

## FIRE RESISTANCE TEST REPORT

**SINGLE LEAF COMPOSITE TIMBER DOOR with GLAZED ELEMENTS, &  
DOUBLE LEAF COMPOSITE TIMBER DOOR with GLAZED ELEMENT and  
OVERHEAD PANEL**

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

**Test Sponsor: Garish Crown Fire Engineering & Consultancy**

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**Report Number: IT 13-125**

**Date of Issue: 2013-07-11**

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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 and an overhead panel, namely Door A; and a single leaf composite timber door with two glazed elements, namely Door B. The specimens were manufactured and supplied for test by Leung's Wooden Company Limited, the Sponsor.

The specimens achieved the following fire resistance:

| <b>Door A</b>           |                                   |                        |         | <b>Door B</b>          |                    |                                   |         |
|-------------------------|-----------------------------------|------------------------|---------|------------------------|--------------------|-----------------------------------|---------|
| <b>INTEGRITY</b>        |                                   | <b>(E)</b>             |         | <b>INTEGRITY</b>       |                    | <b>(E)</b>                        |         |
|                         | Sustained Flaming                 | 66                     | Minutes |                        | Sustained Flaming  | 73                                | Minutes |
|                         | Gap Gauge                         | 73                     | Minutes |                        | Gap Gauge          | 73                                | Minutes |
|                         | Cotton Pad                        | 73                     | Minutes |                        | Cotton Pad         | 73                                | Minutes |
| <b>INSULATION</b>       |                                   | <b>(I<sub>1</sub>)</b> |         | <b>INSULATION</b>      |                    | <b>(I<sub>1</sub>)</b>            |         |
| Door Leaves & Framework | Average Temp. Rise                | 73                     | Minutes | Door Leaf & Door Frame | Average Temp. Rise | 73                                | Minutes |
|                         | Max. Temp. Rise (I <sub>1</sub> ) | 73                     | Minutes |                        | Glazed Elements    | Max. Temp. Rise (I <sub>1</sub> ) | 73      |
| Glazed Element          | Average Temp. Rise                | 73                     | Minutes | Glazed Elements        |                    | Average Temp. Rise                | 73      |
|                         | Max. Temp. Rise                   | 73                     | Minutes |                        | Overhead Panel     | Max. Temp. Rise                   | 73      |
| Overhead Panel          | Average Temp. Rise                | 73                     | Minutes | Overhead Panel         |                    | Average Temp. Rise                | 73      |
|                         | Max. Temp. Rise (I <sub>1</sub> ) | 73                     | Minutes |                        | Overhead Panel     | Max. Temp. Rise (I <sub>1</sub> ) | 73      |

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## 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 Sponsor:</b>                      | Leung's Wooden Company Limited<br>Garish Crown Fire Engineering & Consultancy   |                          |
| <b>ID no. of the specimens:</b>           | Door A: QT 13-108A; Door B: QT 13-108B  |                          |
| <b>Date Received:</b>                     | 2013-05-20  |                          |
| <b>Test Number:</b>                       | QT 13-108<br>*This report (Report no. IT13-125) is issued in addition to the report (Report no. IT13-076) issued on 2013-07-11 on this test |                          |
| <b>Date Tested:</b>                       | 2013-05-21  | <b>Start Time:</b> 15:00 |
| <b>Approved Test Operator from FORTE:</b> | Ms. Cheng San Mei, Sammi  |                          |
| <b>Witness of the Test:</b>               | Mr. C.K. Leung – Official Delegate of the Sponsor   |                          |

## 3. Construction Details of Specimens

### 3.1 Specimens Description

#### 3.1.1 Door A

##### 3.1.1.1 Framework and Sub-frame

The wooden sub-frame was sized 18 mm (width) x 100 mm (thick). The sub-frame was fixed onto the back of the door frame by metal pins and wood screws with plastic plug.

The wooden framework was single rebate type of overall sizes 1569 mm (w) x 2923 mm (height). The perimeter frame had a sectional dimension 50 mm (w) x 100 mm (t) with 20 mm door stop rebate; whereas the transom had a sectional dimension 70 mm (w) x 100 mm (t) with 20 mm door stop rebate on both sides. The framework with the sub-frame was fixed onto the concrete support frame by 10 x 112 screws at approximate 400 - 500 mm centre to centre on head and both jambs.

45 mm (w) x 12 mm (t) architraves were fixed over the door frame and sub-frame on both sides by metal pins at approximate 250 mm centre to centre.

1 number of 30 mm (w) x 4 mm (t) intumescent strip was fitted into the groove on the frame perimeter the overhead panel.

1 number of 20 mm (w) x 4 mm (t) intumescent strip with 10 mm (w) x 4 mm (t) intumescent strip aside was fitted into the groove on the frame perimeter. The 20 mm (w) intumescent strip was interrupted at the hinge positions whereas the 10 mm (w) one was not interrupted.

1 number of smoke seal was adhered along the framework rebate corner.

The space between sub-frame, framework and the concrete support frame was filled with backer rod and fire sealant.

### 3.1.1.2 Door Leaves

The specimen comprised of an active leaf sized 1050 mm (w) x 2300 mm (h) x 54 mm (t) and an inactive leaf sized 450 mm (w) x 2300 mm (h) x 54 mm (t).

The stiles and rails were made of 3 numbers of wooden slabs with each size of 45 mm (w) x 38 mm (t). The stiles and rails were secured together by screws and glue. The core between stiles and rails was filled with 38 mm (t) perlite board. The mid rails were made of wooden slabs with size of 45 mm (w) x 38 mm (t).

On both sides of the door core were covered by 4 mm (t) fire board sub-facing and 4 mm (t) medium density fibreboard (MDF) facing. The sub-facing was fixed to the door core by wood screws and metal pins at 250 - 400 mm centre to centre and glue; whereas the MDF facing was fixed to the sub-facing by glue.

The door meeting was unequal single rebate type.

1 number of 10 mm (w) x 4 mm (t) intumescent strip was fitted into groove along meeting edge on the active leaf. 1 number of conceal bottom smoke seal was fitted into groove at the bottom edge of the active leaf. 1 number of 10 mm (w) x 4 mm (t) intumescent strip was fitted into groove at the bottom edge of the active leaf close to the push side.

1 number of 20 mm (w) x 4 mm (t) intumescent strip was fitted into groove along meeting edge on the inactive leaf. 1 number of 20 mm (w) x 4 mm (t) intumescent strip with side plastic fins was fitted into groove at the bottom edge of the inactive leaf.

1 number of smoke seal was adhered along the meeting edge rebate corner on the inactive leaf.

The door lipping was made of wooden strip.

### 3.1.1.3 Glazed Element

A glazed element of visual size 225 mm (w) x 1575 mm (h) was installed 200 mm above the bottom edge and 148 mm away from the meeting edge.

The glazed elements were comprised of nominal 25 mm (t) interlayered glass pane. The glass pane was lined by ceramic fibre and fire sealant. The glass pane was pushed to and clamped by a pair of 1 mm (t) stainless steel (SS) angles, which were fixed onto the door leaf by  $\varnothing 4 \times 25$  mm wood screws. Chamfered wooden glazed beads sized 25 mm (width, parallel to the glass) x 16.5 mm (thick, perpendicular to the glass) with bolection return were fixed onto the door leaf on both sides by wood nails at approximate 200 mm centre to centre.

The edges of the glass pane were caulked with fire sealant.

### 3.1.1.4 Overhead Panel

The specimen comprised of an overhead panel. The overhead panel was sized 1503 mm (w) x 550 mm (h).

The framework of the overhead panel was made of wooden slabs of 45 mm (w) x 38 mm (t) wooden slabs. The core of the overhead panel was filled with 38 mm (t) perlite board.

The overhead panel was fixed to the framework by  $\varnothing 5 \times 72$  mm wood screws and metal pins.

### 3.1.1.5 Ironmongery

The active leaf was supported into the framework by 4 numbers of square butt hinges, whereas the inactive leaf was supported into the framework by 4 numbers of spring hinges.

1 number of surface mount door closer was installed at the top rim of the active leaf on the exposed side.

1 number of mortise lock was installed on the active leaf 1000 mm above the bottom edge of the door leaf.

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

1 number of door selector was installed at the door frame over the top of meeting edge on the unexposed side.

1 number of 1 mm (t) SS push plate was fixed on both sides of both door leaves by glue.

### 3.1.2 Door B

#### 3.1.2.1 Door Frame and Sub-frame

The sub-frame, door frame and architraves were constructed same as that of Door A.

1 number of 30 mm (w) x 4 mm (t) intumescent strip was fitted into the groove on each jamb and head of the door frame. The width of the intumescent strip was reduced at the hinge positions.

1 number of rebate corner smoke seal was adhered along the framework rebate corner.

1 layer of 4 mm fire rated board was applied on the exposed side of the door frame.

The space between sub-frame, door frame and the concrete support frame was filled with backer rod and fire sealant.

#### 3.1.2.2 Door Leaf

The specimen comprised of a door leaf sized 1100 mm (w) x 2300 mm (h) x 54 mm (t).

The stiles and rails were made of wooden slabs sized 45 mm (w) x 38 mm (t). The stiles and rails were secured together by screws and glue. The core between stiles and rails was filled with 38 mm (t) perlite board.

On both sides of the door core were covered by 4 mm (t) fire board sub-facing and 4 mm (t) MDF facing. The sub-facing was fixed to the door core by wood screws, metal pins at 250 - 400 mm centre to centre and glue; whereas the MDF facing was fixed to the sub-facing by glue.

