report is a record of a fire resistance test conducted by Forte Testing and Consultants Co., Ltd, in conformity with requirements in *BS EN 1634-1: 2008 "Fire resistance and smoke control tests for door, shutter and openable window assemblies and elements of building hardware Part 1: Fire resistance tests for doors, shutters and openable windows"* and particular requirements in *BS EN 1363-1: 1999 "Fire resistance tests – Part 1: General requirements"*.

The test subjects were two doors: an unequal double leaf composite timber door with single glazed element, namely Door A; and a single leaf composite timber door with single glazed element, namely Door B.

This report only contains test results and details for Door A.

The specimen was manufactured and supplied for test by Leung's Wooden Company Limited.

The specimen achieved the following fire resistance:

INTEGRITY (E)		INSULATION (I ₂)		
Sustained Flaming	122 Minutes	Door Leaves & Framework	Average Temp. Rise	122 Minutes
Gap Gauge	122 Minutes		Max. Temp. Rise (I ₂)	122 Minutes
Cotton Pad	122 Minutes	Glazed Elements	Average Temp. Rise	122 Minutes
			Max. Temp. Rise	122 Minutes

2. Test Information

Test Laboratory:	FORTE Testing and Consultants Company Limited	
Test Location:	West Side of Huan Xiang Shan, Xin Yu Road, Shajin, Baoan District, Shenzhen, Guangdong Province, China.	
Test Sponsor:	Leung's Wooden Company Limited Garish Crown Fire Engineering & Consultancy	
ID no. of the specimen:	Door A: QT 13-153A; 2013-06-15	
Date Received:	*A total of two sets of report (Report no. IT13-107 and IT13-154) are issued on this test	
Test Number:	QT 13-153	
Date Tested:	2013-06-19	Start Time: 14:35
Approved Test Operator from FORTE:	Ms. Cheng San Mei, Sammi	
Witness of the Test:	Mr. C.K. Leung – Official Delegate of the Sponsor	

3. Construction Details of Specimen

3.1 Specimen Description

3.1.1 Framework and Sub-frame

The composite timber framework was overall sized 1589 mm (width) x 2347mm (height). The sectional dimensions of the perimeter framework was 65 mm (w) x 100 mm (thick) with 25 mm single door stop rebate.

The sub-frame was made of film plywood sized 100 mm (w) x 18 mm (t). The sub-frame was fixed into the concrete supporting frame by M10 X 52 anchor bolts with metal plugs at 400 - 500 mm centre to centre.

The framework was fixed onto the sub-frame by corrugated fasteners at 400 - 500 mm centre to centre.

Wooden architraves sized 45 mm (w) x 15 mm (t) were fixed over the framework and sub-frame on both sides by wood nails at approximate 250 - 300 mm centre to centre.

Some parts of the timber frame were covered by 2 mm intumescent sheet and a layer of 5 mm thick fire rated board.

The smoke seal was located at the rebate corner of the door frame.

The space between framework, sub-frame and concrete support frame was filled with back rods and fire sealant.

3.1.2 Door Leaves

The specimen comprised of two unequal timber door leaves: an active leaf sized 1050 mm (w) x 2300 mm (h) x 62 mm (t) and an inactive leaf sized 450 mm (w) x 2300 mm (h) x 62 mm (t).

The stiles and rails were made from 3 numbers of 45 mm (w) wooden slab and the mid rails were a 45 mm (w) wooden slab. The space between stiles and rails were filled with 38 mm (t) wooden strips. Both sides of the core were covered by a layer of 5 + 3 mm mm (t) fireproof boards sub-facing and finished by a layer of medium density fiber facing (exposed fire side) and plywood facing (unexposed fire side). The sub-facing was fixed onto the door core by glue and screws and the facing was fixed onto the sub-facing by glue.

The meeting edge was unequal rebated type.

1 number of 10 mm (w) x 4 mm (t) intumescent seal was fitted into the groove along meeting edge on active door leaf. 1 number of 10 mm (w) x 4 mm (t) intumescent seal was fitted into the groove at the bottom lipping with 8 mm away the door edge from exposed fire side. The smoke seal was located at the rebate corner of the meeting edge which was overlapped the intumescent. The seals were interrupted at door lock's and flush bolt's position.

1 number of 30 mm (w) x 4 mm (t) intumescent seal was fitted into the groove along meeting edge on inactive door leaf, horizontal edges and vertical edges at hinge's side of both door leaves.

The door lipping was made of wooden strip.

3.1.3 Glazed Element

The specimen comprised of single glazed element.

On the active leaf there was single glazed element overall sized 290 mm (w) x 890 mm (h); whereas the bottom one was installed under the top glazed element with 410 mm distance and installed 200 mm away the meeting edge. The glazed element consisted of a piece of 42 mm (t) interlayered glass pane. It were set and lined with ceramic fibre. The glazing was sandwiched by 1.5 mm thick steel angle and plate clad with wooden bead. The steel components of glazing beads were fixed onto the door leaf by screw at approximate 150 – 250 mm.

The edges of glass pane were caulked with fire sealant.

3.1.4 Ironmongery

The active door leaf was supported into the framework by 4 numbers of butt hinges.

The inactive door leaf was supported into the framework by 4 numbers of spring hinges.

A mortises lock was installed 1000 mm above the bottom of the active leaf.

1 number of flush bolt was installed at the top and another at the bottom closed to the meeting edge on the inactive leaf on the exposed side.

1 number of surface mount door closer was regular arm mounted at the top rim of both door leaves on the exposed side.

1 number of conceal bottom seal was installed at the bottom edge of both door leaves.

Push and kicking plates were installed at the both door leaves.

Intumescent materials and fire sealant were applied to underneath of hinge blades and mortised area for ironmongeries.

3.2 Material Schedule

Parts specifications were summarized in the following tables.

A star mark "*" indicates those not being verified by FORTE.

Door Frame

Manufacturer:	Leung's Wooden Co., Ltd.
Materials:	Hardwood
Density:	550 - 700 kg/m ³ *
Overall Sizes:	1589 mm by 2347 mm
Section Dimensions:	65 mm by 100 mm
Rebate:	25 mm
Connection Method of Head to Jamb:	Mitered Joint with Groove and Tongue; Fixed by Wood Screws
Connection Method of Transom to Jamb:	Mortise and Tenon; Fixed by Wood Screws
Fixing Method to Sub-frame:	Screws with Metal Pins
Gap Filling between Door Frame and Sub-frame:	Fire Sealant

Door Sub-frame

Manufacturer:	Leung's Wooden Co., Ltd.
Material:	Film Plywood
Density:	350 kg/m ³ *
Sizes:	18 mm by 100 mm
Fixing Method to Concrete Sub-frame:	Screws with Metal Plug

Architraves

Manufacturer:	Leung's Wooden Co., Ltd.	
Material:	Unexposed Side	Hardwood *
	Exposed Side	Hardwood *
Hardwood Density:	550 - 700 kg/m ³ *	
Overall Sizes:	45 mm by 15 mm	

Door Leaves

Manufacturer:		Leung's Wooden Co., Ltd.
Overall Sizes:		(1050 + 450) mm by 2300 by 62 mm
Stiles and Rails	Material:	Wooden Slabs
	Width:	45 mm
	Thickness:	38 mm
	Density:	350 - 450 kg/m ³ *
	Moisture Content:	12 - 17% *
Core	Supplier:	Leung's Wooden Co., Ltd.
	Material:	Perlite *
	Thickness:	38 mm
	Density:	380 kg/m ³ *

Door Leaf Lippings

Manufacturer:	Leung's Wooden Co., Ltd.
Material:	Hardwood *
Density:	550 - 700 kg/m ³ *
Thickness:	6 mm

Door Leaf Facings

Manufacturer:	Leung's Wooden Co., Ltd.
Material:	Medium Density Fiberboard / Plywood
Density:	350 - 450 kg/m ³ *
Thickness:	4 mm

Door Leaf Sub-facings

Supplier:	Leung's Wooden Co., Ltd.
Brand:	Gemtree
Material:	Magnesium Oxide *
Density:	900 kg/m ³ *
Thickness:	5 mm & 3 mm

Glazed Element – Glass Pane

Supplier:	Leung's Wooden Co., Ltd.
Brand:	Hengbao *
Nominal Thickness:	42 mm
Full Sizes:	290 mm by 890 mm
Visual Sizes:	240 mm by 840 mm
Depth of Cover of Glass Edge:	25 mm
Fixing Method:	Lined by Mineral Wool, Clamped by 1.5 mm thick Steel Angles/Plate and Wooden Glazed Beads on Both Sides

Glazed Element – Fixing Angles/Plate

Supplier:	Leung's Wooden Co., Ltd.
Material:	Stainless Steel *
Sizes:	Angel - 1.5 mm by 44 mm by 28 mm Pate – 1.5 mm by 35 mm

Glazed Element – Mineral Wool

Supplier:	Garish Crown Fire Engineering & Consultancy
Material:	Fire Resistant Wool (Ceramic Fiber Tape) *
Density:	200 kg/m ³ *
Locations of Application:	Glass Pane Liner

Glazed Element – Glazing Beads

Manufacturer:	Leung's Wooden Co., Ltd.
Material:	Hardwood *
Density:	550 - 700 kg/m ³ *
Sizes:	45 mm by 20 mm
Fixing Method:	Adhesive

Butt Hinges

Supplier:	Leung's Wooden Co., Ltd.
Brand:	BONCO
Model:	BI-4435 BB
Sizes:	102 mm by 102 mm by 3 mm

