



## 1. Scope of Test

This report was 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 subject was a double acting double-leaf composite metallic door. The specimen was supplied for test by Garish Crown Fire Engineering & Consultancy and Kwok Shing Construction Limited, the Sponsors.

The specimen achieved the following fire resistance:

INTEGRITY (E)		INSULATION (I)		
Sustained Flaming	261 Minutes	Door Frame	Max. Temp. Rise (I <sub>2</sub> )	261 Minutes
Gap Gauge	261 Minutes	Door Leaves	Average Temp. Rise	261 Minutes
Cotton Pad	261 Minutes		Max. Temp. Rise (I <sub>2</sub> )	261 Minutes

## 2. Test Information

<b>Test Laboratory:</b>	FORTE Testing and Consultants Company Limited		
<b>Test Location:</b>	West Side of Huan Xiang Shan, Xin Yu Road, Shajin, Baoan District, Shenzhen, Guangdong Province, China.		
<b>Test Sponsors:</b>	Garish Crown Fire Engineering & Consultancy Kwok Shing Construction Limited		
<b>Specimen Supplier:</b>	Garish Crown Fire Engineering & Consultancy		
<b>ID no. of the Specimen:</b>	QT17-048A		
<b>Date Received:</b>	2017-05-03		
<b>Test Number:</b>	QT17-048 *Two sets of report (Report no. IT17-039 and IT17-308) with identical content had issued at request of the sponsors		
<b>Date Tested:</b>	2017-05-10	<b>Start Time:</b>	14:15
<b>Approved Test Operator from FORTE:</b>	Mr. Tang Shui Fai		
<b>Witness of the Test:</b>	Mr. Ho Siu Ping and Mr. Joe Li – Official Delegates of the Sponsors		
<b>Report Issue Record:</b>	Version 1 – 2017-12-21		

### 3. Construction Details of Specimen

### 3.1 Specimen Description

### 3.1.1 Door Frame

The overall sized of the rectangular composite metallic door frame was 2856 mm (width) x 2847 mm (height). The sectional dimension of the door frame was 50 mm (w) x 137 mm (thickness).

The rectangular composite metallic door frame was made of a 30 mm x 50 mm x 1.5 mm (t) mild steel hollow section and multi-layer of 10 mm (t) fire board. No material was filled in the mild steel hollow section.

The fire boards were screw fixed to the mild steel hollow section together with a 1 mm (t) J-shape stainless steel plate. The door frame was finished with 1mm (t) stainless steel cladding with angle returns and they were fixed by glue.

Door frame head and jambs were fixed together by tongue and groove joint with manchincal screw fixing.

The door frame was fixed to the test frame by welding the steel hollow section to  $\phi 12$  mm x 100 mm (length) steel anchor bolts that prefixed onto the test frame. There were 6 numbers of fixings at each head and jamb at approximately 280 mm to 680 mm centre to centre.

2 numbers of 25 mm (w) x 4 mm (t) intumescent seal with intumescent pad underneath were centrally fitted into the groove along each jamb and the head of door frame.

The space between the door frame and the test frame was fully filled by ceramic fibre and lined up with fire sealant.

### 3.1.2 Door Leaves

The specimen comprised of two equal width door leaves each sized 1370 mm (w) x 2787 mm (h) x 75 mm (t).

The centre layer of each door leaf was a 3 mm (t) fire board. 2 numbers of mild steel hollow section framework were clamped to the 3 mm (t) fire board and fixed together by screws. Each framework had a mid-stile and 5 numbers of mid-rail with equal span. They were made of 2 numbers of mild steel hollow section excepted the top mid-rail was made of a single mild steel hollow section. The mild steel hollow sections were sized 30 mm x 20 mm x 1.8 mm (t) with no material infill and they were fixed together by spot welding.

The door core was fitted with 20 mm (t) ceramic fibre boards. Triple layer of 5 mm (t) fire board sub-facing was cover on both sides and fixed by  $\phi 4$  mm x 38 mm (l) screws.

The door leaf sub-lippings were made of 10 mm (t) fire board.

A 1 mm (t) stainless steel cladding with angle return was fixed to the door leaf framework by screws on both sides and formed the chamfered vertical door edges.

The specimen had a flush rebated type meeting edge.

2 numbers of 20 mm (w) x 4 mm (t) intumescent seal with plastic fins were centrally pack fitted into the groove along the perimeter edge of each door leaf.

### 3.1.3 Ironmongery

Each door leaf was supported by floor spring hinge and top pivot.

A pull handle was installed at 1000 mm above the bottom edge of each door leaf on fire unexposed side.

A mortise floor lock was installed at the bottom edge of the active door leaf at 200 mm away from the meeting edges.

Intumescent pad was applied to mortised area for ironmongeries.

### 3.2 Material Schedule

Parts specifications were summarized in the following tables.

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

## Door Frame

Supplier:	Garish Crown Fire Engineering & Consultancy Kwok Shing Construction Limited
Components:	30 mm x 50 mm x 1.5 mm Steel Hollow Sections (with No Infill) + 10 mm Fire Board + 1 mm J-shape Stainless Steel Plate + 1 mm Stainless Steel Cladding
Overall Sizes:	2856 mm x 2847 mm
Sectional Dimensions:	50 mm x 137 mm
Connection Method of Head to Jamb:	Tongue and Groove with Screw Fixed
Fixing Method to Test Frame:	Welded to ø12 mm x 100 mm Steel Anchor Bolts that Prefixed onto the Test Frame
Gap Filling between Door Frame and Test Frame:	Ceramic Fibre with Fire Sealant

### Intumescent Seal - Door Frame

Supplier:		Garish Crown Fire Engineering & Consultancy
Brand:		Ying Mu *
Head & Jams	Model:	YM2504A *
	Sizes:	25 mm x 4 mm

### Intumescent Pad

Supplier:	Garish Crown Fire Engineering & Consultancy Kwok Shing Construction Limited
Brand:	Ying Mu *
Model:	50A *
Thickness:	2 mm
Location Applied:	Underneath the Intumescent Seal along the Door Frame Head and Jambs

## Door Frame and Leaf Cladding

Material:	Stainless Steel Plate
Thickness:	1 mm
Fixing Method:	By Screws with Angle Return

## Door Leaves

Supplier:		Garish Crown Fire Engineering & Consultancy Kwok Shing Construction Limited
Overall Sizes:		(1370+1370) mm x 2787 mm
Nominal Thickness:		75 mm
Measured Thickness:		79.31 - 79.62 mm
Skeleton	Description:	3 mm (t) Fire Board (Centre Layer) Clamped by 2 Nos. of Steel Hollow Sections
	Dimensions:	Steel Hollow Sections : 30 mm x 20 mm x 1.5 mm
Core	Supplier:	Garish Crown Fire Engineering & Consultancy
	Brand:	HLGX *
	Model:	YM20 *
	Density:	330 kg/m <sup>3</sup>
	Description:	Ceramic Fibre Board
	Nominal Thickness:	20 mm

## Fire Board

Supplier:	Kwok Shing Construction Limited
Brand:	Gemtree
Description:	Magnesium Oxide Composite
Density:	1100 - 1300 kg/m <sup>3</sup>
Thickness:	3 mm, 5 mm, 10 mm

## Intumescent Seal and Smoke - Door Leaf

Supplier:		Garish Crown Fire Engineering & Consultancy
Brand:		Ying Mu *
Perimeter Edges	Model:	YM2002A (With 4 mm Long Plastic Fins)*
	Sizes:	20 mm x 4 mm

## Floor Spring Hinge

Supplier:	Kwok Shing Construction Limited
Brand:	Exidor *
Model:	990 *
Material:	Stainless Steel *
Sizes:	Floor Spring Hinge: 307 mm x 78 mm x 60 mm Strap: 200 mm x 34 mm x 18 mm