1 number of conceal bottom smoke seal was fitted into groove at the bottom edge of the door leaf. 1 number of 10 mm (w) x 4 mm (t) intumescent strip was fitted into groove at the bottom edge of the door leaf close to the push side.

1 number of rebate corner smoke seal, which is the same model applied on the door frame, was adhered onto the top edge of the door leaf near the pull side. The smoke seal was cut in half to form a V-shape profile.

The door lipping was made of wooden strips.

### 3.1.2.3 Glazed Elements

The specimen comprised of two glazed elements: the top glazed element was visually sized 720 mm (w) x 175 mm (h); the lower glazed element was visually sized 275 mm (w) x 275 mm (h). The top glazed element was installed at center 400 mm below the top edge of the door leaf; and the lower glazed element was installed 400 mm below the top glazed element.

The glazed elements were comprised of nominal 25 mm (t) interlayered glass pane. The glass pane was lined by ceramic fibre and fire sealant. The glass pane was pushed to and clamped by a pair of 1 mm (t) SS angles, which were fixed onto the door leaf by Ø4 x 25 mm wood screws. Chamfered wooden glazed beads sized 25 mm (width, parallel to the glass) x 16.5 mm (thick, perpendicular to the glass) with bevel return were fixed onto the door leaf on both sides by wood nails at approximate 200 mm centre to centre.

The edges of the glass pane were caulked with fire sealant.

### 3.1.2.4 Ironmongery

The door leaf was supported into the door frame by 4 numbers of conceal hinges.

1 number of conceal door closer was installed at the top edge of the door leaf.

1 number of lever handle mortised lock was installed 1000 mm above the bottom of the door leaf.

1 number of 1 mm (t) SS push plate was fixed on both sides of the door leaf by glue.

1 number of 800 mm (h) x 1.5 mm (t) SS kicking plate was fixed above the bottom edge on the exposed side of the door leaf.

Intumescent material was filled to the mortised area for conceal hinges.

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### 3.2 Material Schedule

Parts specifications were summarized in the following tables. The specifications are shared by both Door A and Door B unless specified.

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 <sup>3</sup> *                              |                    |
| Overall Sizes:                                | Door A   | 1569 mm by 2923 mm |
|   | Door B   | 1166 mm by 2337 mm |
| Dimensions:                                   | Door A - Perimeter Frame                                   | 50 mm by 100 mm    |
|   | Door A - Transom   | 70 mm by 100 mm    |
|   | Door B   | 50 mm by 100 mm    |
| Rebate:                                       | 20 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:                   | Wood Screws and Metal Pins                                 |                    |
| Gap Filling between Door Frame and Sub-frame: | Fire Sealant   |                    |

#### Door Sub-frame

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

#### Architraves

|                      |                               |
|----------------------|-------------------------------|
| Manufacturer:        | Leung's Wooden Co., Ltd.      |
| Material:            | Hardwood                      |
| Density of hardwood: | 550 - 700 kg/m <sup>3</sup> * |
| Overall Sizes:       | 45 mm by 12 mm                |

**Door Leaves**

|                  |                   |   |
|------------------|-------------------|---|
| Manufacturer:    |                   | Leung's Wooden Co., Ltd.                |
| Overall Sizes:   |                   | Door A (1050 + 400) mm by 2300 by 54 mm |
|                  |                   | Door B 1100 mm by 2300 mm               |
| Stiles and Rails | Material:         | Wooden Slabs                            |
|                  | Width:            | 45 mm                                   |
|                  | Thickness:        | 38 mm                                   |
|                  | Density:          | 350 - 450 kg/m <sup>3</sup> *           |
|                  | Moisture Content: | 12 - 17% *                              |
| Core             | Supplier:         | Leung's Wooden Co., Ltd.                |
|                  | Material:         | Perlite                                 |
|                  | Thickness:        | 38 mm                                   |
|                  | Density:          | 380 kg/m <sup>3</sup> *                 |

**Door Leaf Lippings**

|               |                               |
|---------------|-------------------------------|
| Manufacturer: | Leung's Wooden Co., Ltd.      |
| Material:     | Hardwood                      |
| Density:      | 550 - 700 kg/m <sup>3</sup> * |
| Thickness:    | 8 mm                          |

**Door Leaf Facings**

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

**Door Leaf Sub-facings**

|             |                               |
|-------------|-------------------------------|
| Supplier:   | Leung's Wooden Co., Ltd.      |
| Brand:      | Gemtree*                      |
| Description | Fire rated board              |
| Density:    | 950 ± 100 kg/m <sup>3</sup> * |
| Thickness:  | 4.5 ± 0.5 mm                  |



**Glazed Element – Glass Pane**

|                    |   |                   |
|--------------------|---|-------------------|
| Supplier:          | Leung's Wooden Co., Ltd.  |                   |
| Brand - Model:     | Hengbao - HFR-25 (Pane1 and 2) / AGC - Pyrobel (Pane 3)   |                   |
| Nominal Thickness: | 25 mm   |                   |
| Full Sizes:        | Pane1 - Door A  | 250 mm by 1600 mm |
|                    | Pane 2 - Door B Upper   | 750 mm by 200 mm  |
|                    | Pane 3 - Door B Lower   | 300 mm by 300 mm  |
| Visual Sizes:      | Pane1   | 225 mm by 1575 mm |
|                    | Pane 2  | 725 mm by 175 mm  |
|                    | Pane 3  | 275 mm by 275 mm  |
| Fixing Method:     | Lined by Mineral Wool, Clamped by Stainless Steel Angles and Wooden Glazing Beads on Both Sides |                   |

**Glazed Element – Fixing Angles**

|            |                          |
|------------|--------------------------|
| Supplier:  | Leung's Wooden Co., Ltd. |
| Material:  | Stainless Steel *        |
| Thickness: | 1 mm                     |

**Glazed Element – Mineral Wool**

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

**Glazed Element – Glazing Beads**

|                |   |
|----------------|---|
| Manufacturer:  | Leung's Wooden Co., Ltd.                          |
| Material:      | Hardwood  |
| Density:       | 550 - 700 kg/m <sup>3</sup> *                     |
| Sizes:         | 25 mm by 16.5 mm                                  |
| Fixing Method: | Wood Nails at Approximate 200 mm Centre to Centre |

**Butt Hinges - Door A**

|           |                          |
|-----------|--------------------------|
| Supplier: | Leung's Wooden Co., Ltd. |
| Brand:    | BONCO                    |
| Model:    | BI-4430 BB               |
| Sizes:    | 102 mm by 102 mm by 3 mm |

**Spring Hinges - Door A**

|           |                          |
|-----------|--------------------------|
| Supplier: | Leung's Wooden Co., Ltd. |
| Brand:    | BONCO                    |
| Model:    | BI-SS8114                |
| Sizes:    | 102 mm by 102 mm by 3 mm |

**Conceal Hinges - Door B**

|           |                          |
|-----------|--------------------------|
| Supplier: | Leung's Wooden Co., Ltd. |
| Brand:    | Ying Mu                  |
| Model:    | CH                       |
| Sizes:    | 48 mm by 140 mm by 50 mm |

**Door Closers - Door A**

|           |                          |
|-----------|--------------------------|
| Supplier: | Leung's Wooden Co., Ltd. |
| Brand:    | BONCO                    |
| Model:    | B3-2003                  |

**Conceal Door Closer - Door B**

|           |                          |
|-----------|--------------------------|
| Supplier: | Leung's Wooden Co., Ltd. |
| Brand:    | BONCO                    |
| Model:    | B3-CB-3835               |
| Sizes:    | 239 mm by 37 mm by 61 mm |

**Flush Bolts - Door A**

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

**Door Lock - Door A**

|           |                           |
|-----------|---------------------------|
| Supplier: | Leung's Wooden Co., Ltd.  |
| Brand:    | BONCO                     |
| Model:    | B2-4924K-X-4627-A1-70     |
| Sizes:    | 102 mm by 140 mm by 32 mm |

**Door Lock - Door B**

|           |                           |
|-----------|---------------------------|
| Supplier: | Leung's Wooden Co., Ltd.  |
| Brand:    | BONCO                     |
| Model:    | B2-4626P                  |
| Sizes:    | 100 mm by 172 mm by 25 mm |

**Push Plate**

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

**Kicking Plate - Door B**

|            |                          |
|------------|--------------------------|
| Supplier:  | Leung's Wooden Co., Ltd. |
| Material:  | Stainless Steel *        |
| Thickness: | 1.5 mm                   |
| Sizes:     | 1100 mm by 800 mm        |

**Door Selector**

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

**Conceal Bottom Smoke Seal**

|                           |   |
|---------------------------|---|
| Supplier:                 | Garish Crown Fire Engineering & Consultancy |
| Brand:                    | Raven                                       |
| Model:                    | RP8Si / RP308Si (replacement)               |
| 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:                    | Lorient                  |                                    |                |               |
| Model:                    | Not Provided             |                                    |                |               |
| Size:                     |                          | Door A                             | Door B         |               |
|                           | Door Frame               | 20 mm by 4 mm and<br>10 mm by 4 mm | 30 mm by 4 mm  |               |
|                           | Door Meeting<br>Edge     | 20 mm by 4 mm and<br>10 mm by 4 mm | Not Applicable |               |
|                           | Bottom Edge              | Active Leaf                        | 10 mm by 4 mm  | 10 mm by 4 mm |
|                           |                          | Inactive Leaf                      | 20 mm by 4 mm  |               |
| Framework<br>around Panel | 30 mm by 4 mm            | Not Applicable                     |                |               |

**Intumescent Pad – Ironmongery**

|                           |   |
|---------------------------|---|
| Supplier:                 | Leung's Wooden Co., Ltd.                            |
| Brand:                    | Ying Mu   |
| Thickness:                | 2 mm  |
| Locations of Application: | Mortised Area for Conceal Hinges and Conceal Closer |