Spring Hinges

Supplier:	Leung's Wooden Co., Ltd.
Brand:	Best
Model:	PH-102 mm
Sizes:	102 mm by 102 mm by 3 mm

Door Closers

Supplier:	Leung's Wooden Co., Ltd.
Brand:	BONCO
Model:	B3-2005

Flush Bolts

Supplier:	Leung's Wooden Co., Ltd.
Brand:	BONCO
Model:	B5-FB-069
Sizes:	Ø10 by 150 mm

Door Lock

Supplier:	Leung's Wooden Co., Ltd.
Brand:	"MF"
Model:	"TP" EURO – MORTISE – 60 X 85 – PASS - PSS:
Sizes:	95 X 180 X 20 mm

Push Plate

Supplier:	Leung's Wooden Co., Ltd.
Material:	Stainless Steel *
Thickness:	1 mm
Sizes:	100 mm by 200 mm

Door Chain

Supplier:	Leung's Wooden Co., Ltd.
Brand:	Best
Model:	CSC-122-SCP

Door Selector

Supplier:	Leung's Wooden Co., Ltd.
Brand:	BONCO
Model:	B5-DS-053

Conceal Bottom Smoke Seal

Supplier:	Garish Crown Fire Engineering & Consultancy
Brand:	Ying Mu
Model:	BSS
Locations of Application:	Bottom Edge of the Active Leaf

Rebate Corner Smoke Seal

Supplier:	Garish Crown Fire Engineering & Consultancy
Brand:	Ying Mu
Model:	Seal 1212
Material:	PVC
Locations of Application:	Framework Rebate Corner

Intumescent Material – Door Edges

Supplier:	Leung's Wooden Co., Ltd.		
Brand:	Ying Mu		
Model:	Not Provided		
Sizes:	Door Frame Protection	2 mm Thickness	
	Door Meeting Edge	30 mm by 4 mm and 10 mm by 4mm	
	Bottom Edge	Active Leaf	10 mm by 4 mm
		Inactive Leaf	10 mm by 4 mm
	Perimeter of Leaf	30 mm by 4 mm	

Fixing – Door Frame

Supplier:	Leung's Wooden Co., Ltd.
Brand:	Howin - HMF
Size:	10 by 112 mm Screws with Metal Plug

Fire Sealant

Supplier:	Garish Crown Fire Engineering & Consultancy
Brand:	FIREMATE
Model:	Not Provided

Glue

Supplier:	Leung's Wooden Co., Ltd.
Brand:	Not Provided
Type:	木膠粉 *

3.3 Drawing on Specimen provided by the Sponsor (Total 1 Page)

NOTE

- (1) 65mm THK HARDWOOD DOOR FRAME
- (2) 20mm THK INTUMESCENT STRIP
- (3) 80mm THK LEUNG FLYWOOD BALCONIS FRAME
- (4) 15x30mm WIDE WOOD STRIP
- (5) 20mm THK FIREPROOF DOOR CORE BOARD
- (6) 3mm THK HDF BOARD
- (7) 12mm THK CLEAR FRP GLASS PANEL
- (8) ADHESIVE SMOKE SEAL
- (9) 2mm THK INTUMESCENT SHEET
- (10) 10x40mm THK INTUMESCENT STRIP
- (11) 5mm THK GLASS FIBRE FRP MESH WITH GLASS FIBRE
- (12) 5mm THK FRP LIPPING
- (13) 35x5mm THK S.S GLAZING BEADS
- (14) 10x15x15mm THK S.S ANGLE
- (15) 10x10x2mm S.S HMBBS
- (16) DOOR LOCK SET
- (17) DOOR OVER HEAD SURFACE FLOGGER
- (18) FRP ROCK WOOL
- (19) 15x15mm THK FRP ARCHITRAVE
- (20) AUTOMATIC DOUBLE BOTTOM SMOKE SEALS PROSSEL
- (21) 10x10x2mm S.S SPRING HINGES
- (22) 80x80mm THK FRP LIPPING
- (23) 3mm THK PLYWOOD BOARD

PROJECT
120 MIN FIRE RESISTANCE TEST ON TIMBER DOORSET.

DRAWING TITLE
DETAILS FOR SMOKE TEST DOOR (DOUBLE DOOR)

50mm THICK SOLID CORE FLUSH DOOR WITH 120 MIN. FIRE RESISTANCE.

LEUNG'S WOODEN CO LTD
PAN YU
DRAWING NO. SPT-TTD-002
SCALE: 1/4"
DATE: 2015 May 30th

Drawing provided by the Sponsor (1)

5. Test Method

5.1 Pre-test Conditioning

The pre-test conditionings of the specimen were carried out on 2012-05-20 prior to the fire test with reference to *BS EN 1634-1: 2008* and *clause 5.1, BS EN 14600: 2005*.

5.2 Ambient Temperature

The ambient temperature was measured by mineral insulated metal sheathed type K thermocouple. The measuring junction was screened by two concentric plastic pipes from radiated heat and draught, at a position approximate 1500 mm away the test construction.

5.3 Heating Condition

The average temperature inside the furnace was monitored and controlled throughout the test according to the standard heating curve stated in *BS EN 1363-1:1999* given by the equation

$$T = 345 \log_{10} (8t+1) + 20$$

Where,

T is the average furnace temperature, in degree Celsius

t is the time, in minutes

The temperature inside the furnace was measured in conformity with *BS EN 1363-1: 1999* by 9 numbers of plate thermometers. These thermometers were evenly distributed over a vertical plane approximately 100 mm from the exposed surface of the test construction.

The positions of furnace thermocouples are shown in *Figure 1*.

5.4 Unexposed Surface Temperature

The unexposed surface temperatures of the specimen were measured by 29 numbers of type K thermocouples. These thermocouples were positioned and fixed on unexposed surface of the test specimen in conformity with *BS EN 1634-1: 2008*.

The specimen was evaluated against the maximum temperature rise criterion given by supplementary procedure – Classification I₂ at the request of the Sponsor.

The positions of unexposed surface temperature measurement points are shown in *Figure 3*. The locations of thermocouples are explained in the following table.

Thermocouple	Area	Description
U1 – U5	Door Leaves	For average and maximum unexposed surface temperature rise
U6 – U13;	Door Leaves	For maximum unexposed surface temperature rise (Supplementary Procedure, I₂)
U14 – U18	Framework	For maximum unexposed surface temperature rise
U19 – U21	Glazed Elements	For average and maximum unexposed surface temperature rise
U22 – U29	Door Leaves	Unexposed surface temperature rise for additional information only (shown in Appendix A)

5.5 Pressure Condition

The pressure inside the furnace was continuously monitored in compliance with *BS EN 1363-1: 1999* during the whole test. The pressure at a point 500 mm above the notional floor level was to be maintained 0 ± 5 Pa by five minutes from commencement of the test and 0 ± 3 Pa that from ten minutes onwards with respect to the atmosphere.

5.6 Deflection Measurements

Measurements of the deflection of the test specimen were taken with a steel rule from cross line laser across the top, mid-height and bottom of the specimen.

The positions of deflection measurement points are shown in *Figure 3*.

Figure 1. Position of thermocouples and pressure measuring probe inside the furnace.

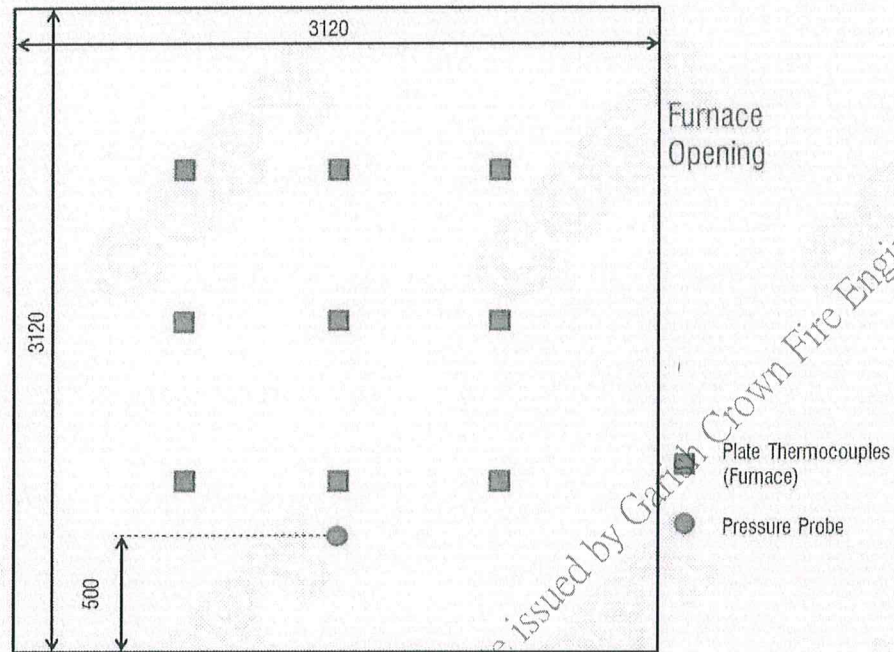


Figure 2. Primary gaps measurement positions.