## Top Pivot

Supplier:	Kwok Shing Construction Limited
Brand:	Exidor *
Model:	X056 *
Material:	Stainless Steel *
Sizes:	Ø9 mm x 40 mm Long

## Pull Handle

Supplier:	Kwok Shing Construction Limited
Material:	Stainless Steel *
Sizes:	Ø25 mm x 200 mm
Location Applied:	1000 mm Above the Bottom Edge of the Door Leaf on Fire Unexposed Side

## Glue

Supplier:	Not Provided
Brand:	曙光防火膠 *

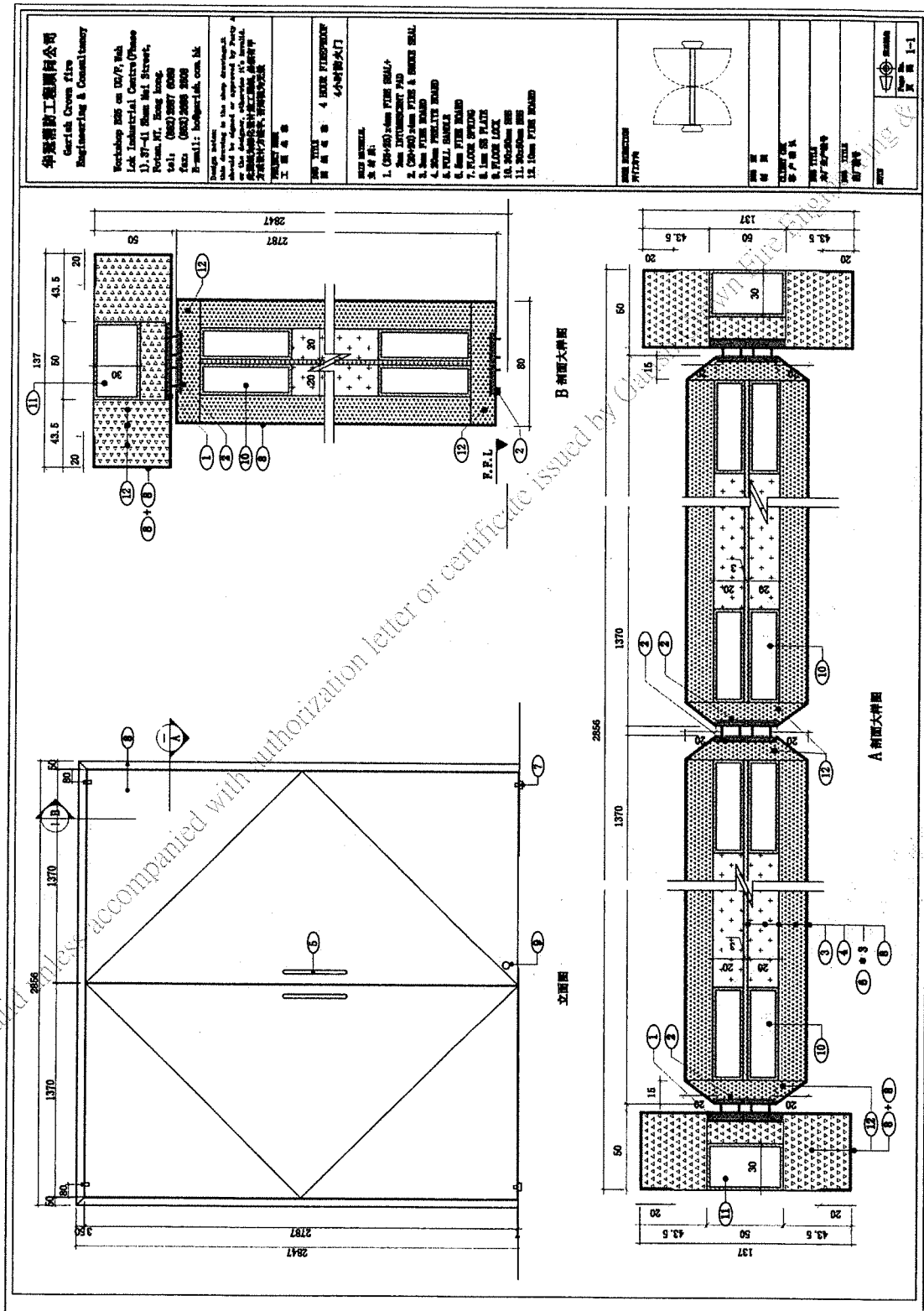
## Fire Sealant

Supplier:	Garish Crown Fire Engineering & Consultancy
Brand:	Firemate
Location Applied:	Between the Door Frame and Test Frame

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

(Drawings of the specimen on specific construction kept as confidential information in the Test Sponsor and FORTE)

Drawings provide by the Sponsor (1)



#### 4. Specimen Condition

#### 4.1 Selection of the Specimen

The specimen was selected by the Sponsor and submitted to the Test Location. FORTE did not involve in the selection of the specimen.

All the components of the test specimen was supplied by the Sponsor.

## 4.2 Verification of the Specimen

The specimen was transferred to the Test Location on 2017-05-03 by the Sponsor.

Parts of the manufacture processes were over seen by FORTE delegate.

In *section 3.2* of this report, items which had been verified by FORTE was clearly identified and distinguished from those relying on Sponsor's declaration.

### 4.3 Supporting Construction

The specimen was fixed to a supporting construction made of fully cured reinforced normal density concrete slabs provided by FORTE. The concrete slabs formed a structural opening 2940 mm (w) x 2970 mm (h).

#### 4.4 Installation of the Specimen

The specimen was assembled and installed by workers delegated by the Sponsor from 2017-05-03 to 2017-05-05.

#### 4.5 Specimen Conditioning

The specimen was stored in the Test Location from 2017-05-03, the date which specimen was received, to 2017-05-10, the date which fire resistance test performed.

The average environment parameters in the Test Location within this period were:

Ambient Temperature (°C)	Relative Humidity (%)
30 ± 3	74 ± 10

#### 4.6 Direction of Fire Side and Others

The Sponsor designated and installed that the door leaves could be swung both inwards and outwards the furnace.

The door was UNLATCHED, UNLOCKED and UNBOLTED during the test.



## 5. Test Method

### 5.1 Pre-test Conditioning

The pre-test conditioning of the specimen was carried out on 2017-05-09 prior to the fire test with reference to *BS EN 1634-1: 2008* and *clause 5.1.1.1 5 and 5.1.1.3, BS EN 14600: 2005*.

Operability test of the specimen:

The specimen should be tested for operability in the fire test frame by operating from fully closed to fully open at 90 degrees for 25 cycles.

### Self-closing for doorset without coordinating devices:

The specimen had each leaf opened to  $10^\circ \pm 2^\circ$  and held for  $20\text{s} \pm 2\text{s}$  and then without shock and allowed to closed at the speed between one-tenth of the leaf width per second up to a maximum leading edge speed of 300 mm/s.

## 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 thermometer. These thermometers were evenly distributed over a vertical plane approximately 100 mm from the exposed surface of the test construction.

The positions of furnace thermocouple were shown in *Figure 1*.

## 5.4 Door Gaps

The widths of frame-to-leaf or leaf-to-leaf gaps were measured after the door assembly and prior to the test. Measurement positions were shown in *Figure 2*.

### 5.5 Unexposed Surface Temperature

The unexposed surface temperatures of the specimen was measured by 29 numbers of type K thermocouple.

The temperature rise was calculated by subtracting the initial average temperature from the unexposed temperature measured.

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

These thermocouples were positioned and fixed on unexposed surface of the test specimen in conformity with BS EN 1634-1: 2008.

The positions of unexposed surface temperature measurement points were shown in Figure 3. The locations of thermocouple were explained in the following table.