**Fixing – Door Frame**

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

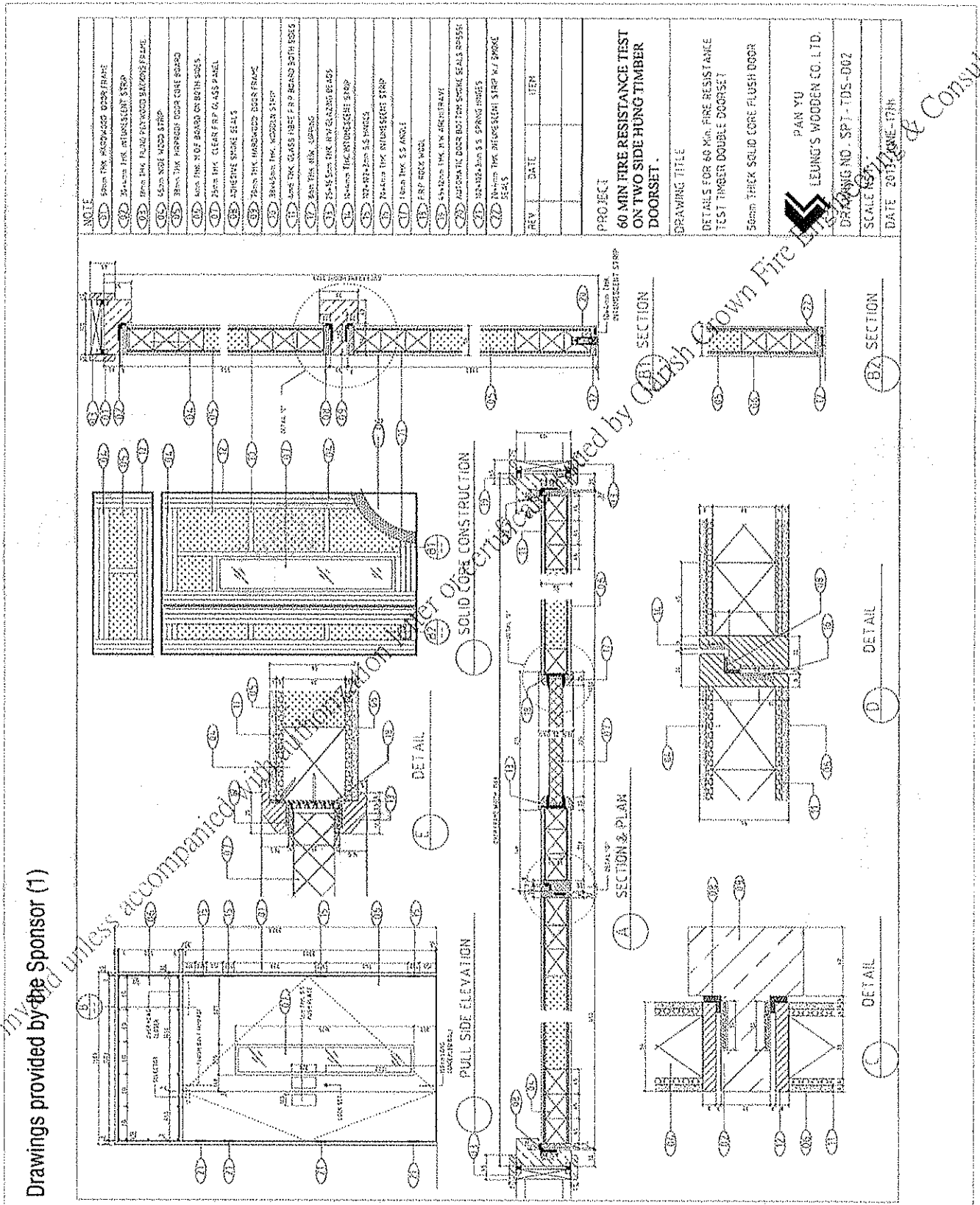
**Fire Sealant**

|                           |   |
|---------------------------|---|
| Supplier:                 | Garish Crown Fire Engineering & Consultancy   |
| Brand:                    | FIREMATE  |
| Model:                    | Not Provided  |
| Locations of Application: | Gap between the door frame and subframe/subframe and test rig<br>If any gap formed between door leaf or door frame and the lock or butt hinge |

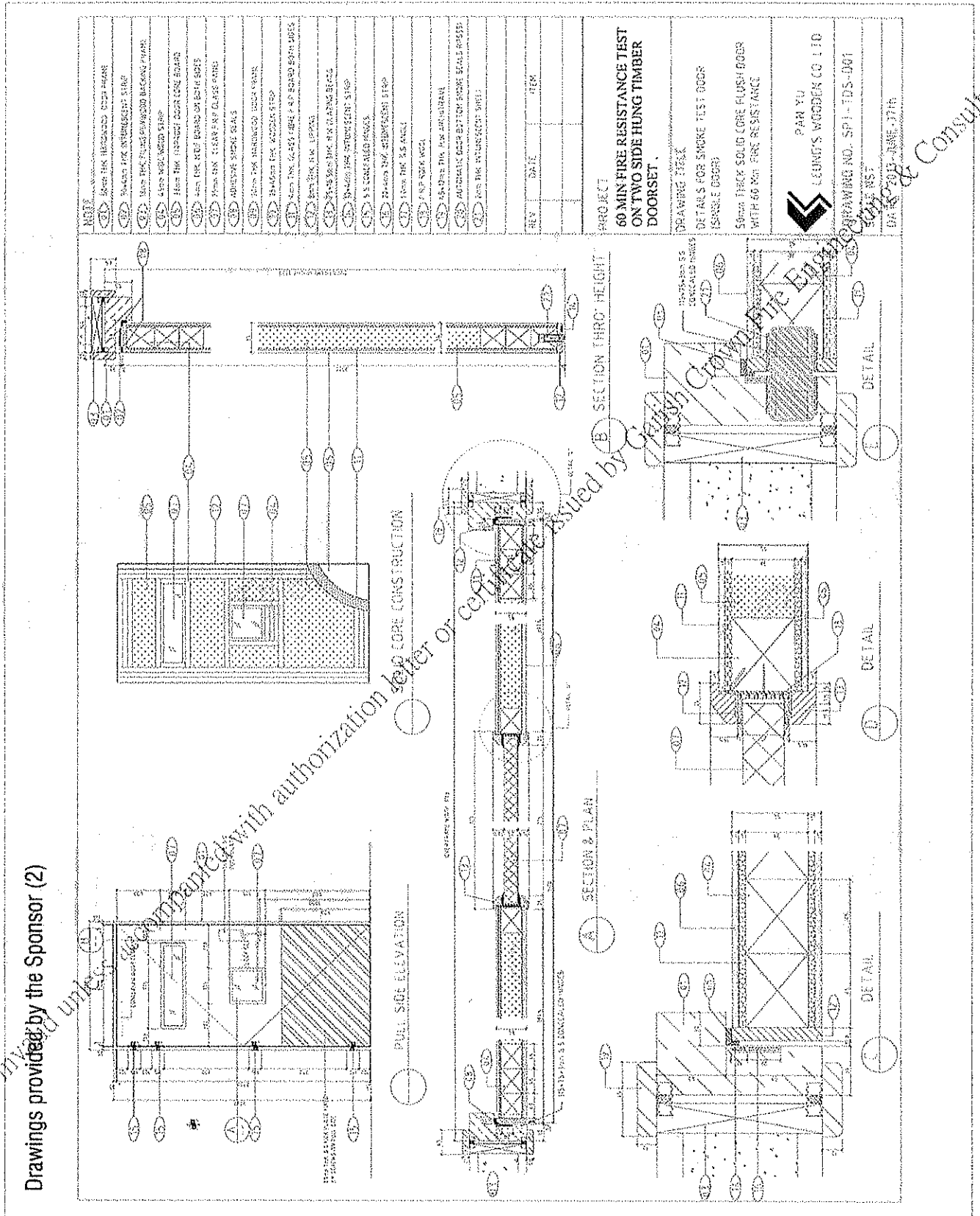
**Glue**

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

3.3 Drawings on Specimens provided by the Sponsor (Total 2 Pages)



Drawings provided by the Sponsor (1)



This report is intended to be used with authorization letter or certificate issued by Forte Testing and Consultants Co., Ltd.

Drawings provided by the Sponsor (2)

#### 4. Specimens Condition

##### 4.1 Selection of the Specimens

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

All the components of the test specimens were supplied by the Sponsor.

##### 4.2 Verification of the Specimens

Samples of components of the specimen were prepared by the Sponsor.

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 specimens were fixed into a supporting construction made of fully cured reinforced normal density concrete slabs provided by FORTE. The concrete slabs formed a structural opening 1623 mm (w) x 2985 mm (h) for Door A, and another structural opening 1221 mm (w) x 2400 mm (h) for Door B.

##### 4.4 Installation of the Specimens

The specimens was assembled and installed by workers delegated by the Sponsor on 2012-05-20.

##### 4.5 Specimens Conditioning

The specimens were stored in the Test Location from 2012-05-20, the date which specimens were received, to 2012-05-21, 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 ± 5                   | 75 ± 10               |

##### 4.6 Direction of Fire Side and Others

The Sponsor has designated and installed the specimens that door leaves could only be swung inwards the furnace.

With reference to *Clause 13; BS EN 1634-1: 2008*, hinged timber leaf timber frame doors tested opening into the furnace may cover the opposite direction on both integrity and insulation criteria.

Door A: The door lock and flush bolts were NOT locked and NOT latched during the test.