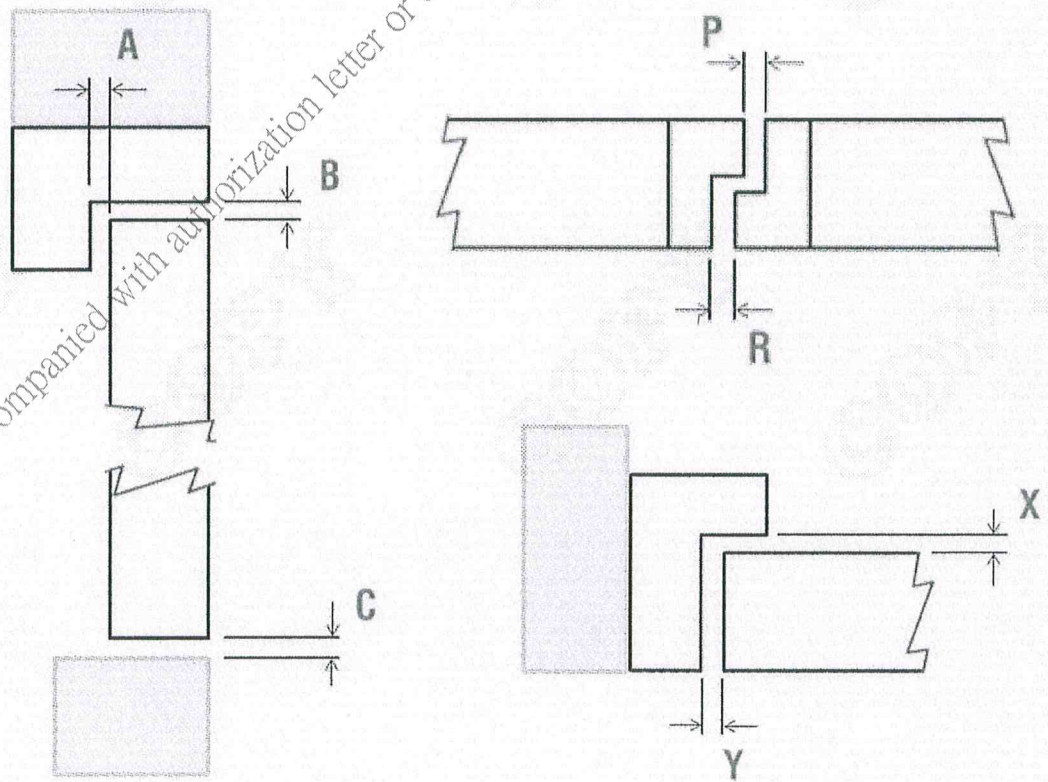


Figure 3a. Positions of fixed surface thermocouples (U) on Door A.

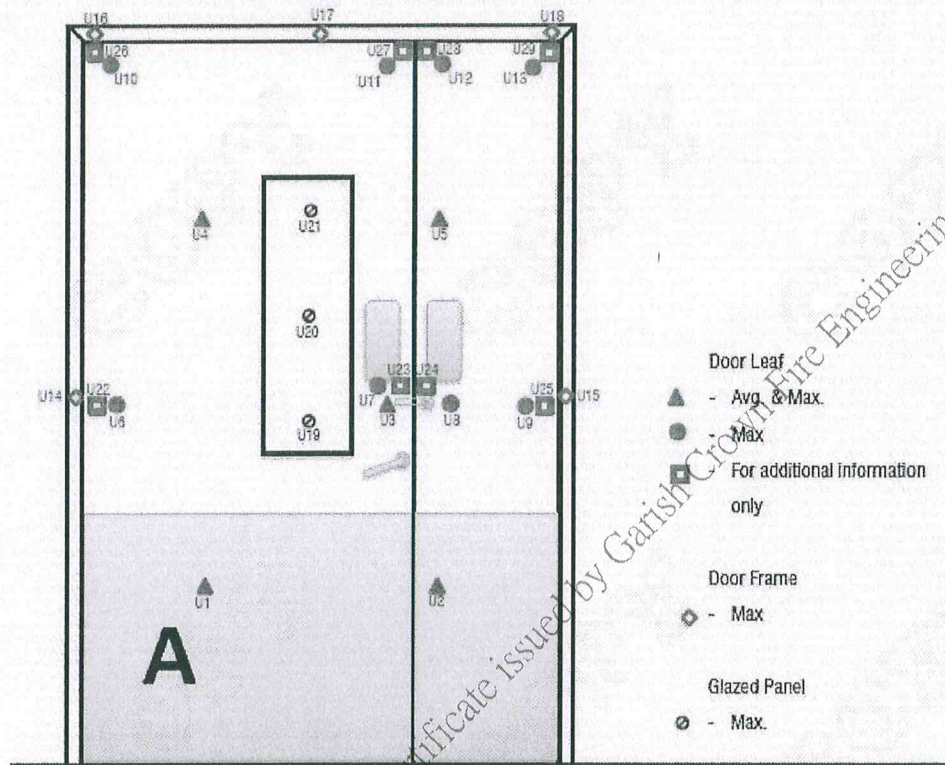
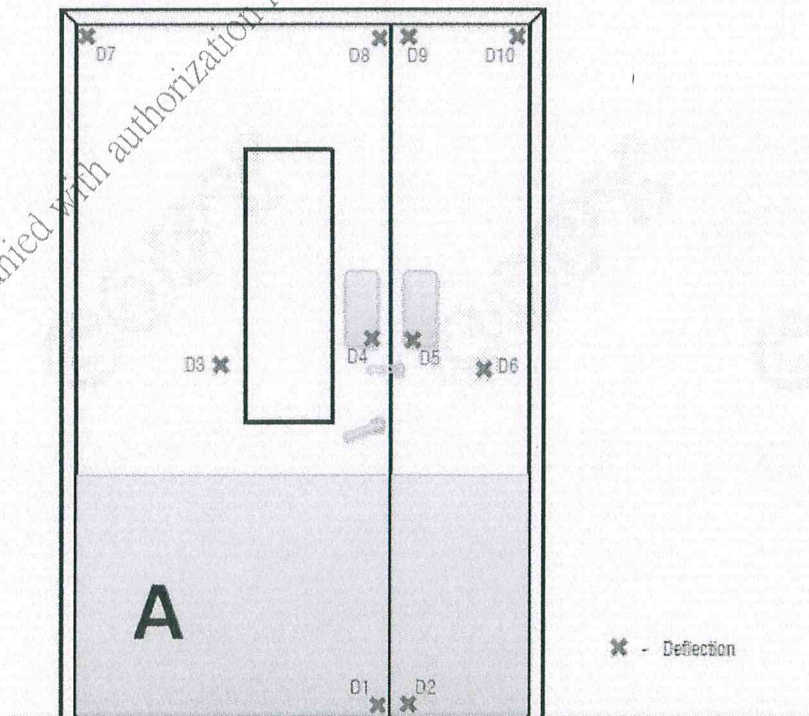


Figure 3b. Positions of deflection measuring points (D) on Door A.



6. Test Data

6.1 Retention Forces

The retention forces on each door leaf for each direction of opening were determined. The respective highest gauge measurements are summarized in the following table.

Leaf		Push	Pull
Door A	Active	62.2 N	73.6 N
	Inactive	43.6 N	34.6 N

6.2 Gaps Measurement

Primary gaps of the specimen were measured and subsequently processed in accordance with *BS EN 1634-1: 2008* and summarized in the following table.

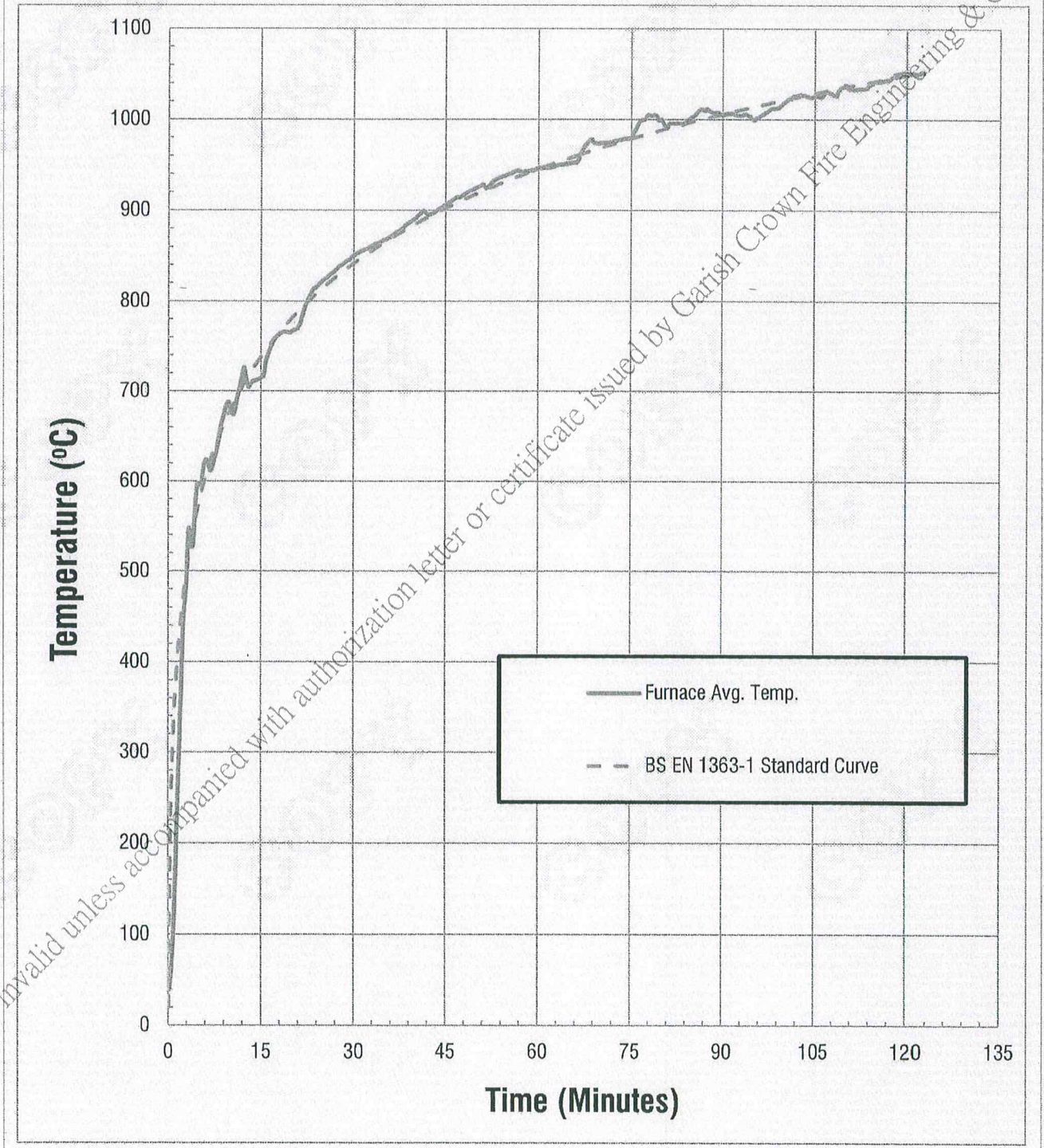
Measurements were taken in mm.