Thermocouple	Area	Description
U1 – U5	Door Leaves	For average and maximum unexposed surface temperature rise
U6 – U14	Door Leaves	For maximum unexposed surface temperature rise <b>(Normal Procedure, I<sub>2</sub>)</b>
U15 – U19	Door Frame	For maximum unexposed surface temperature rise
U20 – U29	Door Leaves	For additional information only (Show in Appendix A)

## 5.6 Pressure Condition

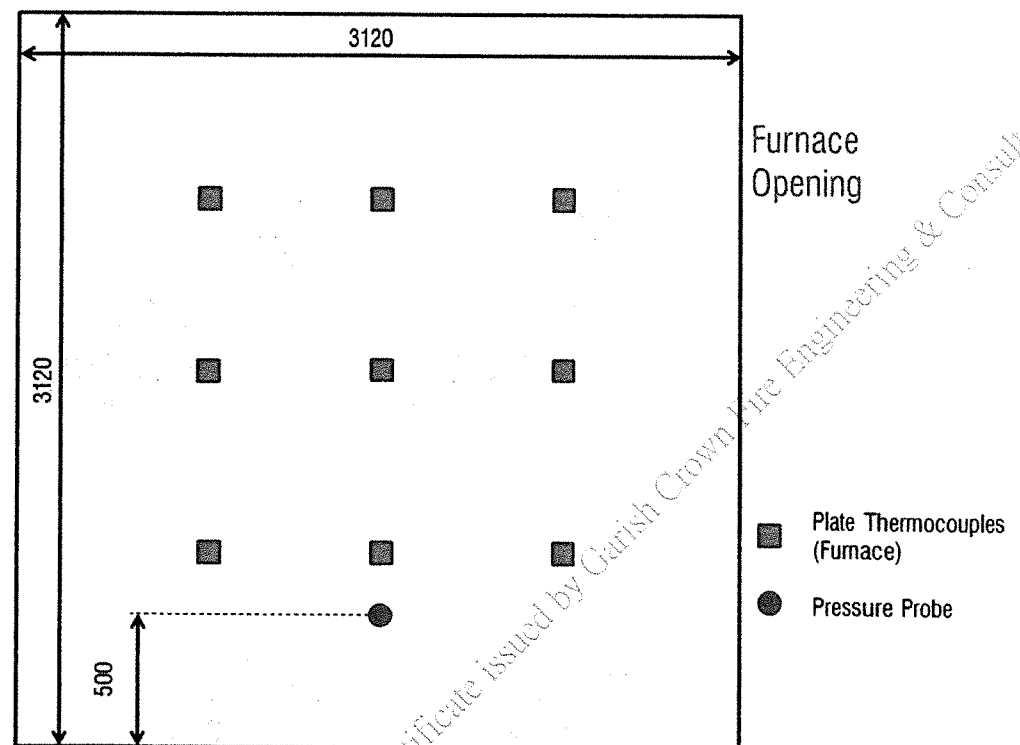
The pressure inside the furnace was continuously monitored in compliance with *BS EN 1363-1: 1999* during the whole test. The pressure at a point 500 mm above the notional floor level was to be maintained  $0 \pm 5$  Pa by five minutes from commencement of the test and  $0 \pm 3$  Pa that from ten minutes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

## 5.7 Deflection Measurements

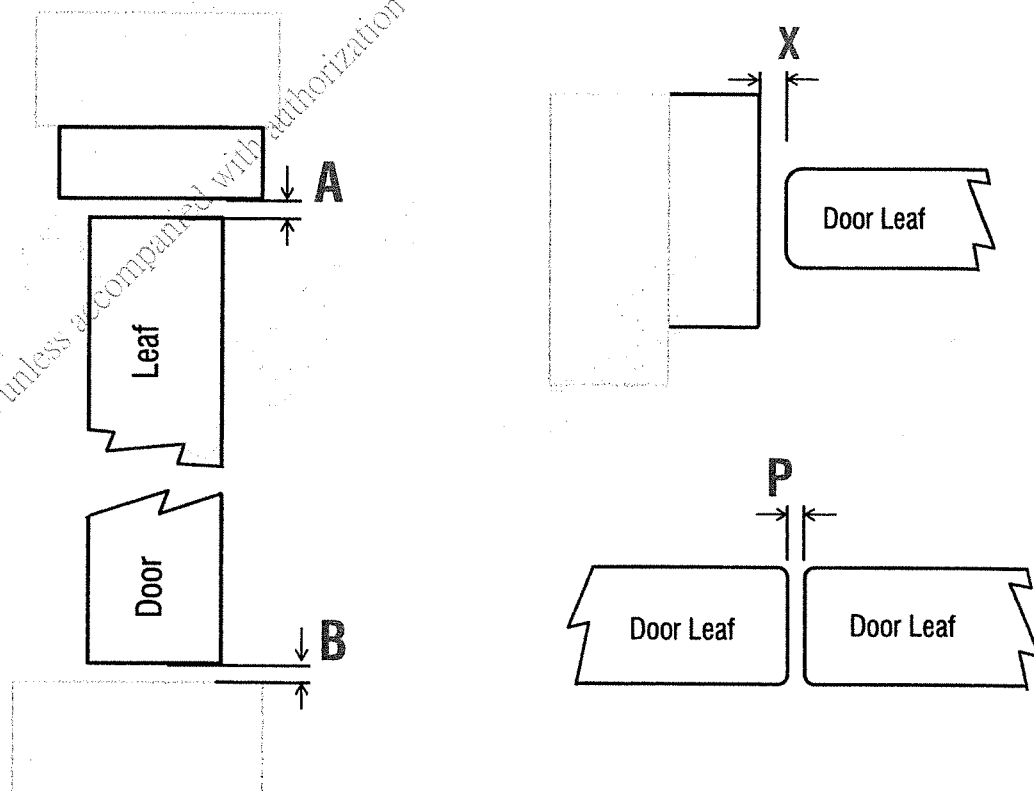
Measurements of the deflection of the test specimen was taken with a steel rule from cross line laser across the top, mid-height and bottom of the specimen.

The positions of deflection measurement point were shown in *Figure 4*.

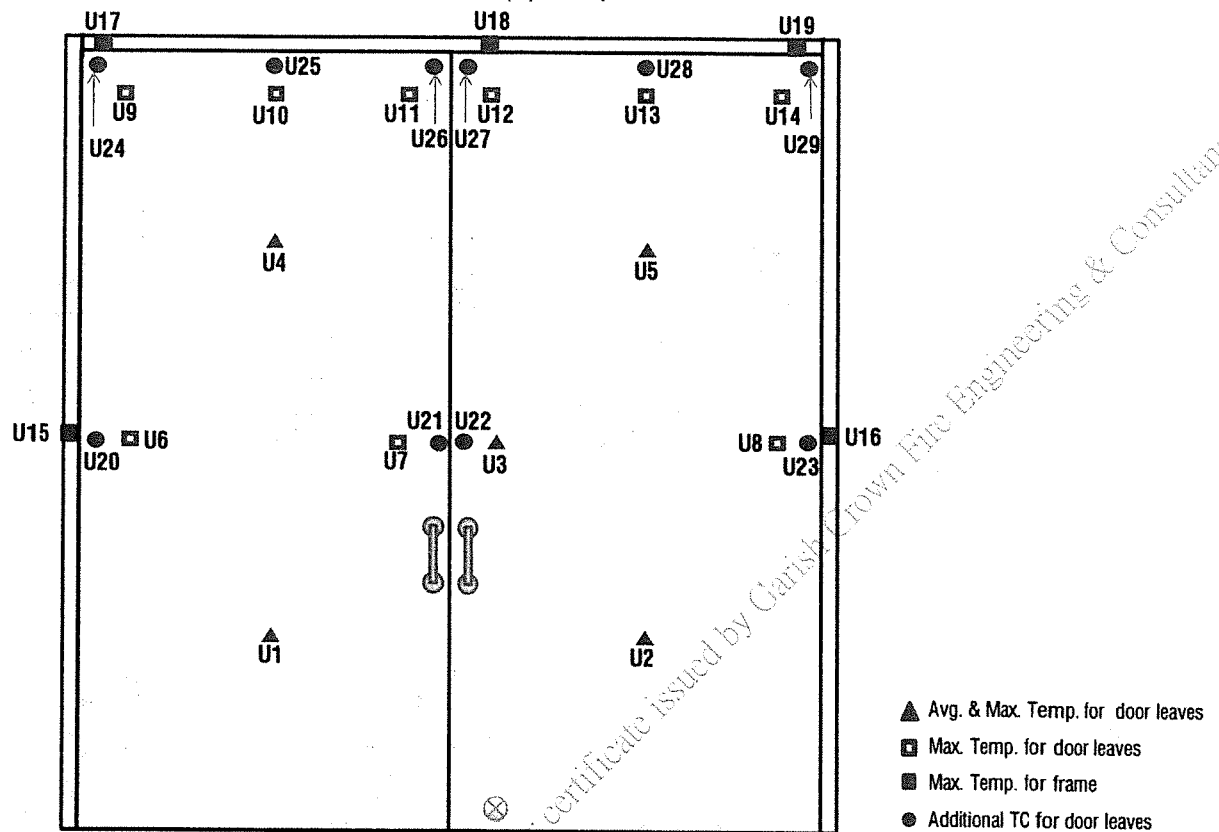
**Figure 1.** Positions of thermocouple and pressure measuring probe inside the furnace.