Door B: The door lock was NOT locked but latched during the test.

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## 5. Test Method

### 5.1 Pre-test Conditioning

The pre-test conditionings of the specimens 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*.

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#### 5.4 Unexposed Surface Temperature

The unexposed surface temperatures of the specimens were measured by 49 numbers of type K thermocouples. These thermocouples were positioned and fixed on unexposed surface of the test specimens in conformity with *BS EN 1634-1: 2008*.

The specimens were evaluated against the maximum temperature rise criterion given by supplementary procedure – Classification I<sub>1</sub> 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     |
|--------------|-------------------------|-----------------|
| Door A       | U1 – U5                 | Door Leaves     |
|              | U6 – U12;<br>U32 – U39  | Door Leaves     |
|              | U13 – U20               | Framework       |
|              | U21 – U23               | Glazed Element  |
|              | U24 – U25               | Overhead Panel  |
|              | U26 – U31;<br>U40 – U45 | Overhead Panel  |
| Door B       | U46 – U50               | Door Leaf       |
|              | U51 – U53;<br>U61 – U64 | Door Leaf       |
|              | U54 – U57               | Door Frame      |
|              | U58 – U60               | Glazed Elements |
|              |                         |                 |

#### 5.5 Pressure Condition

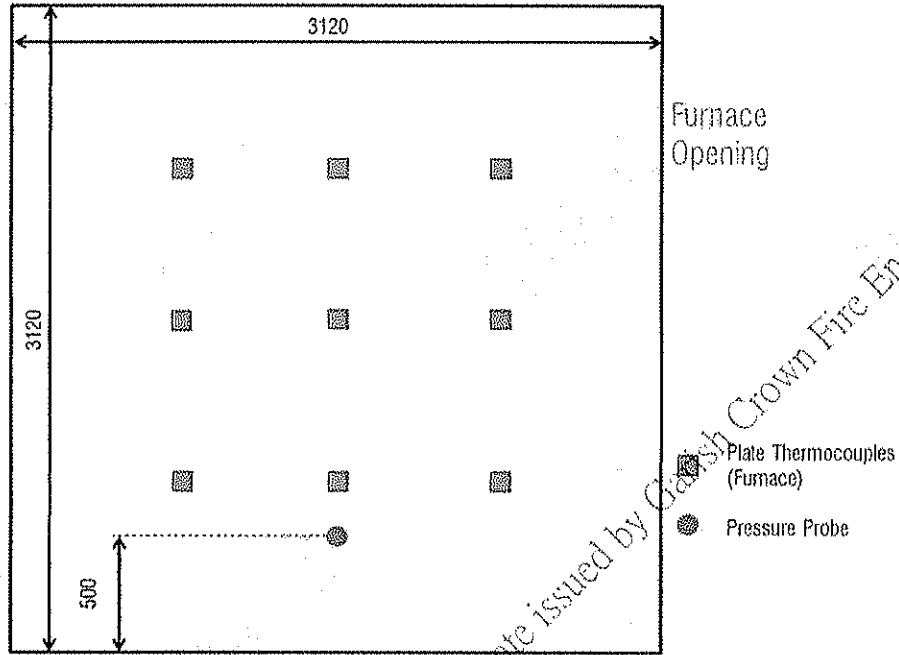
The pressure inside the furnace was continuously monitored in compliance with *BS EN 1363-1: 1999* during the whole test. The pressure at a point 500 mm above the notional floor level was to be maintained  $0 \pm 5$  Pa by five minutes from commencement of the test and  $0 \pm 3$  Pa that from ten minutes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

#### 5.6 Deflection Measurements

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

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.

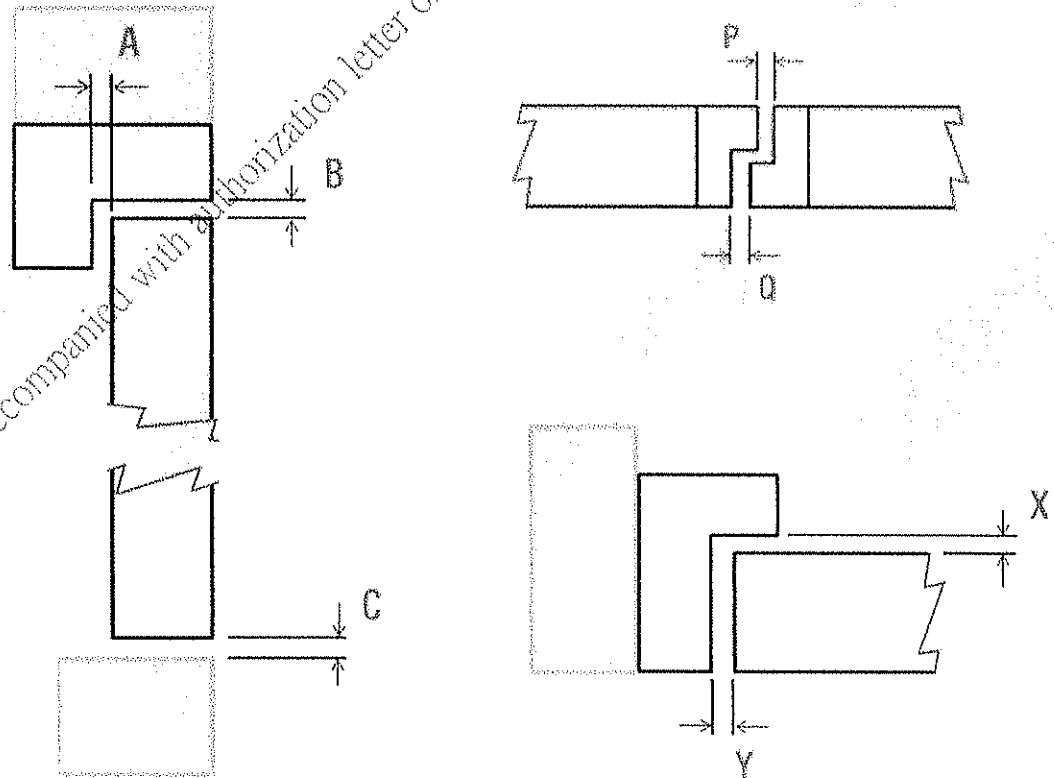


Figure 3a. Positions of fixed surface thermocouples (U) on Door A.

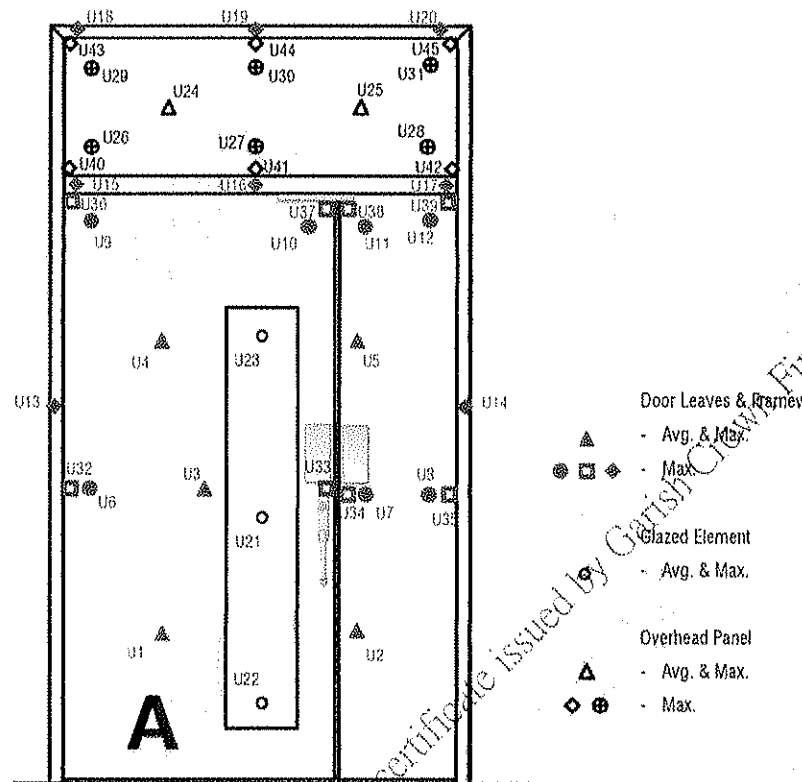
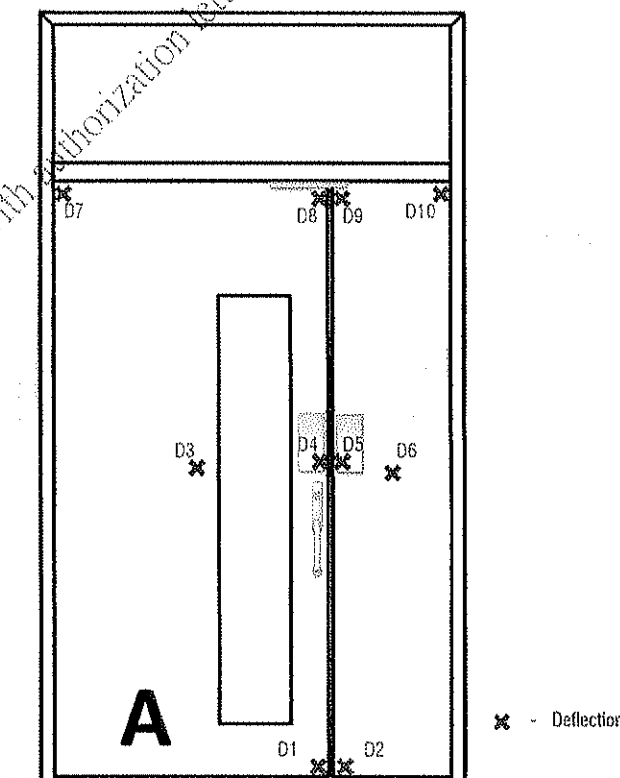
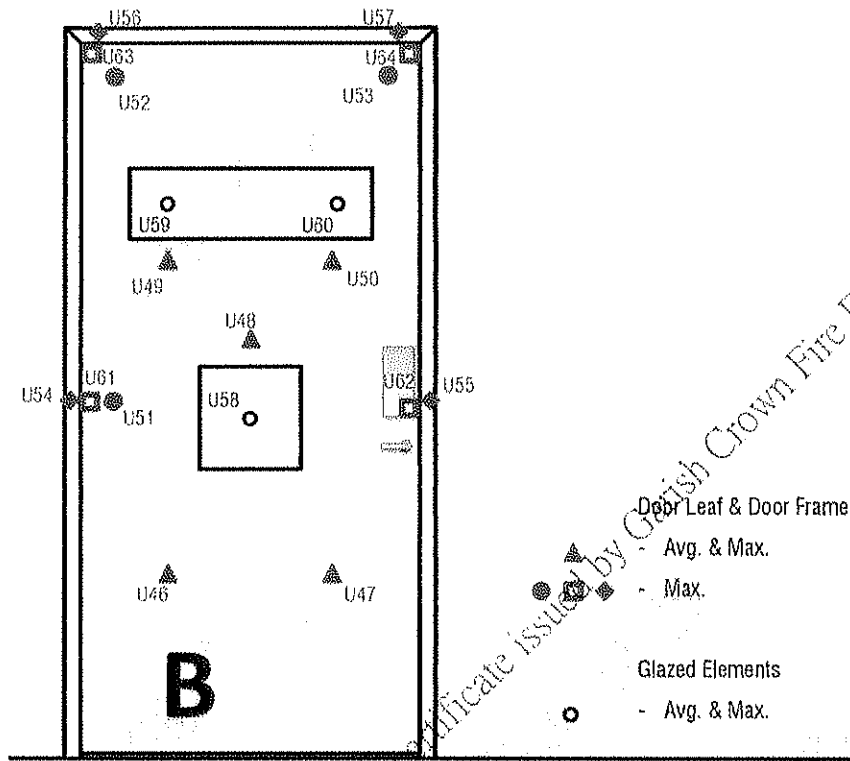