Gap		Measured		
		Minimum	Maximum	Average
Door A	A	2.5	4.7	3.6
	B	2.7	4.8	3.8
	C	1.0	3.2	2.1
	X	2.6	5.5	4.1
	Y	1.8	5.6	3.7
	P	3.6	4.7	4.2
	R	1.6	4.3	3.0

6.3 Furnace Temperature

The furnace average temperature over the test period is shown in *Figure 4*.

Figure 4. Furnace average temperature over the test period.



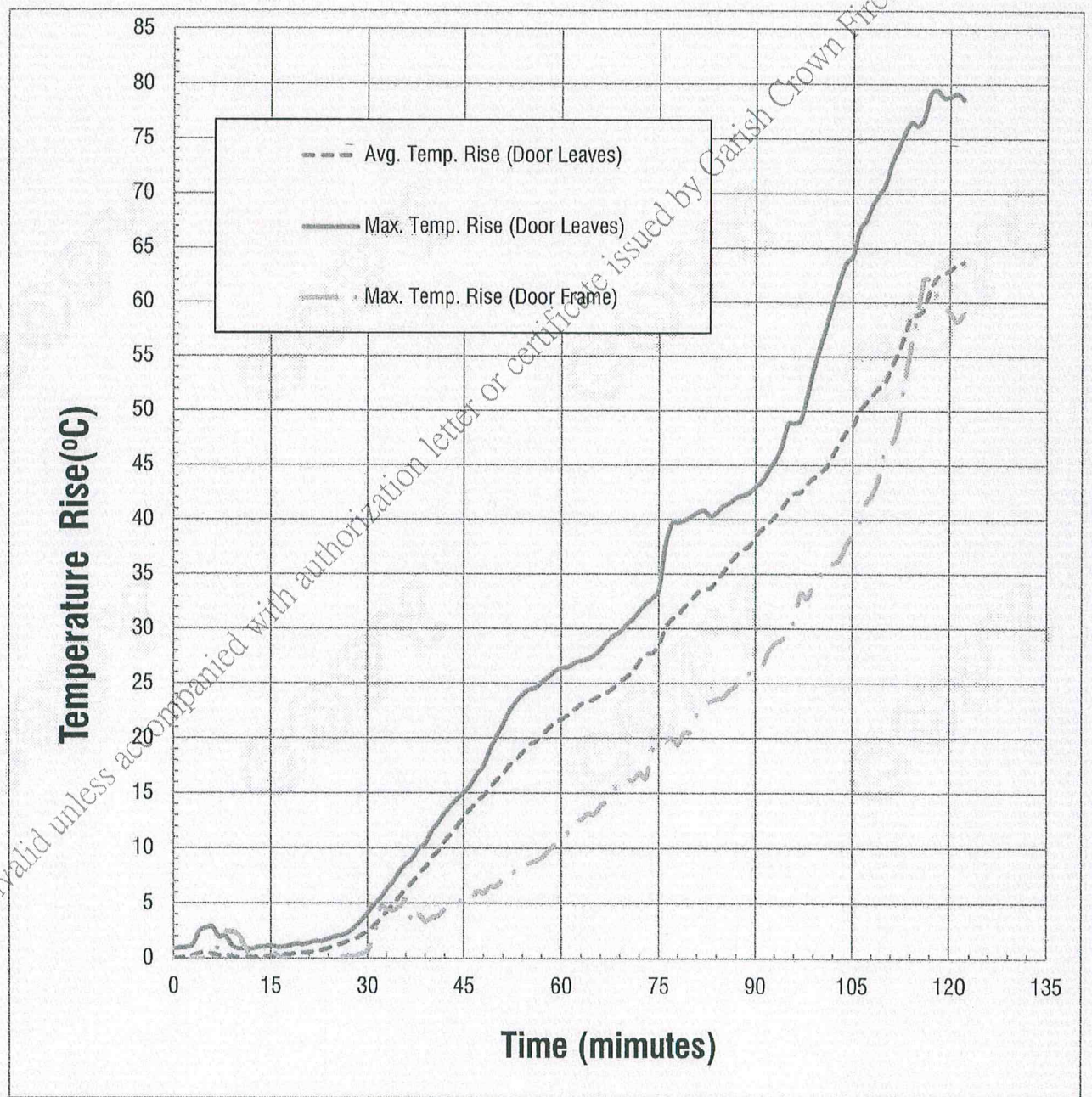
6.4 Unexposed Surface Temperature Rise

6.4.1 Door A

6.4.1.1 Fixed surface thermocouples – Door Leaves and Framework

The temperature rises of unexposed surface of Door A measured by fixed surface thermocouples on door leaves and framework over the test period are shown in Figure 5.

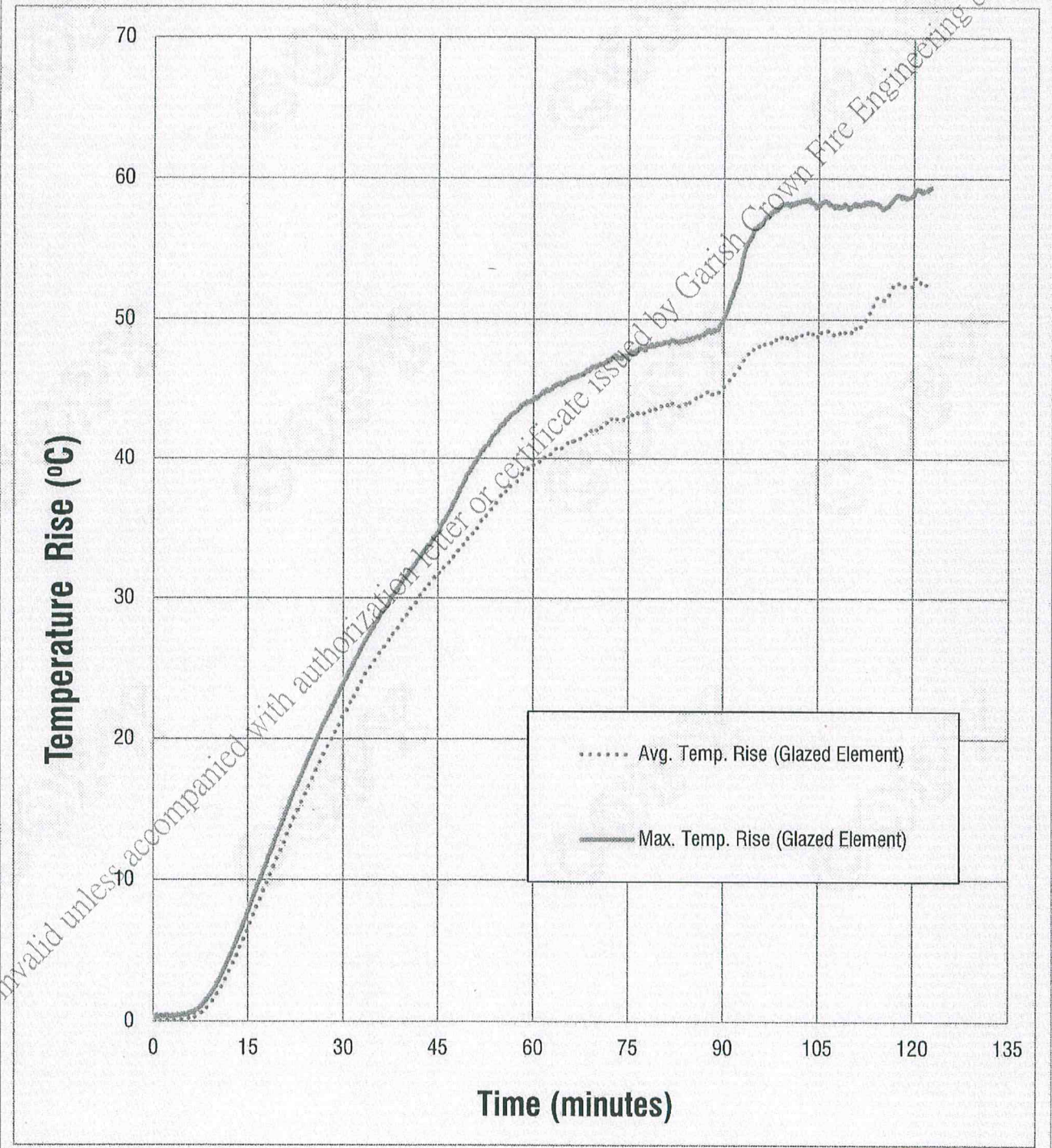
Figure 5. Average and maximum temperature rise on door leaves and framework on Door A over the test period.