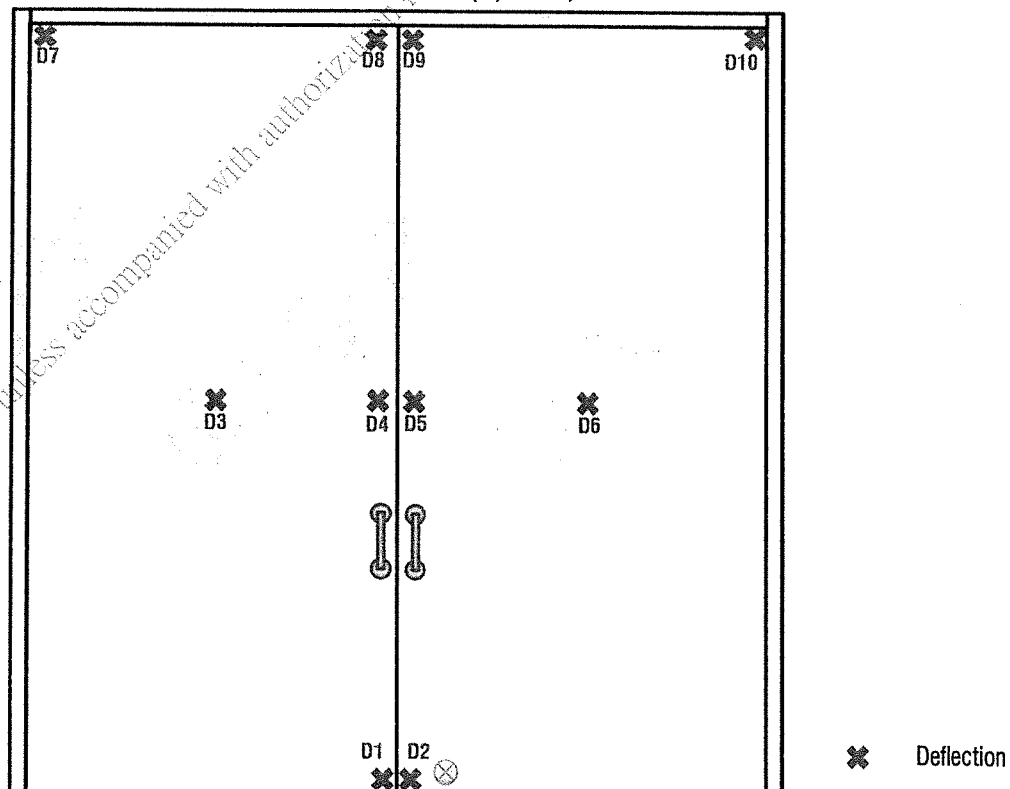
**Figure 2.** Primary gaps measurement position of the specimen.



**Figure 3.** Positions of fixed surface thermocouple (U) on specimen.



**Figure 4.** Positions of deflection measurement point (D) on specimen.



## 6. Test Data

## 6.1 Retention Forces

The retention forces on each door leaf of the specimen for each direction of opening were determined from the fire unexposed side. The respective highest gauge measurements were summarized in the following table.

Leaf	Push	Pull
Active	35.4 N	33.6 N
Inactive	50.3 N	46.6 N

**Operability test of the specimen:**

The specimen had been tested for operability in the fire test frame by operating from fully closed to fully open at 90 degrees for 25 cycle.

Closing speed of the specimen without coordinating devices:

Leaf	Leading Edge Speed (mm/s)
Active	261.01
Inactive	296.83

## 6.2 Gaps Measurement

Primary gaps of the specimens were measured according to *BS EN 1634-1: 2008* clause 10.1.2 “There shall be minimum of three measurements made along each side, top and bottom of each leaf. Measurements to determine the gaps shall be made at distances not greater than 750 mm apart.”

The measured record was summarized to the minimum, maximum and average value in the following table.

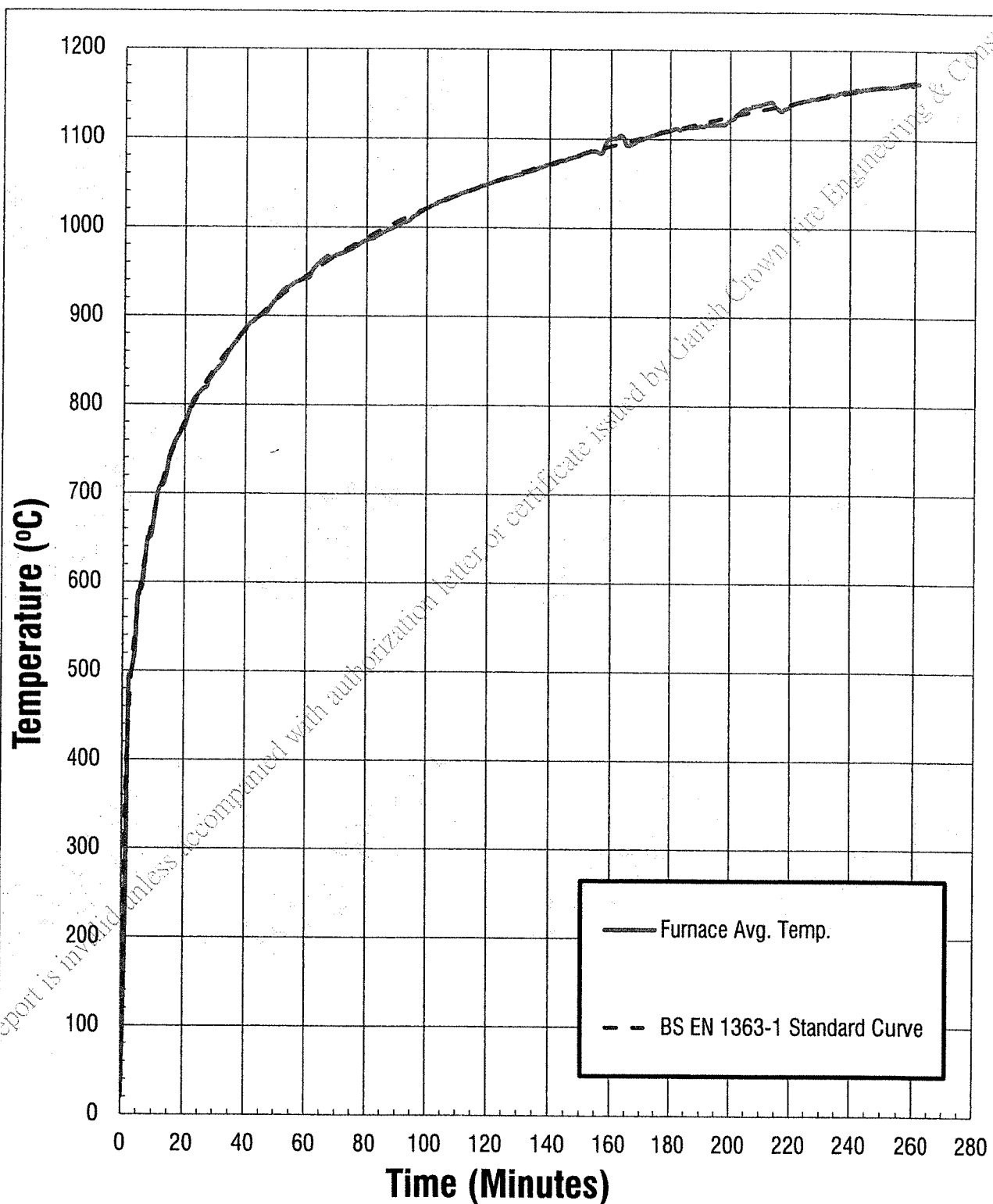
Measurements were taken in mm.