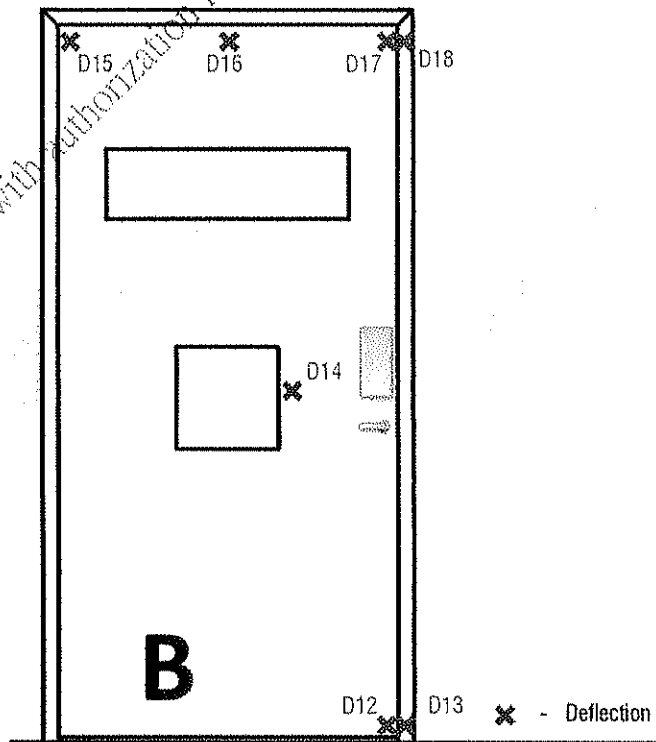
Figure 3b. Positions of deflection measuring points (D) on Door A.



**Figure 3c.** Positions of fixed surface thermocouples (U) on Door B.



**Figure 3d.** Positions of deflection measuring points (D) on Door B.



## 6. Test Data

### 6.1 Retention Forces

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

| Leaf   |          | Push   | Pull   |
|--------|----------|--------|--------|
| Door A | Active   | 82.4 N | 78.8 N |
|        | Inactive | 51.5 N | 44.2 N |
| Leaf   |          | Push   | Pull   |
| Door B |          | 92.8 N | 93.6 N |

### 6.2 Gaps Measurement

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

Measurements were taken in mm. "N.P." stands for not provided.

#### 6.2.1 Door A

| Gap | Measured |         |         | Declared |
|-----|----------|---------|---------|----------|
|     | Minimum  | Maximum | Average | Mean     |
| A   | 1.4      | 2.1     | 1.7     | 3        |
| B   | 2.0      | 3.5     | 2.8     | 3        |
| C   | 0.5      | 1.9     | 1.2     | 3        |
| X   | 1.5      | 2.6     | 2.1     | 4        |
| Y   | 2.0      | 3.6     | 2.5     | 3        |
| P   | 1.2      | 3.0     | 2.2     | 3        |
| R   | 1.4      | 2.8     | 2.3     | 3        |

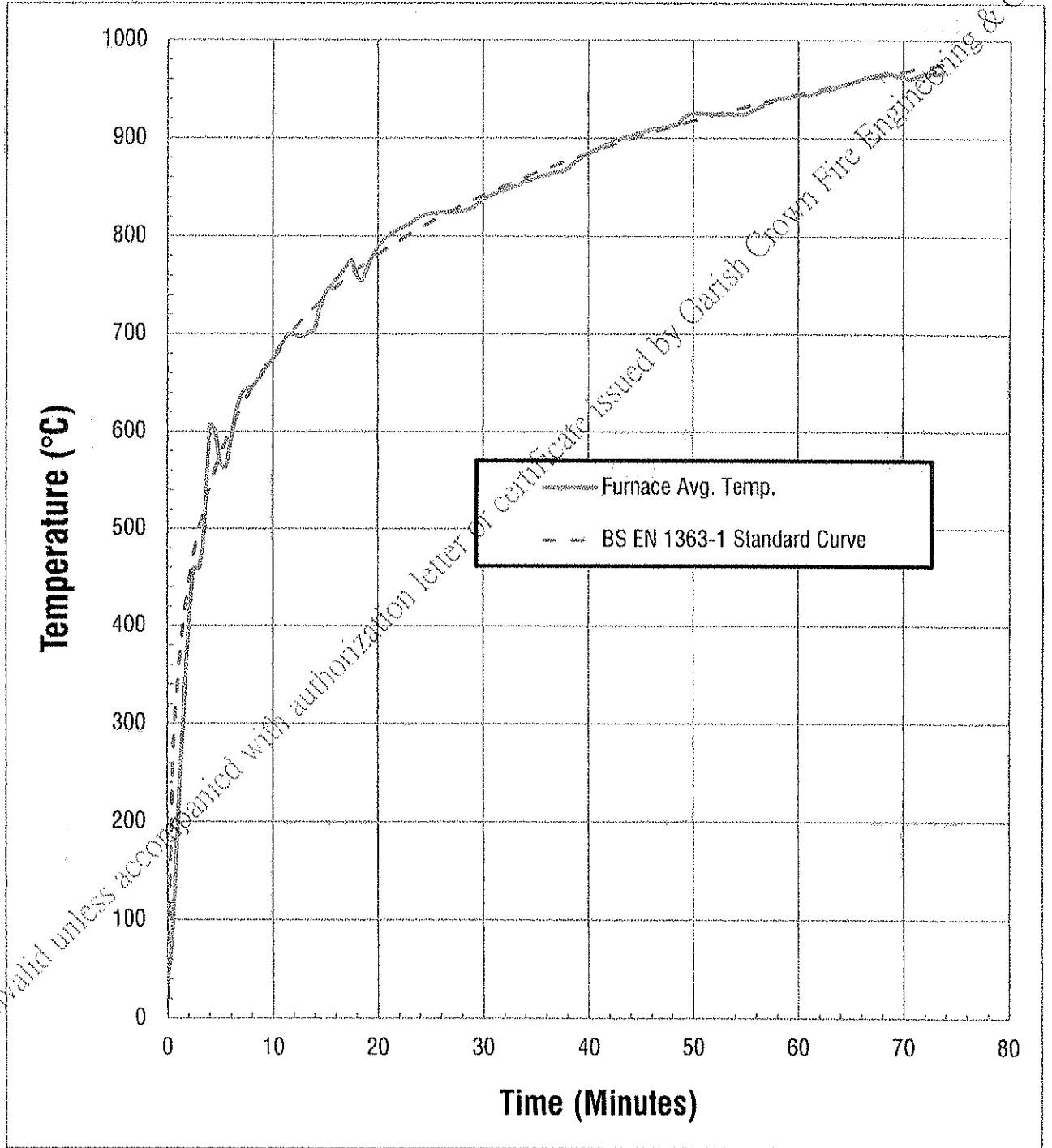
#### 6.2.2 Door B

| Gap | Measured |         |         | Declared |
|-----|----------|---------|---------|----------|
|     | Minimum  | Maximum | Average | Mean     |
| A   | 1.5      | 2.5     | 2.0     | 3        |
| B   | 2.5      | 3.0     | 2.8     | 3        |
| C   | 1.4      | 2.7     | 2.1     | 3        |
| X   | 2.0      | 3.5     | 2.6     | 4        |
| Y   | 1.1      | 2.9     | 2.1     | 3        |