6.4.1.2 Fixed surface thermocouples – Glazed Element

The temperature rises of unexposed surface of Door A measured by fixed surface thermocouples on glazed element over the test period are shown in *Figure 6*.

Figure 6. Average and maximum temperature rise on glazed element on Door A over the test period.



6.4.2 Fixed surface thermocouples – Detailed Temperature Records

The outputs of the unexposed surface thermocouples on Door A are summarized in the following tables.

Measurements were taken in °C.

Temperature outputs from unexposed surface temperature U1 to U10

Time (min)	U1	U2	U3	U4	U5	U6	U7	U8	U9	U10
0.0	36.1	36.6	36.3	36.0	37.2	36.3	35.9	35.5	36.6	35.9
5.0	36.0	36.3	36.3	35.5	37.3	37.8	36.0	35.5	36.7	39.1
10.0	36.0	36.3	36.4	36.5	37.2	36.3	35.7	35.7	36.5	36.8
15.0	36.3	36.3	36.7	36.6	37.5	36.6	36.0	35.7	36.5	36.7
20.0	36.5	36.6	36.9	36.6	37.6	36.8	36.4	36.2	36.9	36.9
25.0	36.8	37.0	38.0	36.7	38.3	37.5	37.1	36.8	37.6	37.2
30.0	37.3	37.7	40.4	36.4	39.2	38.4	39.1	38.0	38.7	38.5
35.0	38.2	38.7	44.2	37.0	41.4	42.3	43.3	40.0	42.9	42.2
40.0	39.9	40.2	47.3	36.6	44.1	46.3	47.6	43.1	47.9	46.5
45.0	42.3	48.0	51.0	36.7	47.2	49.9	50.7	45.9	51.4	51.0
50.0	44.7	56.5	53.6	36.7	49.7	52.6	53.5	48.9	54.3	54.5
55.0	47.8	60.7	57.2	36.7	52.6	55.3	56.4	51.7	57.0	57.6
60.0	50.8	62.7	59.9	36.7	54.7	56.7	59.2	54.3	59.0	59.5
65.0	52.9	63.5	62.2	36.6	56.8	58.2	61.6	56.1	60.6	60.4
70.0	54.9	64.2	64.8	36.3	58.8	59.2	64.0	58.2	62.2	63.6
75.0	57.4	65.7	67.7	36.2	61.9	63.0	68.0	61.1	66.1	66.2
80.0	59.8	67.0	70.4	76.6	66.1	66.5	72.8	65.4	71.3	69.3
85.0	62.0	67.4	72.5	77.5	70.0	69.4	75.2	69.0	74.3	72.8
90.0	66.1	68.6	74.8	78.7	74.0	73.3	77.9	73.6	79.2	76.9
95.0	69.4	69.7	77.0	82.4	79.0	76.5	81.5	76.9	85.1	79.6
100.0	71.7	71.1	77.5	92.3	81.1	79.7	85.4	77.0	86.0	80.8
105.0	78.2	76.5	80.0	100.6	84.0	86.5	89.7	80.1	88.4	83.3
110.0	76.0	78.0	84.0	107.2	88.1	94.5	94.4	84.6	88.5	87.4
120.0	80.9	88.2	97.3	103.2	99.5	104.3	103.4	96.1	93.1	100.5
121.0	82.2	87.8	98.4	99.5	100.6	104.9	104.7	97.2	93.6	101.6
122.0	82.9	87.1	97.8	98.1	101.3	104.8	104.5	97.9	94.3	102.8

Temperature outputs from unexposed surface temperature U11 to U21

Time (min)	U11	U12	U13	U14	U15	U16	U17	U18	U19	U20	U21
0.0	36.2	36.7	36.6	35.6	35.7	34.2	35.1	35.1	35.5	35.8	35.9
5.0	36.8	36.9	36.7	35.6	35.7	36.4	35.7	35.4	35.6	35.8	36.3
10.0	36.3	36.8	36.7	35.7	35.5	38.4	35.3	35.2	37.2	37.2	38.2
15.0	36.4	37.0	36.7	35.8	35.6	36.9	35.4	35.3	42.0	41.8	43.6
20.0	36.8	37.1	37.1	36.0	35.7	36.0	35.4	35.4	47.1	47.0	49.5
25.0	37.5	38.0	37.9	36.4	35.6	35.6	35.7	35.6	51.7	52.0	54.8
30.0	39.1	39.7	39.5	36.7	35.7	36.9	36.4	37.0	56.0	56.5	59.7
35.0	42.9	43.8	43.7	37.2	36.1	38.0	37.1	41.0	59.6	60.5	63.9
40.0	46.8	47.8	47.9	37.6	36.6	38.5	37.7	40.0	62.6	63.7	67.3
45.0	50.4	51.2	51.3	38.0	37.0	40.2	39.1	41.8	65.4	66.6	70.5
50.0	53.3	54.4	54.2	38.4	37.7	40.8	39.9	42.8	67.3	68.4	74.9
55.0	56.1	57.6	57.9	38.8	38.9	41.4	41.2	44.9	71.0	70.2	78.2
60.0	58.2	60.4	61.1	39.5	40.4	41.9	42.6	47.4	73.9	71.8	80.1
65.0	59.9	62.4	63.9	40.4	41.6	43.0	44.0	49.4	75.2	73.7	81.3
70.0	61.7	64.2	66.7	42.0	41.8	44.1	45.8	52.5	76.0	75.3	82.4
75.0	64.2	66.3	69.9	44.2	43.8	45.8	48.8	55.3	76.8	76.5	83.3
80.0	67.4	69.0	74.1	46.4	45.6	47.6	50.4	56.9	77.3	77.1	84.0
85.0	70.8	71.4	76.8	48.3	47.3	49.2	53.2	60.0	77.9	77.5	84.4
90.0	75.1	74.8	79.3	50.4	50.1	52.0	55.3	62.3	78.6	78.5	85.8
95.0	79.7	77.9	81.5	52.5	51.9	55.4	58.9	65.9	79.4	79.7	92.2
100.0	82.9	79.8	83.4	53.7	52.3	57.1	60.9	71.2	79.5	79.9	94.0
105.0	88.2	81.5	87.3	54.9	54.3	59.1	62.8	75.0	79.4	80.1	93.8
110.0	96.8	84.6	92.8	55.8	55.2	61.0	64.7	83.0	80.1	80.6	93.7
120.0	115.2	103.0	105.8	58.1	57.6	68.7	70.6	95.4	88.7	81.9	94.6
121.0	115.4	104.9	106.8	58.0	57.9	69.8	71.8	94.6	88.7	82.0	94.9
122.0	114.9	106.2	107.9	58.0	57.7	69.5	71.5	95.2	88.1	81.8	94.9

6.5 Pressure

The pressure differential in furnace at 500 mm above notional floor level over the test period was summarized in the following table.

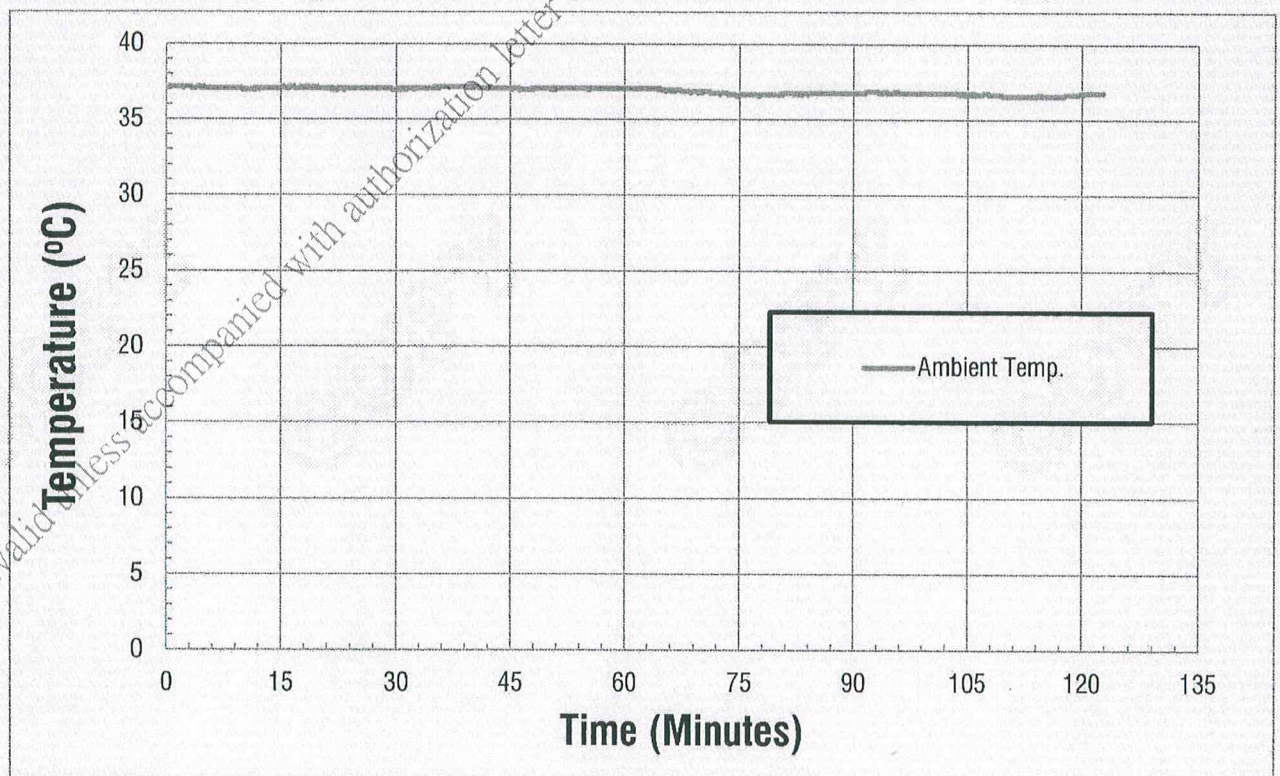
Time (min)	Pressure	Time (min)	Pressure
6.0	1.1	70.0	0.9
10.0	-0.2	80.0	-2.2
20.0	0.4	90.0	-0.2
30.0	0.1	100.0	0.6
40.0	-0.4	110.0	-0.1
50.0	-0.3	120.0	0.2
60.0	-0.1	122.0	-0.1

6.6 Ambient Temperature

The ambient temperature over the test period was recorded and shown in *Figure 10*.