Gap	Measured		
	Minimum	Maximum	Average
A	2.7	6.3	4.1
B	2.9	7.4	5.1
P	2.6	7.7	4.9
X	2.3	5.3	4.0

### 6.3 Furnace Temperature

The furnace average temperature over the test period was shown in *Figure 5*.

**Figure 5.** Furnace average temperature over the test period.

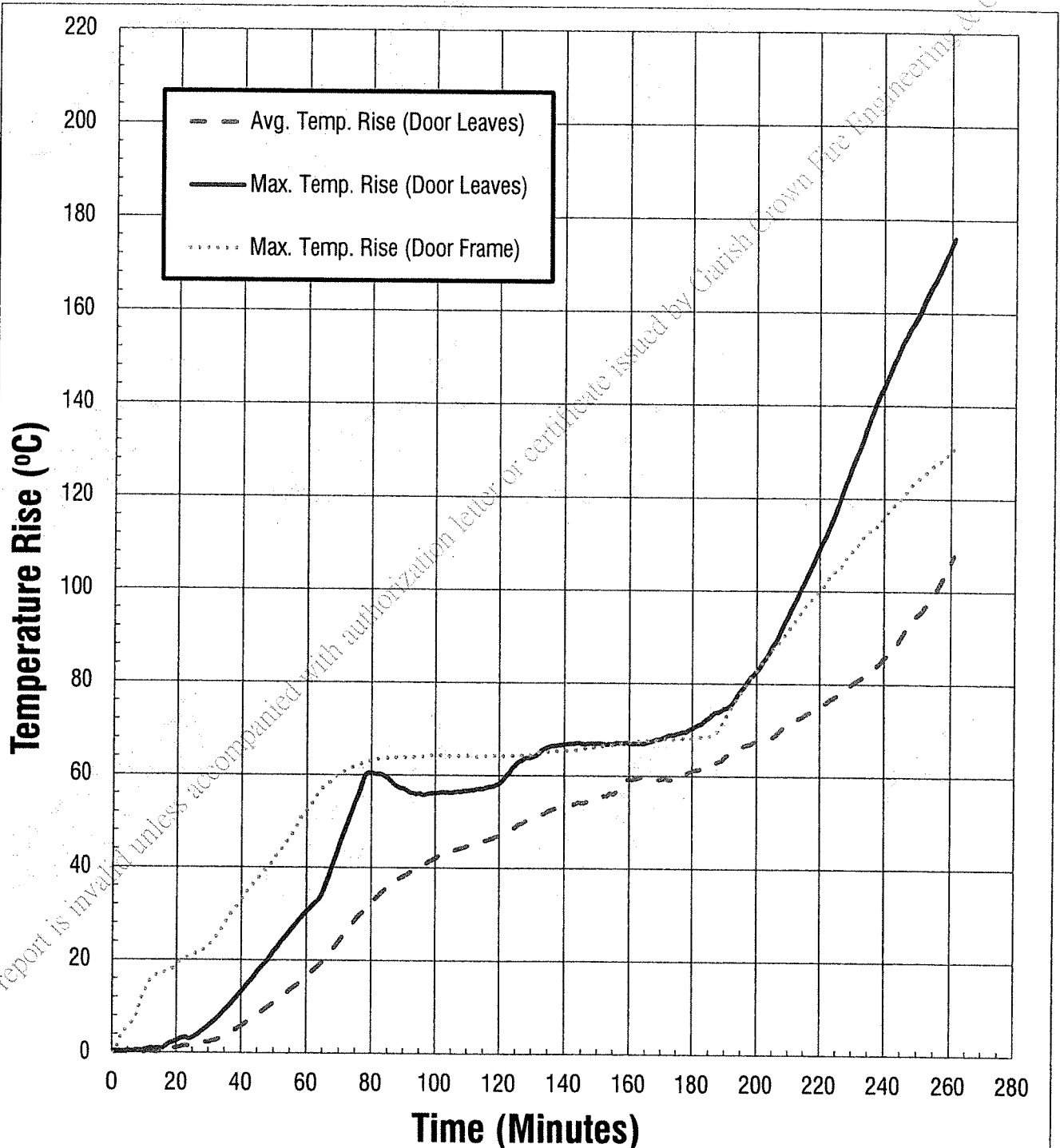


#### 6.4 Unexposed Surface Temperature Rise

#### 6.4.1 Fixed Surface Thermocouples – Door Leaves and Door Frame

The temperature rises of unexposed surface on door leaves and door frame of the specimen measured by fixed surface thermocouples over the test period were shown in *Figure 6*.