### 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

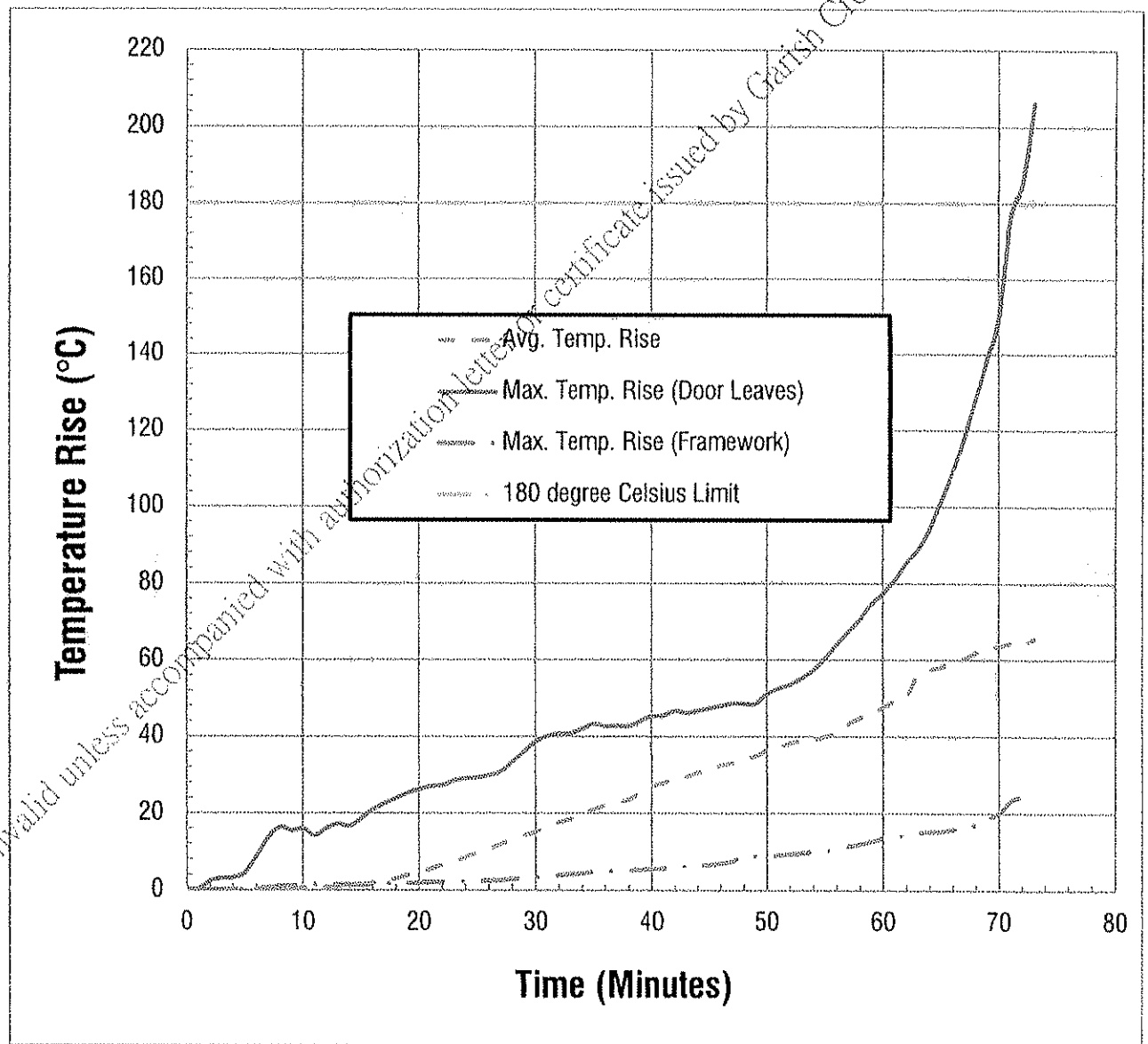
### 6.4.1 Door A

#### 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.

The maximum temperature rise of door leaves measured at 72 minute of test at U33 was 185.4°C which was in excess of 180°C limit.

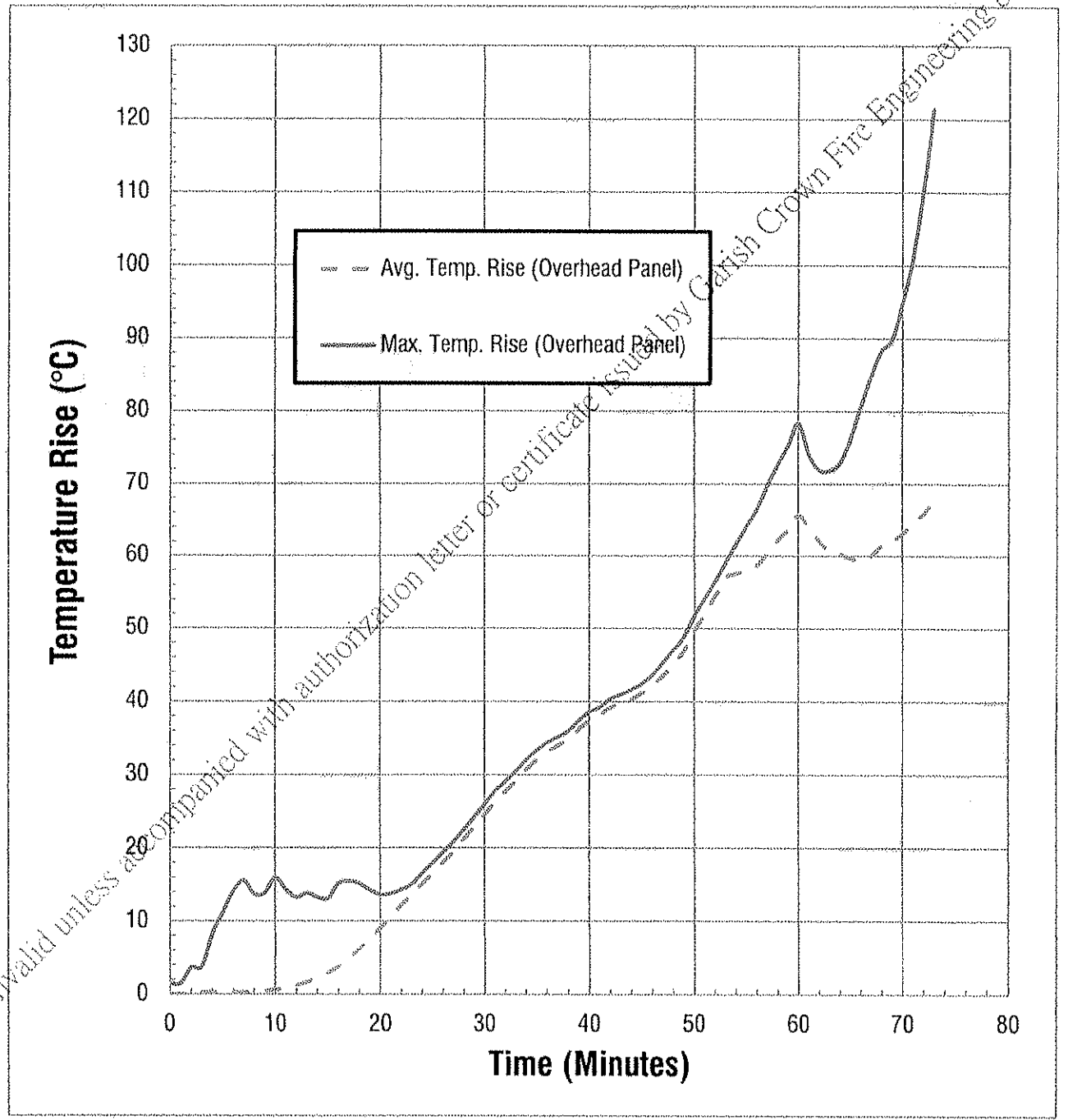
**Figure 5.** Average and maximum temperature rise on door leaves and framework on Door A over the test period.



6.4.1.2 Fixed surface thermocouples – Overhead Panel

The temperature rises of unexposed surface of Door A measured by fixed surface thermocouples on overhead panel 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.