The ambient temperature at the commencement of test was 36.9 °C.

Figure 10. Ambient temperature over the test period.



6.7 Lateral Deflections

Measured lateral deflections over the test period are summarized in the following table. A positive measurement indicates a movement towards into the furnace and vice versa.

Measurements were taken in mm.

Maximum deflection measured on Door A was +57 mm at D10 at 110 & 120 minute of test.

Position \ Time (min)		0	20	40	80	100	110	120
Door A	D1	+0	+8	+5	+2	+4	+4	+4
	D2	+0	-1	-9	-19	-19	-20	-20
	D3	+0	+12	+12	+4	+8	+5	-2
	D4	+0	+13	+9	-7	-2	-5	-9
	D5	+0	+10	+4	-12	-11	-11	-16
	D6	+0	+11	+12	+10	+9	+9	+3
	D7	+0	+1	+5	+8	+8	+3	+7
	D8	+0	+8	+20	+30	+30	+31	+32
	D9	+0	+9	+20	+26	+28	+34	+28
	D10	+0	+15	+35	+33	+56	+57	+57

6.8 Observations

The table below summarized the observation on the specimen during the test period.

Photos taken during the test period are also attached.

Time (min.sec)	Observation (from unexposed side)
00.00	Test started
01.49	Smoke was released from the top of the meeting edge.
02.10	Inside flaming was observed through the glass pane. The interlayer of glass pane started to react.
03.20	Smoke was released from the edges of the door leaves.
04.12	The interlayer of glass pane turned light brown color.
05.09	Smoke was released increased from the edges of the door leaves. The interlayer of glass pane turned to white in color.
08.12	Staining mark was appeared at the second top hinge of left door leaf. Smoke was released from the edges of door leaves.
15.46	The amount of smoke released reduced.
18.48	The interlayer of glass pane turned to light brown in color
30.00	No integrity failure had occurred.
31.44	Smoke was released from the edges of the vision panel.
57.56	Staining mark was appeared at the top of the meeting edge.
60.00	No integrity failure had occurred.
61.06	Cotton fibre pad test was carried out at the top of meeting edge. No flaming or glowing on the cotton pad was observed.
71.24	Cotton fibre pad test was carried out at the top of meeting edge. No flaming or glowing on the cotton pad was observed.
75.03	Smoke was released increase from the top of the meeting edge
84.25	Cotton fibre pad test was carried out at the top of meeting edge. No flaming or glowing on the cotton pad was observed.
95.08	Smoke was released from the head of the door leaves. Staining mark appeared around the latch
112.32	Cotton fibre pad test was carried out at the top of meeting edge. No flaming or glowing on the cotton pad was observed.
113.59	Cotton fibre pad test was carried out at top right corner of the inactive leaf. No flaming or glowing on the cotton pad was observed.
117.28	Cotton fibre pad test was carried out at the top of meeting edge. No flaming or glowing on the cotton pad was observed

Time (min.sec)	Observation (from unexposed side)
118.20	Cotton fibre pad test was carried out at top left corner of the active leaf. No flaming or glowing on the cotton pad was observed
119.19	Cotton fibre pad test was carried out at top right corner of the inactive leaf. No flaming or glowing on the cotton pad was observed.
120.00	No integrity failure had occurred.
120.02	Cotton fibre pad test was carried out at the top of meeting edge. No flaming or glowing on the cotton pad was observed.
121.50	Cotton fibre pad test was carried out at top right corner of the inactive leaf. No flaming or glowing on the cotton pad was observed.
122.52	Test was terminated at request of the Sponsor.
118.20	Cotton fibre pad test was carried out at top left corner of the active leaf. No flaming or glowing on the cotton pad was observed
119.19	Cotton fibre pad test was carried out at top right corner of the inactive leaf. No flaming or glowing on the cotton pad was observed.
120.00	No integrity failure had occurred.
120.02	Cotton fibre pad test was carried out at the top of meeting edge. No flaming or glowing on the cotton pad was observed.
121.50	Cotton fibre pad test was carried out at top right corner of the inactive leaf. No flaming or glowing on the cotton pad was observed.
122.52	Test was terminated at request of the Sponsor.
127.00	Test was terminated at request of the Sponsor

Photos



Photo 1. Exposed surface of the specimen before test. (Left: Door B; Right: Door A)

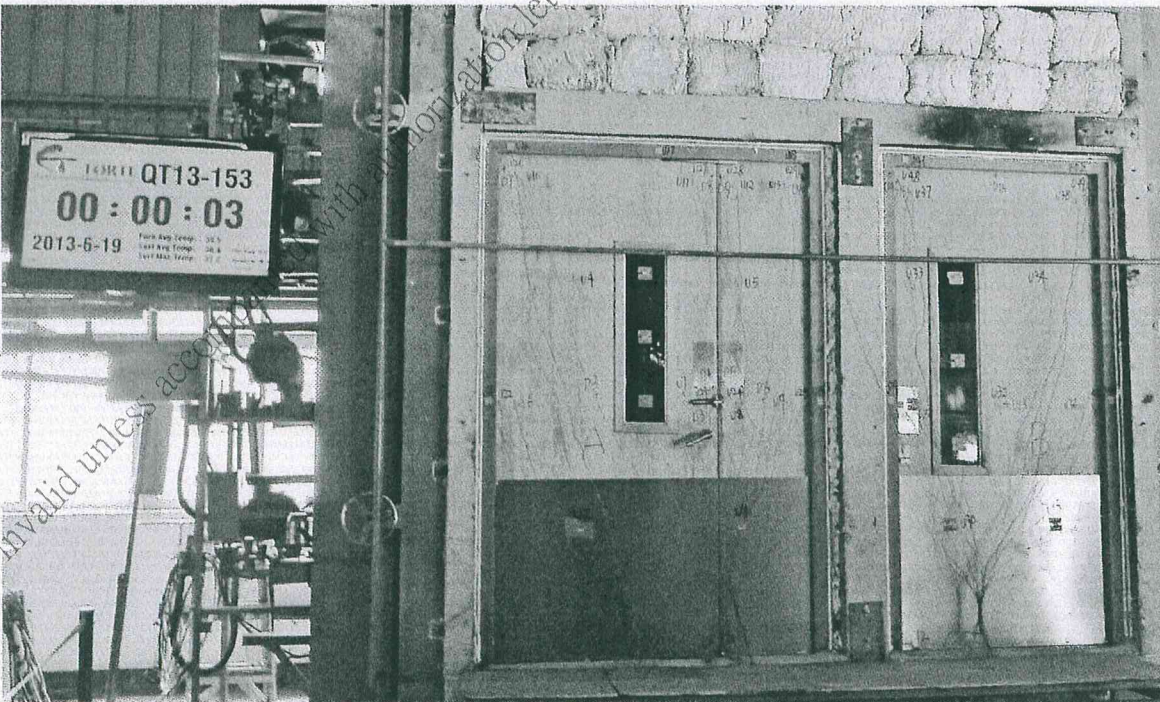


Photo 2. Unexposed surface of the specimen just after the commencement of test. (Left: Door A; Right: Door B)