**Figure 6.** Average and maximum temperature rise on door leaves and door frame over the test period.



#### 6.4.2 Fixed Surface Thermocouples – Detailed Temperature Records

The outputs of the unexposed surface thermocouples on the specimen were 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	28.5	28.4	28.3	28.4	28.5	28.1	27.6	27.0	28.3	28.1
10	28.6	28.4	28.5	28.6	28.5	28.3	27.9	27.0	28.6	28.4
20	31.0	29.5	28.9	29.7	28.6	28.6	28.3	27.2	30.2	29.7
30	30.4	30.7	30.9	31.5	29.9	30.1	30.6	28.8	34.3	31.8
40	32.9	34.2	35.6	36.2	32.1	33.9	35.9	31.3	41.7	36.6
50	37.5	39.3	41.5	42.0	36.3	39.9	43.3	35.8	49.9	42.4
60	42.4	45.1	48.0	48.3	41.5	47.2	50.5	42.5	56.3	48.5
70	49.7	54.3	53.6	56.0	49.2	54.7	56.2	54.4	73.2	55.2
80	60.8	61.8	58.8	64.7	58.7	63.2	61.5	65.4	88.9	65.4
90	67.8	67.0	63.0	70.0	65.2	69.6	67.5	73.5	85.5	73.4
100	71.4	72.3	67.1	72.3	69.6	73.8	73.3	78.5	84.4	76.9
110	73.6	76.0	70.0	74.1	72.0	78.3	78.4	80.9	83.9	79.0
120	75.0	78.2	73.7	76.2	73.8	82.6	80.7	84.8	85.4	80.9
130	76.8	81.4	84.4	77.5	76.1	86.5	82.4	86.6	86.3	83.2
140	78.6	83.4	89.5	78.0	78.9	89.2	83.5	87.8	88.4	84.9
150	79.1	86.0	90.6	79.5	81.6	90.2	85.1	90.8	91.4	88.6
160	83.1	87.6	90.8	81.3	95.2	94.1	86.8	92.0	93.4	92.1
170	83.2	88.2	91.8	85.1	90.1	93.8	89.6	91.0	93.4	93.3
180	83.5	88.7	91.9	89.9	93.8	94.7	92.6	88.7	93.4	94.1
190	88.1	89.2	92.1	96.3	96.8	94.1	92.5	90.1	92.9	95.8
200	93.6	89.9	93.2	100.4	102.2	93.7	95.6	93.0	92.8	98.8
210	94.6	90.4	93.6	103.5	115.6	93.5	100.1	93.2	94.0	104.4
220	94.7	90.8	93.6	109.3	129.5	94.9	106.9	99.5	98.0	115.0
230	94.4	92.9	93.3	117.8	143.6	94.7	114.9	101.0	103.7	124.8
240	94.6	98.0	93.7	128.6	155.5	97.2	122.9	103.8	111.3	136.0
250	93.7	110.1	99.3	143.7	169.7	110.3	131.3	104.7	121.4	145.8
257	95.4	111.0	102.7	162.4	181.6	121.9	136.2	110.3	129.8	154.8
258	95.8	111.4	103.1	165.5	184.2	123.2	137.6	108.5	131.4	156.3
259	95.8	112.7	103.6	168.8	185.7	124.3	138.4	109.8	132.7	157.5
260	96.3	113.9	104.2	171.8	188.0	125.3	139.3	110.7	133.8	158.6
261	96.9	114.9	104.6	174.8	189.9	125.9	140.6	114.5	134.4	159.2



Temperature outputs from unexposed surface temperature U11 to U19

Time (min)	U11	U12	U13	U14	U15	U16	U17	U18	U19
0	28.1	28.3	28.8	27.8	27.2	27.0	28.1	28.4	28.3
10	28.2	28.5	29.0	28.0	27.3	26.9	37.6	32.2	41.4
20	29.2	29.2	29.8	29.0	28.1	27.5	44.6	32.4	47.3
30	32.5	32.1	33.3	32.4	30.4	28.7	51.2	35.5	51.7
40	40.2	37.7	36.7	36.3	36.0	32.4	60.2	41.9	61.5
50	50.5	45.4	41.8	41.1	45.3	39.1	67.7	52.4	70.4
60	59.0	54.1	48.1	48.3	54.7	47.4	74.3	60.0	80.7
70	65.9	63.1	57.3	64.5	60.8	54.9	78.9	65.6	88.7
80	73.1	73.6	68.1	73.2	65.1	64.0	83.2	73.5	91.6
90	78.1	79.5	81.8	75.5	69.7	71.7	87.0	76.0	92.3
100	81.5	83.3	84.6	77.3	74.1	76.2	89.2	77.6	92.7
110	84.0	84.9	85.1	79.7	78.8	78.3	90.1	79.1	92.6
120	86.7	86.7	86.7	82.2	80.8	80.4	90.1	81.6	92.8
130	92.3	91.3	89.8	85.6	82.3	82.6	90.2	84.5	92.8
140	92.7	95.3	93.4	89.1	83.5	83.3	90.8	86.2	93.7
150	92.7	95.4	94.3	90.7	84.5	83.3	91.9	87.6	94.6
160	92.6	95.5	95.0	91.3	85.3	82.9	93.2	88.0	95.8
170	93.0	95.3	96.5	91.8	86.5	83.2	93.9	89.3	96.3
180	92.5	95.5	98.7	92.5	89.6	83.6	94.9	90.6	96.6
190	93.0	95.4	103.1	93.0	90.0	83.8	98.1	91.2	100.7
200	94.9	96.2	111.2	93.9	89.8	84.3	103.1	91.3	111.3
210	99.7	99.1	123.0	96.2	90.9	86.4	110.6	93.2	119.9
220	106.5	103.1	137.6	100.3	92.2	87.5	119.9	98.5	128.5
230	115.8	107.9	154.8	105.7	93.3	88.7	129.5	106.1	136.9
240	124.4	114.4	172.4	112.8	93.1	88.8	139.3	118.7	144.4
250	132.7	122.5	187.3	121.7	93.4	89.5	148.1	130.2	152.6
257	138.8	129.5	198.4	131.0	93.5	90.0	154.6	140.1	156.6
258	139.6	130.5	200.1	132.1	93.6	89.8	155.5	141.7	157.3
259	140.4	131.5	201.4	133.3	93.6	90.0	156.4	142.9	158.1
260	141.0	132.8	202.9	134.8	93.7	90.1	157.2	144.6	158.7
261	140.4	133.7	204.5	136.1	93.5	90.1	158.3	146.0	159.2

## 6.5 Pressure

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

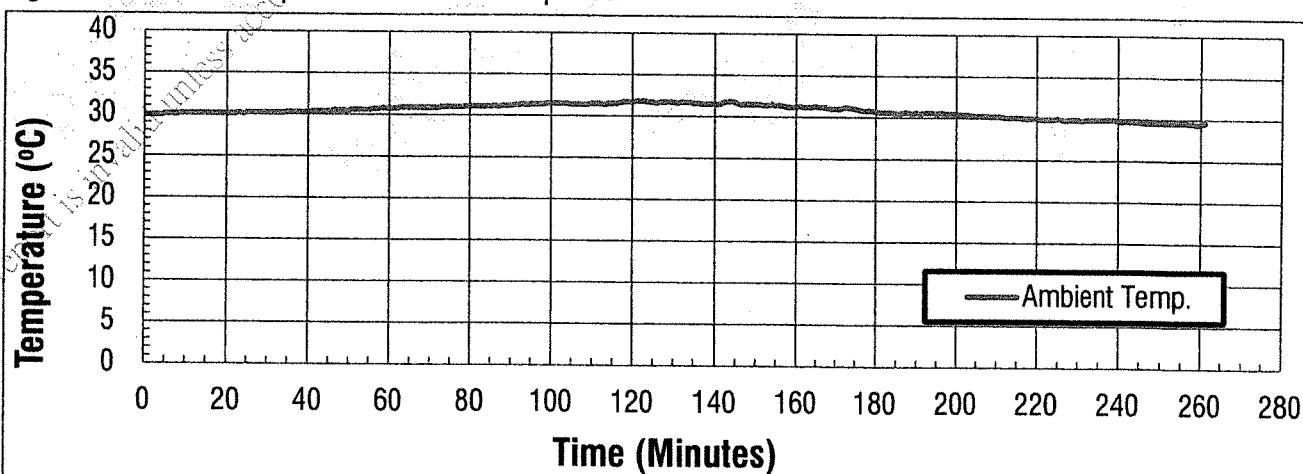
Time (min)	Pressure (Pa)	Time (min)	Pressure (Pa)	Time (min)	Pressure (Pa)
6	2.1	95	1.0	185	0.4
10	2.4	100	-1.1	190	-1.8
15	-1.9	105	1.5	195	1.6
20	1.1	110	-1.0	200	-0.8
25	0.5	115	-0.9	205	-1.0
30	0.8	120	-2.4	210	0.6
35	-0.3	125	-0.5	215	-2.1
40	-1.6	130	-1.8	220	-0.2
45	-0.4	135	1.3	225	-1.2
50	-1.1	140	0.1	230	-1.5
55	-0.1	145	-1.3	235	-0.2
60	1.0	150	1.0	240	-0.4
65	-0.1	155	-1.6	245	-1.1
70	-1.6	160	-0.7	250	1.5
75	-0.9	165	-1.2	255	0.2
80	0.8	170	-0.1	260	0
85	-2.8	175	1.3	261	0.6
90	2.9	180	-0.1		

## 6.6 Ambient Temperature

The ambient temperature over the test period was recorded and shown in *Figure 7*.