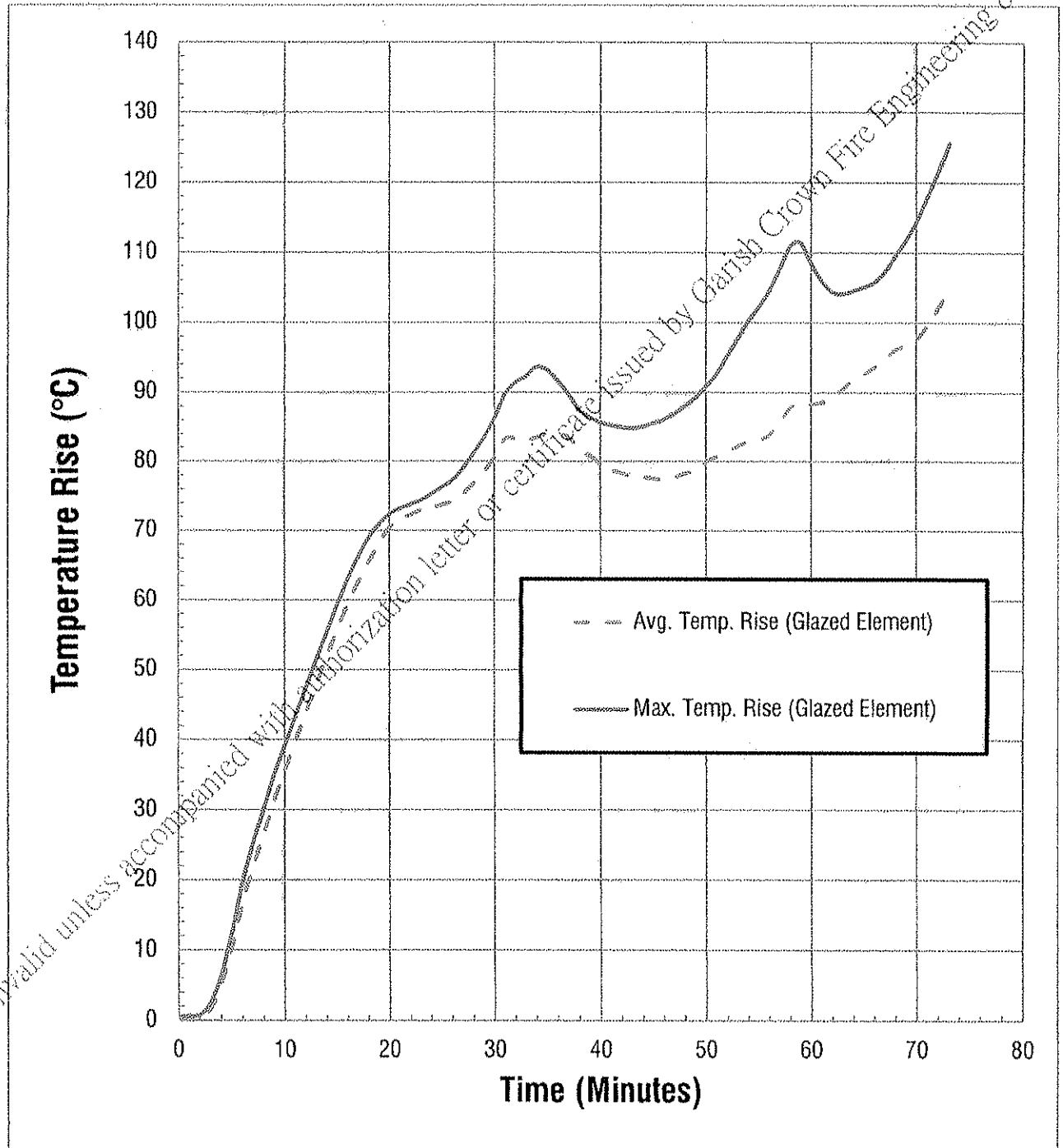




6.4.1.3 Fixed surface thermocouples – Glazed Element

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 7*.

**Figure 7.** Average and maximum temperature rise on glazed element on Door A over the test period.

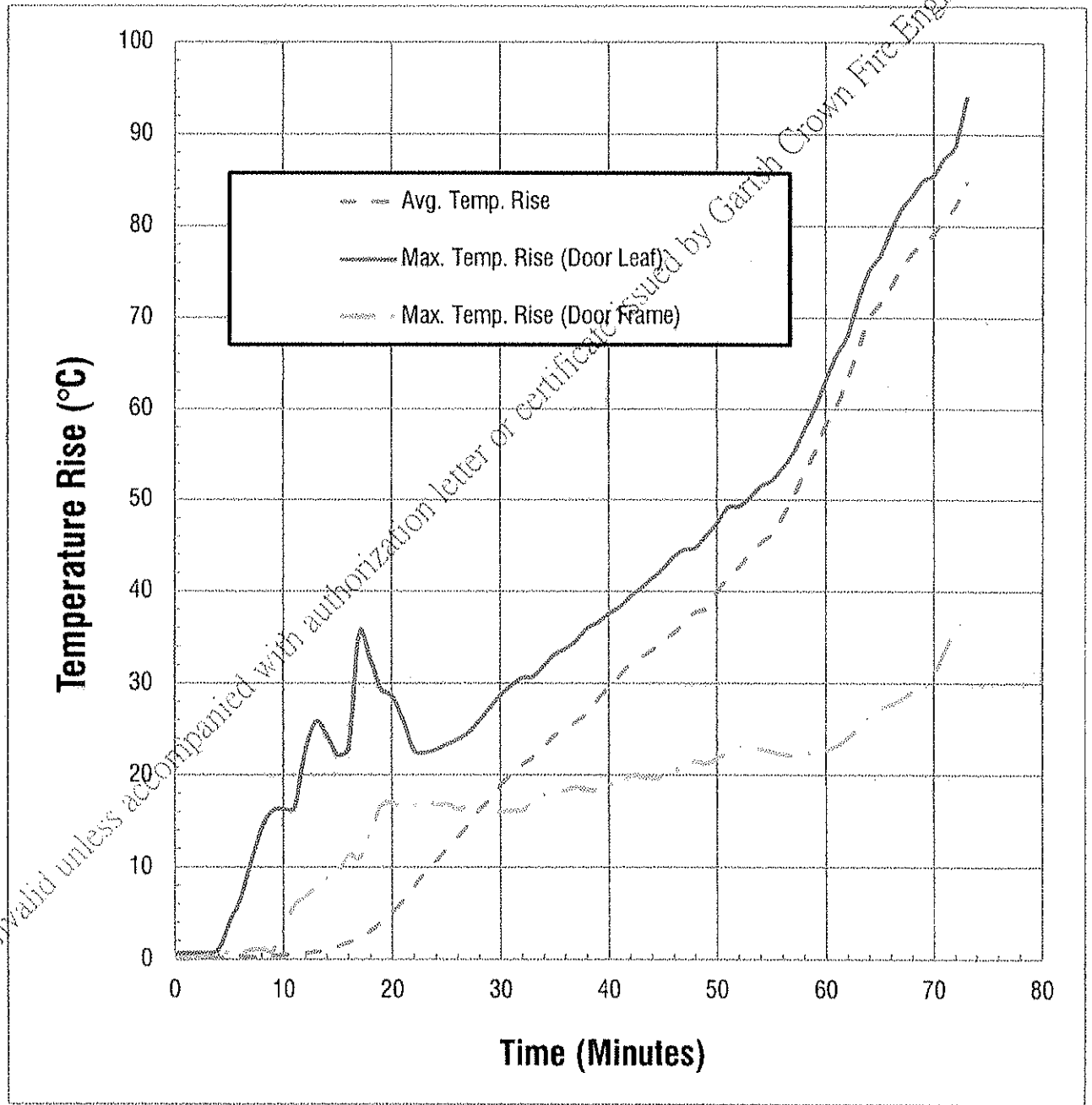


6.4.2 Door B

6.4.2.1 Fixed surface thermocouples – Door Leaf and Door Frame

The temperature rises of unexposed surface of Door B measured by fixed surface thermocouples on door leaf and door frame over the test period are shown in Figure 8.

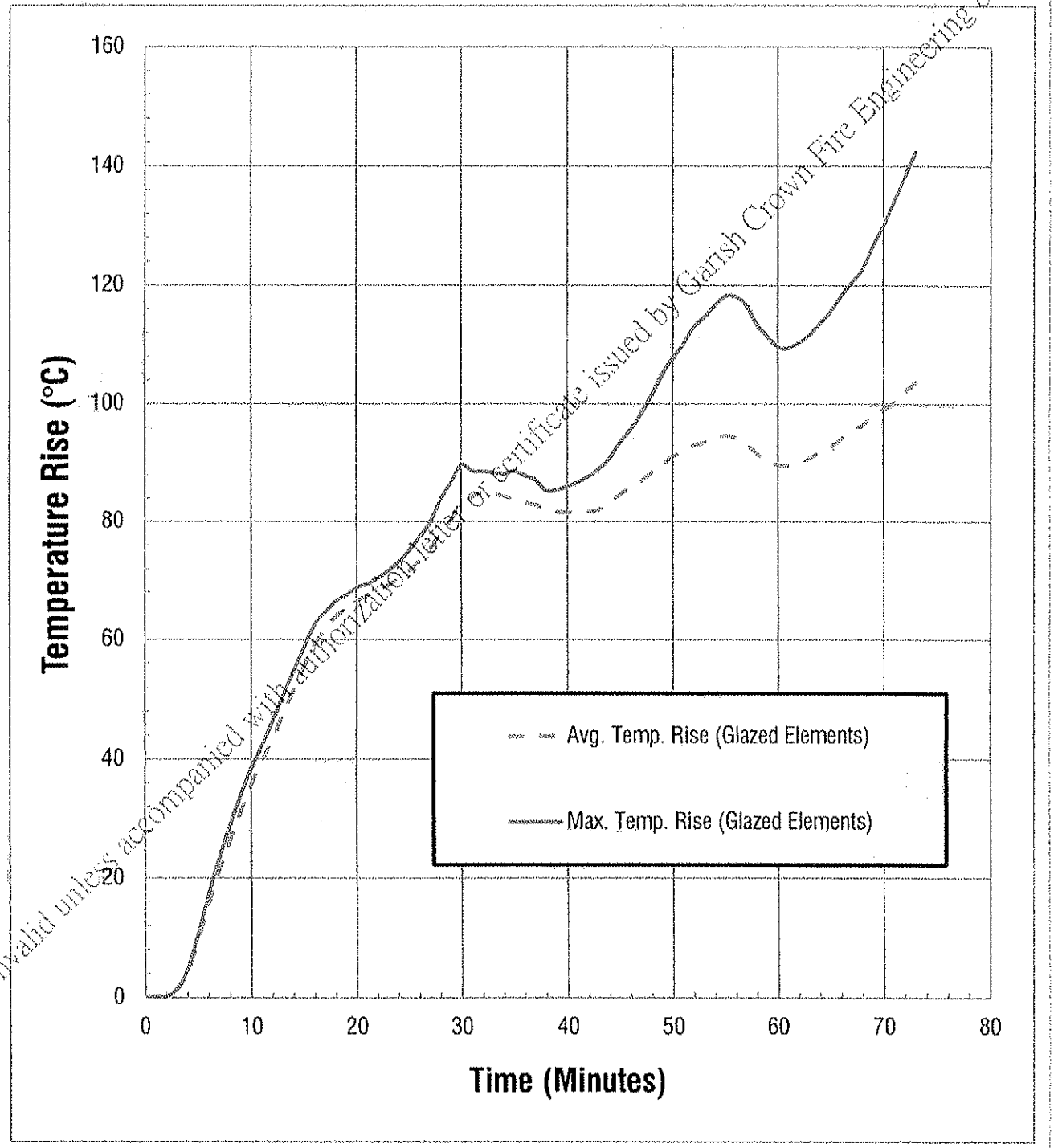
**Figure 8.** Average and maximum temperature rise on door leaf and door frame on Door B over the test period.