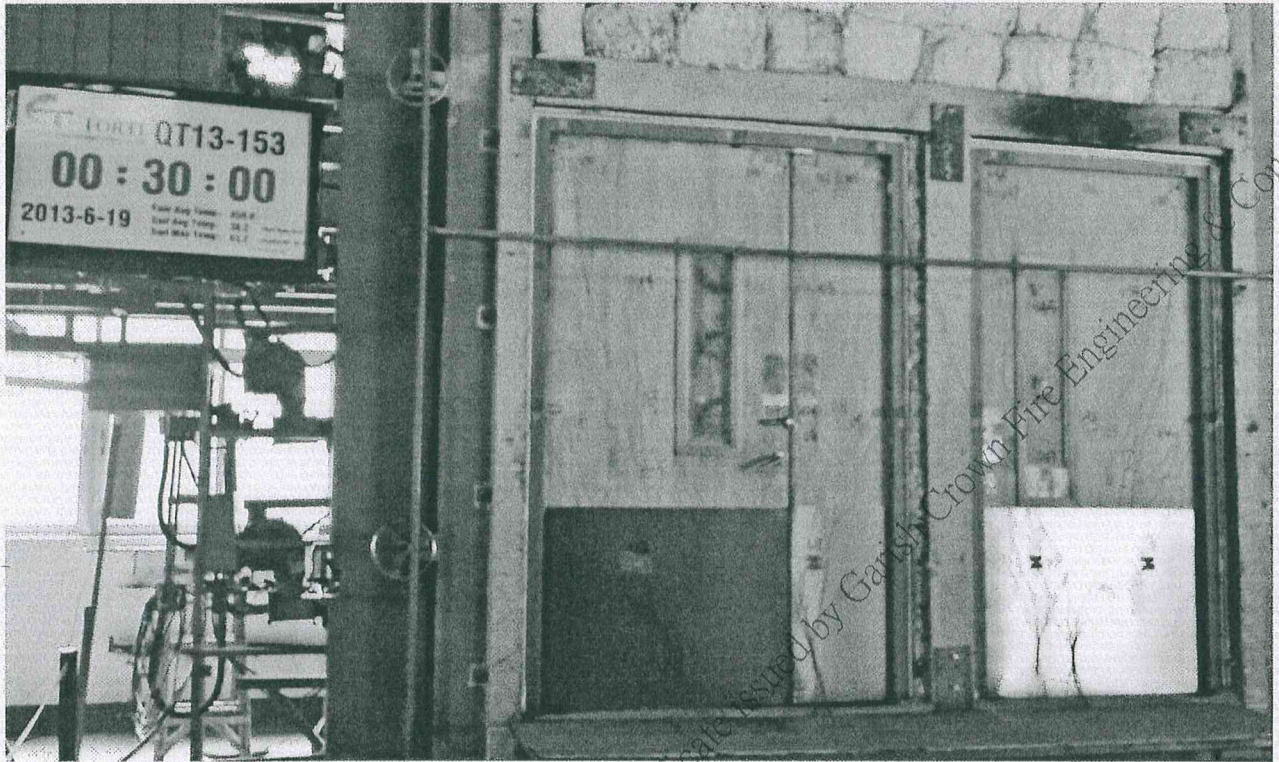


Photo 3. Unexposed surface of the specimen at 30 minute of test. (Left: Door A; Right: Door B)

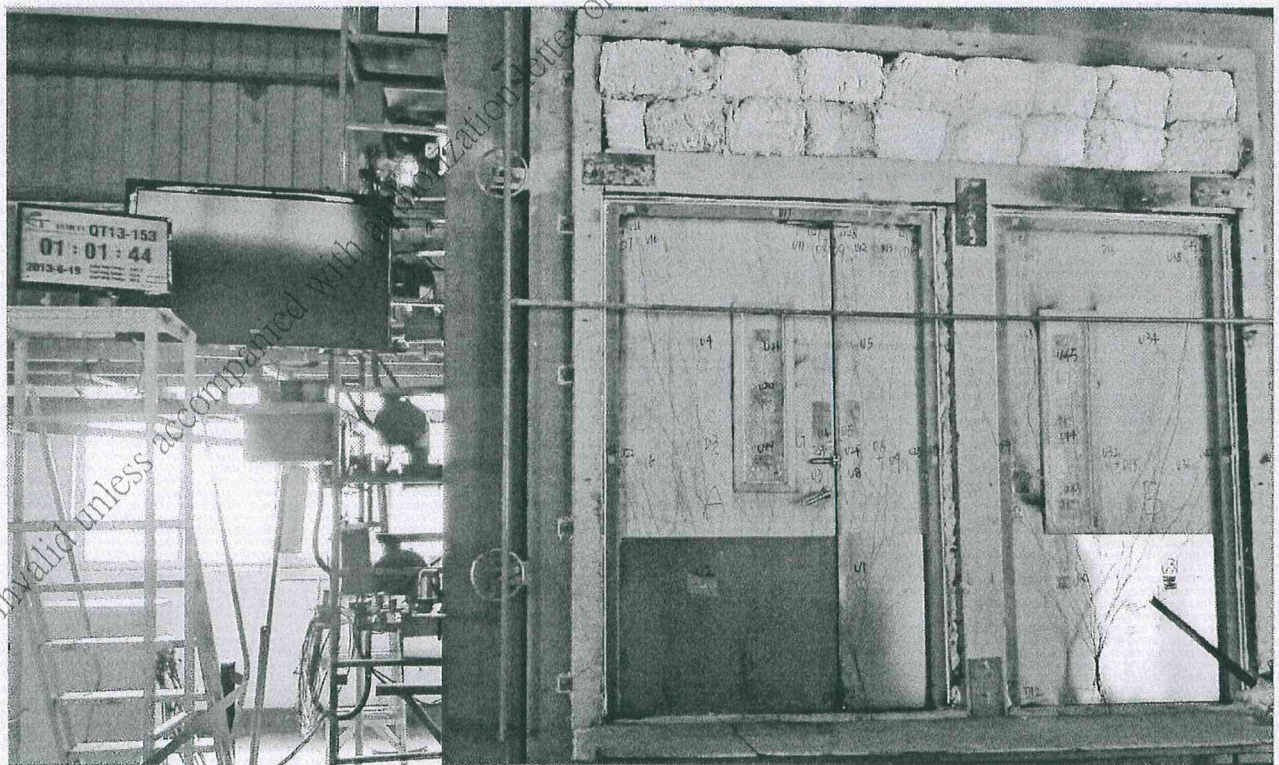


Photo 4. Unexposed surface of the specimen at 60 minute of test. (Left: Door A; Right: Door B)

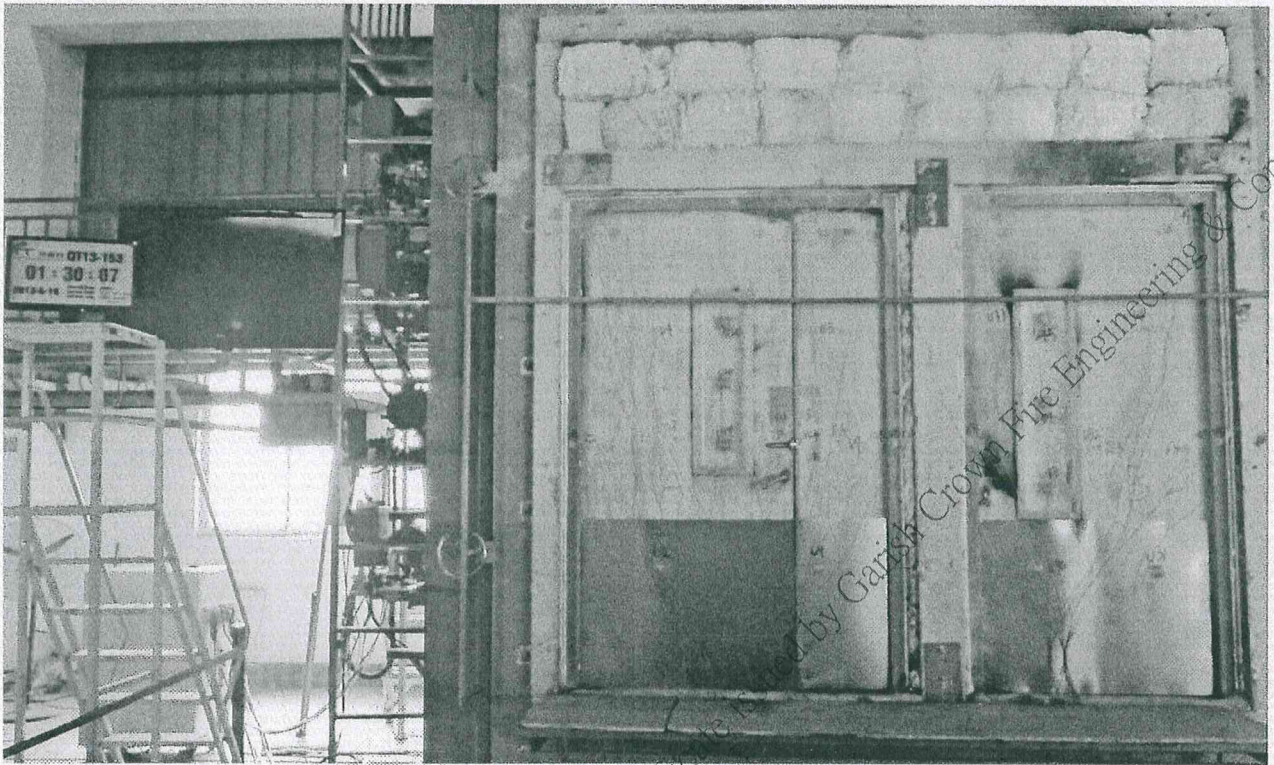


Photo 5. Unexposed surface of the specimen at 90 minute of test. (Left: Door A; Right: Door B)