The ambient temperature at the commencement of test was 29.9°C.

**Figure 7.** Ambient temperature over the test period.



## 6.7 Lateral Deflections

Measured lateral deflections over the test period were 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 value of the specimen was **BOLDED** in the following table.

Position \ Time (min)	0	30	60	90	120	150	180
D1	+0	+7	+8	+6	+1	-3	-7
D2	+0	-5	-10	-13	-13	-23	-27
D3	+0	+15	+11	+22	+42	+52	+60
D4	+0	+17	+15	+25	+44	+56	+74
D5	+0	+12	+4	+10	+27	+38	+52
D6	+0	+12	+1	+5	+24	+35	+43
D7	+0	+5	+1	+0	+2	+1	-2
D8	+0	+9	+7	+7	+10	+7	+6
D9	+0	+7	+0	-2	-2	-3	-2
D10	+0	+1	-6	-11	-15	-18	-17

Position \ Time (min)	210	220	230	240	250	260
D1	-12	-11	-12	-13	-12	-13
D2	-28	-26	-29	-30	-31	-32
D3	+71	+71	+75	+79	+83	+85
D4	+87	+92	+102	+109	+117	+123
D5	+74	+76	+83	+91	+97	+105
D6	+50	+52	+55	+57	+61	+64
D7	-2	-3	-2	-3	-3	-5
D8	+5	+5	+6	+6	+5	+5
D9	-2	-6	-2	-3	-3	-1
D10	-26	-26	-28	-31	-30	-29

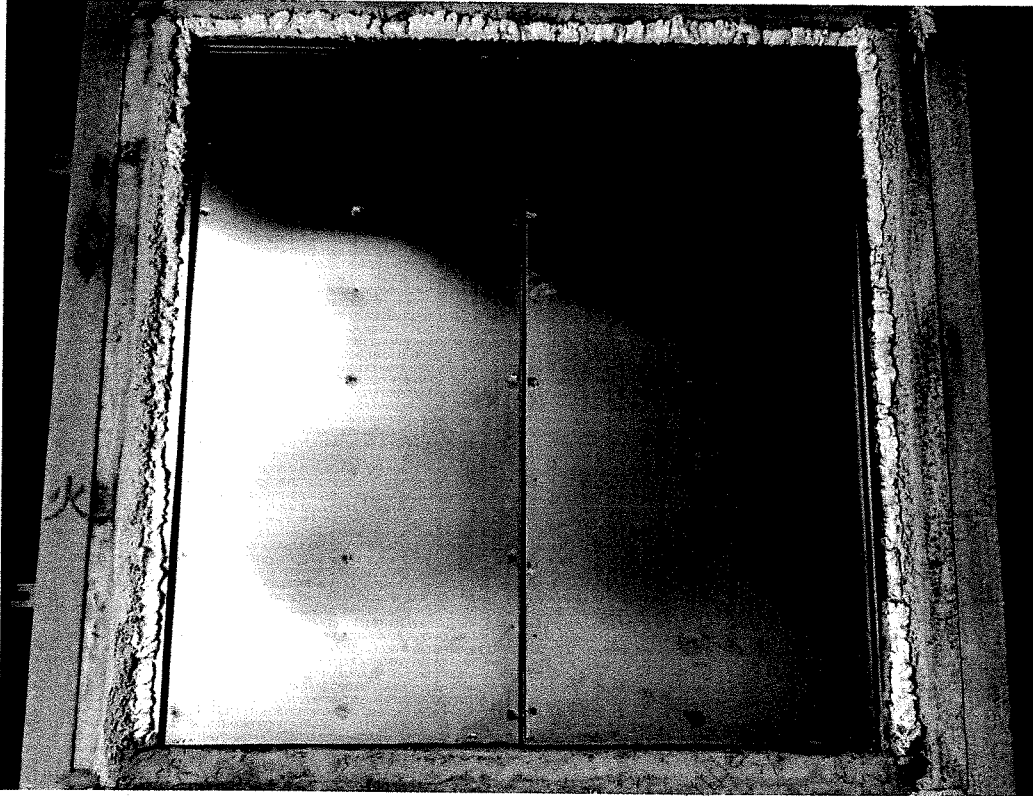
## 6.8 Observations

Significant behaviours of the specimen during the test period were summarized in the following table. Photos taken during the test period were also attached.

Time (min. sec)	Observation (from unexposed side)
00.00	Test Started.
01.22	Smoke released from the top of the pivoted edges.
02.13	Smoker released from the top edge of each door leaves.
05.12	Smoke release increased and water mark appeared from the top edge of each door leaves.
10.44	"Pop" sound was heard from the specimen.
11.25	Smoke released from the top pivoted edge of each door leaf.
12.25	The mid-height of the left door leaf bended slightly towards into the furnace.
16.30	Smoker stopped releas from the top right corner of the right door leaf.
19.06	The surface at bottom portion of the left door leaf turned dull.
21.23	Smoke released from the top pivoted edge of left door leaf.
30.00	<b>No integrity failure had occurred.</b>
37.52	"Pop" sound was heard from the specimen.
39.25	"Pop" sounds were heard from the specimen again.
43.29	Water mark was observed at the meeting edge of door leaves.
57.17	"Pop" sounds were heard from the specimen again. And the cladding of door leaves became unflat.
60.00	<b>No integrity failure had occurred.</b>
67.12	White reacted intumescent material appeared along the meeting edges of door leaves.
69.12	White liquid flowed from the top edges of each door leaves.
75.24	Mid-height of the left door leaf bended towards into the furnace.
82.50	Dark staining mark was observed at the bottom right corner of door leaf. White reacted intumescent material was observed along the pivoted edges of door leaf.
90.00	<b>No integrity failure had occurred.</b>
115.00	No significantly changes were observced from the specimen.
120.00	<b>No integrity failure had occurred.</b>
120.05	White liquid was observed at the sill level below each door leaf.
125.00	Mid-height of the door leaves bended towards into the furnace.
130.25	Light smoke released from the bottom of meeting edges.
150.00	<b>No integrity failure had occurred.</b>
170.19	Yellowish staining mark was observed at the middle top portion of the right door leaf.
180.00	<b>No integrity failure had occurred.</b>
187.50	Smoke released from the mid-height of meeting edges.
198.20	Smoke release increased from the mid-height of meeting edges of door leaves.

Time (min. sec)	Observation Cont'd (from unexposed side)
204.06	Smoke stopped release from the mid-height of meeting edges of door leaves. White reacted intumescent material along the meeting edges of door leaf turned yellowish white colour.
210.00	<b>No integrity failure had occurred.</b>
215.17	Yellowish brown staining mark appeared along the bottom edge of each door leaf.
222.45	No significantly changes were observed from the specimen.
229.15	Dark staining mark appeared at mid-height of the pivoted edge on left door leaf.
230.15	Dark staining mark appeared next to mid-height of the pivoted edge on right door leaf.
237.00	Cotton fibre pad test was carried out on the top right corner of the right door leaf. No flaming or glowing on the cotton was observed.
238.00	Cotton fibre pad test was carried out on the top of door leaf meeting edges. No flaming or glowing on the cotton was observed.
240.00	<b>No integrity failure had occurred.</b>
242.33	Mid-height of both door leaf bended further towards into the furnace.
256.25	Cotton fibre pad test was carried out on the top right corner of the right door leaf. No flaming or glowing on the cotton was observed.
257.15	Cotton fibre pad test was carried out on the mid-height of door leaf meeting edges. No flaming or glowing on the cotton was observed.
261.18	<b>Test terminated at the request of Sponsor.</b>