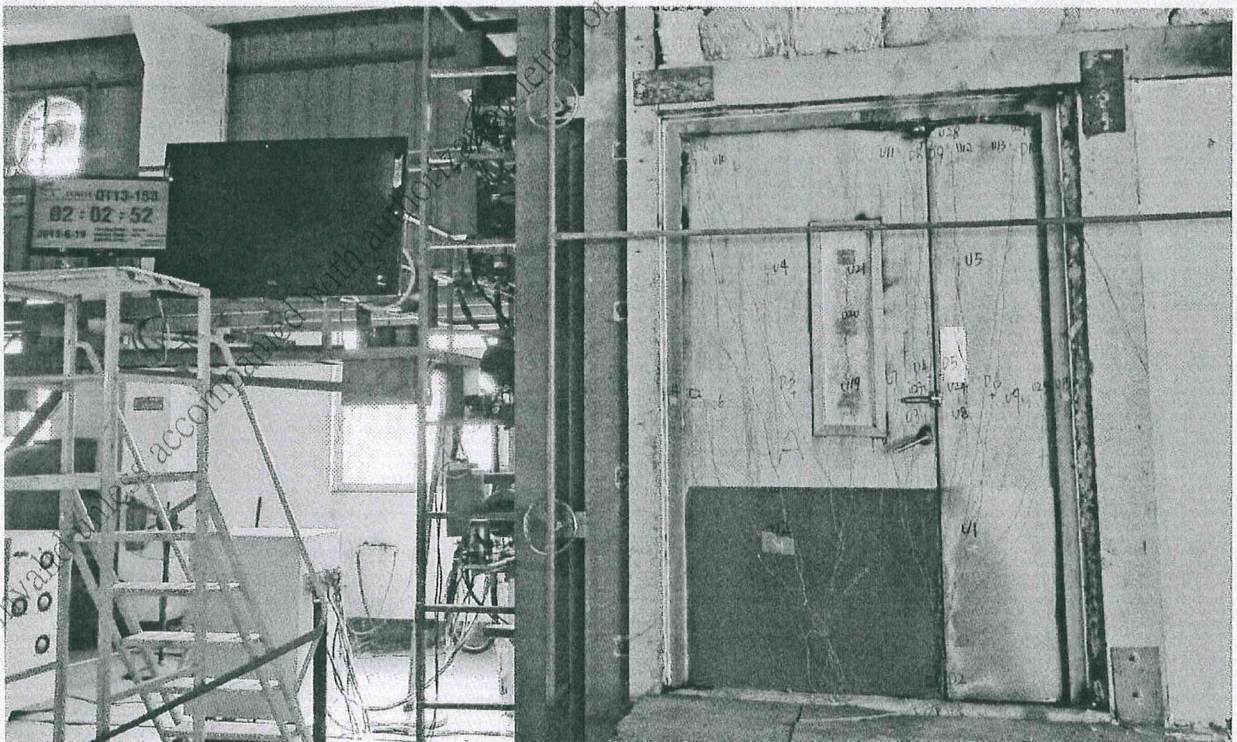


Photo 6. Unexposed surface of the specimen at 120 minute of test. (Door A)

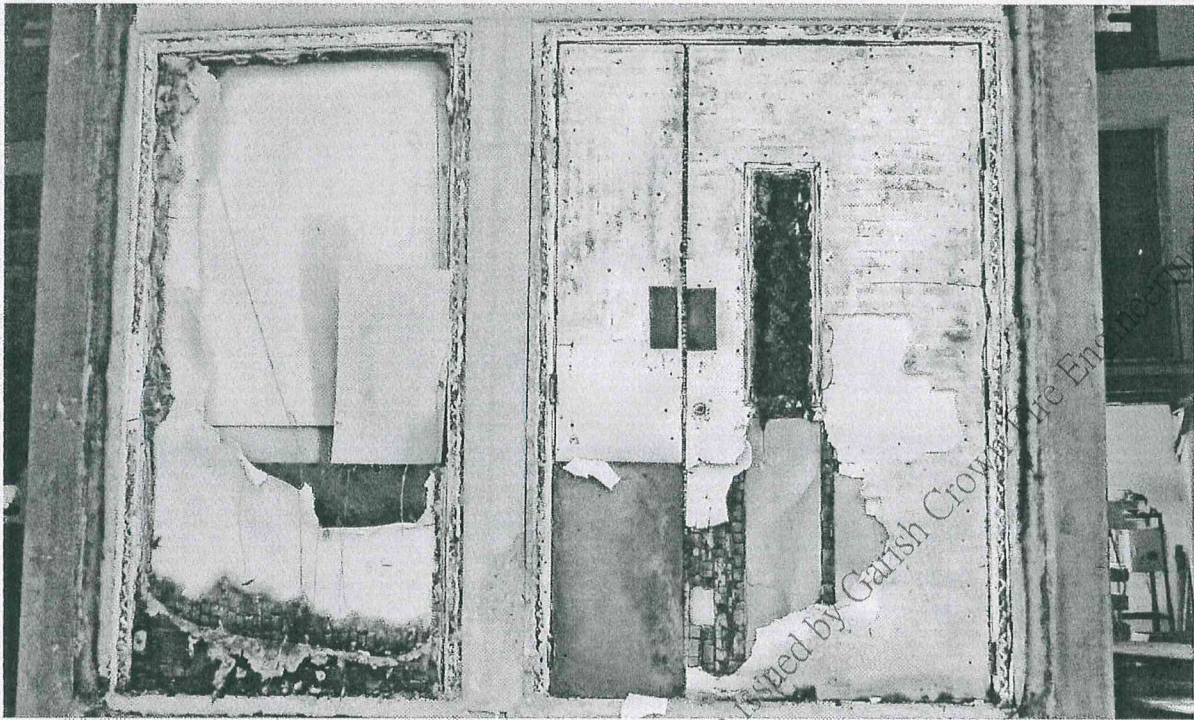


Photo 7. Exposed surface of the specimen after test. (Left: Door B; Right: Door A)

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7. Test Results

The test on Door A was terminated after a test period of 122 minutes at request of the Sponsor.

The test data obtained from the fire resistance test was assessed against performance criteria given in BS EN 1634-1: 2008. The test results are summarized in the following table.

Performance Criteria		Elapsed Time before Failure Occurrence	
Integrity (E)			
Criteria of Failure	Description	Elapsed Time before Failure Occurrence	
Sustained Flaming	Continuous flaming for a period of time greater than 10 seconds on unexposed surface	122 minutes	
Gap Gauge	Ø6 mm Penetration of the gauge into the furnace through the specimen and movable along a 150 mm gap	122 minutes (No Failure)	
	Ø25 mm Penetration of the gauge into the furnace through the specimen		
Cotton Pad	Ignition of the cotton pad	122 minutes (No Failure)	
Performance Criteria		Elapsed Time before Failure Occurrence	
Insulation (I)			
Criteria of Failure	Description	Elapsed Time before Failure Occurrence	
Integrity Failure	The performance criterion "insulation" shall automatically be assumed not to be satisfied when the "integrity" criterion ceases to be satisfied	122 minutes	
Average Temperature Rise	An increase of the average temperature of unexposed surface of the specimen above the initial average temperature by more than 140 °C	[Door Leaves and Framework]	122 minutes (No Failure)
		[Glazed Element]	122 minutes (No Failure)
Maximum Temperature Rise [Supplementary Procedure, I ₂]	An increase of temperature at perimeter frame of the doorset or openable window above the initial average temperature by more than 360 °C; and any other point of the specimen above the initial average temperature by more than 180 °C	[Door Leaves and Framework]	122 minutes
		[Glazed Element]	122 minutes (No Failure)

8. 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 outlined in *BS EN 1363-1*, and where appropriate *BS 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.

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.

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9. Field of Direct Application

The field of direct application defines the allowable changes to the test specimen following a successful fire resistance test. These variations can be introduced automatically without the need for the sponsor to seek additional evaluation, calculation or approval.

The series of rules and guidelines are defined in *Clause 13 "Field of direct application of test results"*, *BS EN 1634-1: 2008* and relevant clauses and annexes. Permitted variations away from the test specimen include 1) materials and construction, 2) size variations, 3) coverage of asymmetrical doorsets and 4) supporting constructions.

The field of direct applications may only be defined following the identification of classification(s). The field of direct and, where applicable, extended application will be included in classification relevant documents.

Appendix A - Temperature outputs from Unexposed Surface. (Additional information only)
Temperature outputs from unexposed surface temperature U22 to U29

Time (min)	U22	U23	U24	U25	U26	U27	U28	U29
0.0	35.6	35.4	34.9	36.1	35.0	35.5	35.7	35.4
5.0	47.6	35.5	35.0	36.1	40.3	38.6	38.5	35.8
10.0	44.0	35.5	36.0	36.2	50.6	42.8	47.2	35.8
15.0	39.7	37.0	37.6	36.2	49.1	44.6	44.4	36.8
20.0	40.1	38.1	39.1	36.6	47.5	46.2	45.5	39.6
25.0	41.2	40.3	40.9	37.3	49.4	46.1	47.0	46.3
30.0	43.3	42.6	42.8	38.7	63.2	48.3	58.9	56.4
35.0	46.7	45.0	45.6	41.5	61.5	53.6	74.1	55.7
40.0	50.0	47.1	48.2	44.7	56.7	55.3	74.0	50.9
45.0	53.2	49.8	50.9	47.9	55.9	58.7	74.4	50.7
50.0	55.7	52.3	53.5	51.1	54.7	62.2	74.7	50.3
55.0	58.3	56.1	56.2	54.0	53.9	66.4	76.6	53.9
60.0	60.2	59.5	57.7	56.5	54.5	70.7	79.0	56.9
65.0	61.7	63.1	59.0	58.9	55.5	74.7	79.9	59.4
70.0	63.1	67.7	60.9	60.9	57.7	80.2	80.6	65.1
75.0	67.3	73.4	63.2	64.0	60.9	84.6	81.6	72.0
80.0	71.0	76.5	67.0	67.9	63.8	113.3	84.6	80.8
85.0	73.3	78.2	69.1	71.0	66.9	118.4	86.9	89.1
90.0	77.5	79.9	71.1	75.9	76.3	135.4	86.8	93.3
95.0	82.4	82.0	74.6	80.1	82.4	129.2	88.9	96.4
100.0	86.9	82.9	82.1	83.9	80.5	118.9	89.9	100.8
105.0	92.4	87.2	88.2	89.4	84.6	124.8	93.5	109.1
110.0	96.9	91.0	89.5	89.5	93.5	153.1	98.8	119.7
120.0	109.7	101.0	94.4	94.1	130.5	247.6	149.9	142.8
121.0	110.9	101.4	94.3	94.3	133.2	271.8	163.8	148.1
122.0	111.5	101.0	94.3	93.8	134.5	293.9	169.4	152.3

END OF REPORT