## 6.9 Photos



**Photo 1.** Exposed surface of the specimen before test.



**Photo 2.** Unexposed surface of the specimen before of test.



**Photo 3.** Unexposed surface of the specimen at 30 minutes of test.

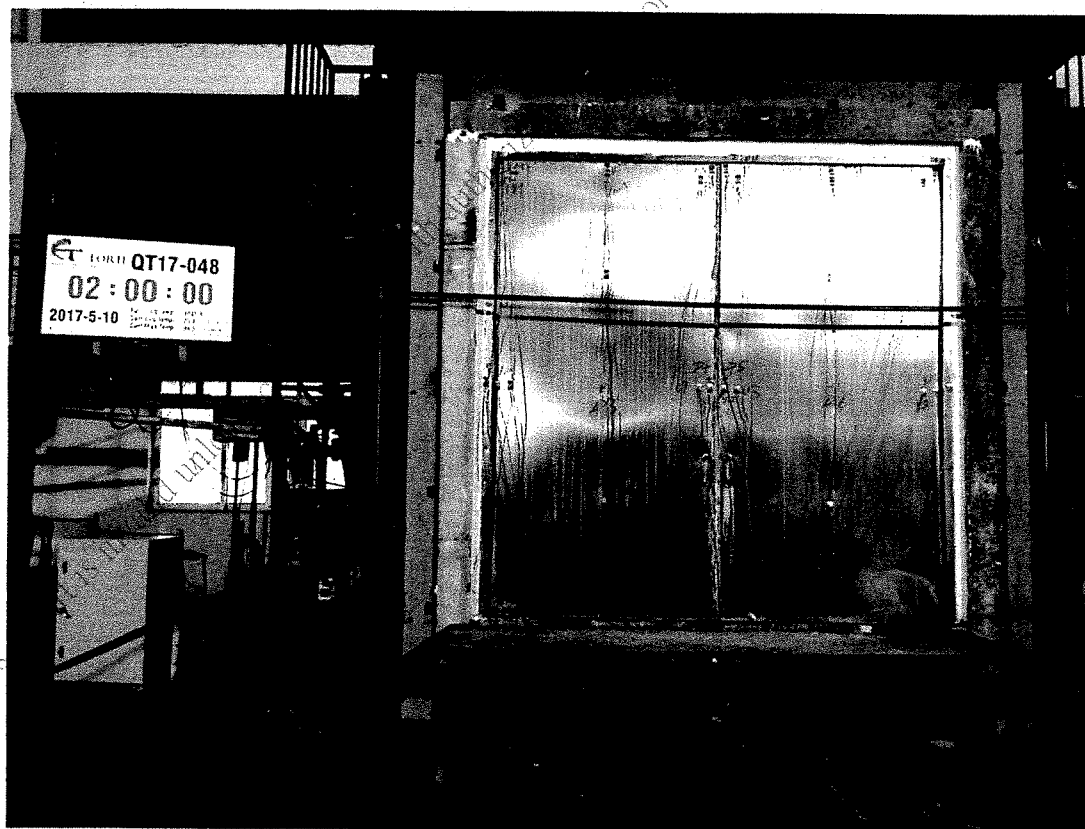


**Photo 4.** Unexposed surface of the specimen at 60 minutes of test.





**Photo 5.** Unexposed surface of the specimen at 90 minutes of test.



**Photo 6.** Unexposed surface of the specimen at 120 minutes of test.





**Photo 7.** Unexposed surface of the specimen at 150 minutes of test.



**Photo 8.** Unexposed surface of the specimen at 180 minutes of test.



**Photo 9.** Unexposed surface of the specimen at 210 minutes of test.



**Photo 10.** Unexposed surface of the specimen at 240 minutes of test.



e end of



## 7. Test Results

The test on the specimen was terminated after a test period of 261 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 were summarized in the following table.

Performance Criteria			
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	261 minutes (No Failure)
Gap Gauge	Ø6 mm	Penetration of the gauge into the furnace through the specimen and movable along a 150 mm gap	261 minutes (No Failure)
	Ø25 mm	Penetration of the gauge into the furnace through the specimen	
Cotton Pad		Ignition of the cotton pad	261 minutes (No Failure)

Performance Criteria				
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	261 minutes (No Failure)	
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]	261 minutes (No Failure)
Maximum Temperature Rise [Normal Procedure, I <sub>2</sub> ]		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]	261 minutes (No Failure)
			[Door Frame]	261 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 was 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 was 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 were 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

### Fixed Additional Surface Thermocouples – Detailed Temperature Records

The outputs of the additional unexposed surface thermocouples are summarized in the following tables. Measurements were taken in °C.

Temperature outputs from unexposed surface temperature U20 to U29

Time (min)	U20	U21	U22	U23	U24	U25	U26	U27	U28	U29
0	28.2	29.0	27.5	26.8	26.1	29.7	29.1	26.6	29.3	29.7
10	28.6	29.2	27.7	26.9	32.5	34.1	32.3	27.4	37.1	38.1
20	30.6	31.6	29.7	29.0	39.7	35.1	37.0	30.4	37.0	46.3
30	35.9	38.2	35.0	33.3	50.8	39.2	46.1	37.8	40.9	56.4
40	43.3	47.2	42.4	40.2	62.4	43.8	54.0	46.4	44.0	65.0
50	51.8	56.6	47.8	48.6	69.7	49.8	71.0	57.2	49.2	74.0
60	63.0	62.2	61.2	58.2	81.6	55.8	76.2	65.8	54.8	95.0
70	69.2	65.5	66.8	69.0	85.8	62.5	74.2	72.3	70.2	97.5
80	76.0	71.3	71.7	75.1	88.2	69.4	84.6	85.1	77.2	97.7
90	80.4	78.1	76.0	80.1	90.9	76.1	88.3	83.6	82.6	95.6
100	85.9	83.7	81.1	83.9	89.3	81.1	92.0	83.9	87.0	96.9
110	92.0	87.2	84.9	87.4	93.4	86.3	96.8	87.2	89.3	99.4
120	94.7	91.3	90.2	89.0	93.8	90.0	97.1	87.4	91.7	99.7
130	93.4	93.5	89.2	93.4	92.9	93.4	97.4	89.0	94.8	100.7
140	92.1	95.0	94.7	93.7	94.6	96.2	98.6	89.4	97.1	103.6
150	98.4	99.4	94.5	93.1	99.5	97.6	103.0	89.4	99.1	109.8
160	106.6	110.3	94.8	93.7	104.2	98.7	106.9	93.3	101.4	118.4
170	129.8	121.6	96.0	96.7	112.9	98.2	115.6	99.8	106.3	128.6
180	145.9	140.1	105.4	106.0	126.8	101.4	128.9	108.4	112.6	141.1
190	166.6	159.4	114.0	122.6	140.7	112.7	146.3	119.8	121.5	155.2
200	194.1	177.6	126.0	144.2	154.9	125.6	162.0	132.2	132.0	166.6
210	217.7	197.7	138.9	171.6	169.5	138.0	175.5	146.7	145.5	177.1
220	234.7	215.2	152.9	194.3	183.7	151.5	188.8	163.1	159.8	186.7
230	245.8	231.7	172.3	215.8	197.3	165.8	204.6	178.1	175.6	197.7
240	253.8	246.0	189.6	230.9	210.9	180.7	221.6	191.8	192.0	207.2
250	270.5	259.2	203.3	243.9	224.0	194.6	237.8	203.8	206.0	218.4
257	280.5	269.8	213.4	253.4	232.9	204.6	248.0	212.6	216.2	225.1
258	281.8	271.1	214.1	254.8	234.1	205.9	249.2	214.0	217.8	225.1
259	282.9	272.7	215.4	256.0	235.1	207.7	250.9	215.3	219.1	226.6
260	283.9	274.0	216.7	257.3	236.2	208.8	252.0	216.3	220.4	226.8
261	284.6	275.2	217.7	258.8	237.2	210.0	253.3	217.1	221.8	227.8

**END OF REPORT**