6.4.2.2 Fixed surface thermocouples – Glazed Elements

The temperature rises of unexposed surface of Door B measured by fixed surface thermocouples on glazed elements over the test period are shown in *Figure 9*.

**Figure 9.** Average and maximum temperature rise on glazed elements on Door B over the test period.



6.4.3 Fixed surface thermocouples – Detailed Temperature Records

The outputs of the unexposed surface thermocouples on both doors 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        | 26.2  | 26.2 | 26.3  | 26.4  | 26.3 | 25.5 | 25.0 | 24.5 | 25.8 | 23.5 |
| 5.0        | 26.5  | 26.4 | 26.3  | 26.5  | 26.8 | 25.8 | 25.7 | 24.9 | 25.9 | 24.2 |
| 10.0       | 26.5  | 26.2 | 27.3  | 26.8  | 27.0 | 25.8 | 25.4 | 24.6 | 26.2 | 24.8 |
| 15.0       | 27.5  | 26.5 | 29.5  | 28.1  | 27.2 | 26.0 | 25.6 | 25.1 | 26.5 | 25.1 |
| 20.0       | 29.9  | 27.8 | 33.5  | 31.4  | 32.2 | 27.5 | 26.7 | 26.8 | 28.8 | 27.6 |
| 25.0       | 35.4  | 29.5 | 39.6  | 37.5  | 38.2 | 30.5 | 29.1 | 29.6 | 32.9 | 33.2 |
| 30.0       | 43.0  | 31.7 | 45.0  | 44.6  | 43.6 | 34.3 | 32.8 | 33.6 | 37.2 | 37.7 |
| 35.0       | 50.3  | 36.2 | 50.7  | 51.7  | 47.7 | 38.7 | 36.4 | 38.7 | 41.5 | 41.1 |
| 40.0       | 57.8  | 42.0 | 56.4  | 59.3  | 50.6 | 42.6 | 40.4 | 45.2 | 45.6 | 44.5 |
| 45.0       | 64.5  | 41.1 | 61.9  | 66.5  | 53.8 | 47.2 | 46.5 | 51.2 | 50.4 | 47.9 |
| 50.0       | 70.0  | 47.1 | 67.5  | 71.0  | 58.4 | 51.8 | 54.4 | 57.1 | 56.9 | 51.9 |
| 55.0       | 74.1  | 42.0 | 74.0  | 79.1  | 62.1 | 57.4 | 60.3 | 64.0 | 66.3 | 56.7 |
| 60.0       | 85.1  | 44.4 | 81.6  | 91.8  | 67.0 | 62.8 | 69.0 | 73.9 | 73.3 | 61.8 |
| 65.0       | 98.0  | 51.0 | 89.8  | 107.2 | 76.4 | 69.0 | 77.6 | 82.8 | 76.6 | 67.0 |
| 70.0       | 108.9 | 57.8 | 97.5  | 105.4 | 80.1 | 75.3 | 80.9 | 84.0 | 81.0 | 73.4 |
| 71.0       | 110.6 | 58.1 | 99.1  | 105.4 | 80.5 | 77.1 | 81.6 | 81.5 | 81.8 | 75.0 |
| 72.0       | 112.4 | 53.4 | 100.7 | 105.4 | 80.9 | 78.6 | 82.7 | 78.9 | 83.1 | 76.3 |
| 73.0       | 115.1 | 52.9 | 102.6 | 105.8 | 82.9 | 79.6 | 85.1 | 78.8 | 84.1 | 78.0 |

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*Temperature outputs from unexposed surface temperature U11 to U20*

| Time (min) | U11  | U12   | U13  | U14  | U15  | U16  | U17  | U18  | U19  | U20  |
|------------|------|-------|------|------|------|------|------|------|------|------|
| 0.0        | 25.7 | 25.9  | 26.3 | 25.5 | 25.1 | 24.4 | 25.6 | 26.0 | 25.5 | 26.0 |
| 5.0        | 26.1 | 26.1  | 26.5 | 25.6 | 25.2 | 24.8 | 25.8 | 26.4 | 25.8 | 26.5 |
| 10.0       | 26.2 | 26.2  | 26.6 | 25.5 | 25.5 | 25.1 | 27.3 | 27.8 | 25.8 | 28.7 |
| 15.0       | 26.7 | 26.7  | 26.7 | 25.6 | 25.5 | 25.0 | 26.3 | 27.6 | 26.2 | 27.6 |
| 20.0       | 29.9 | 30.4  | 27.1 | 25.8 | 26.1 | 25.4 | 26.9 | 28.0 | 26.6 | 28.3 |
| 25.0       | 34.2 | 35.5  | 27.7 | 26.3 | 27.1 | 26.2 | 27.3 | 28.6 | 27.2 | 28.7 |
| 30.0       | 39.2 | 40.1  | 28.3 | 26.8 | 28.3 | 28.4 | 28.0 | 29.6 | 28.2 | 29.0 |
| 35.0       | 44.0 | 44.2  | 29.0 | 27.8 | 29.6 | 30.4 | 29.2 | 31.1 | 29.6 | 29.7 |
| 40.0       | 48.7 | 48.4  | 29.6 | 29.3 | 30.8 | 31.3 | 30.3 | 31.8 | 30.3 | 30.7 |
| 45.0       | 54.7 | 53.4  | 30.3 | 30.5 | 32.1 | 32.8 | 31.7 | 32.9 | 31.7 | 32.3 |
| 50.0       | 60.9 | 59.5  | 31.1 | 32.1 | 33.0 | 34.5 | 33.7 | 34.0 | 33.2 | 35.1 |
| 55.0       | 64.8 | 64.7  | 32.2 | 33.8 | 35.0 | 35.4 | 35.2 | 35.3 | 34.0 | 36.6 |
| 60.0       | 70.2 | 70.3  | 33.5 | 35.3 | 36.5 | 37.4 | 36.4 | 37.0 | 35.7 | 39.9 |
| 65.0       | 74.5 | 76.7  | 35.4 | 37.0 | 38.3 | 39.5 | 39.9 | 39.2 | 38.9 | 41.7 |
| 70.0       | 82.8 | 101.4 | 37.1 | 38.5 | 40.7 | 43.1 | 46.5 | 41.6 | 40.4 | 45.2 |
| 71.0       | 86.3 | 106.3 | 37.6 | 39.3 | 41.2 | 44.2 | 49.6 | 42.0 | 41.0 | 46.1 |
| 72.0       | 91.4 | 106.2 | 38.1 | 39.8 | 41.7 | 45.1 | 51.0 | 42.5 | 41.7 | 46.9 |
| 73.0       | 98.2 | 106.8 | 38.3 | 39.9 | 42.0 | 46.1 | 52.7 | 43.3 | 43.0 | 47.0 |

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*Temperature outputs from unexposed surface temperature U21 to U31*

| Time (min) | U21   | U22   | U23   | U24  | U25   | U26   | U27  | U28   | U29  | U30  | U31   |
|------------|-------|-------|-------|------|-------|-------|------|-------|------|------|-------|
| 0.0        | 26.0  | 25.3  | 24.9  | 24.4 | 26.1  | 25.4  | 25.9 | 26.0  | 26.4 | 25.6 | 25.2  |
| 5.0        | 37.9  | 32.5  | 36.9  | 24.7 | 26.6  | 25.7  | 26.2 | 26.4  | 26.5 | 25.7 | 25.7  |
| 10.0       | 64.6  | 57.2  | 61.3  | 24.9 | 26.9  | 25.6  | 26.4 | 26.5  | 26.5 | 25.9 | 25.9  |
| 15.0       | 84.8  | 78.3  | 80.5  | 27.1 | 29.3  | 26.2  | 26.5 | 27.0  | 26.9 | 26.3 | 27.6  |
| 20.0       | 97.8  | 93.4  | 96.3  | 33.0 | 35.7  | 29.1  | 28.0 | 30.0  | 29.5 | 28.3 | 33.5  |
| 25.0       | 101.7 | 97.1  | 98.8  | 40.3 | 43.2  | 33.5  | 30.7 | 32.9  | 33.4 | 31.5 | 38.9  |
| 30.0       | 111.7 | 100.1 | 106.0 | 48.3 | 51.3  | 38.2  | 35.0 | 36.0  | 38.0 | 35.9 | 43.5  |
| 35.0       | 118.6 | 108.3 | 101.3 | 55.8 | 58.6  | 42.2  | 39.0 | 39.2  | 42.3 | 40.4 | 47.9  |
| 40.0       | 111.1 | 102.4 | 101.6 | 61.4 | 63.9  | 47.1  | 42.7 | 43.2  | 45.8 | 45.1 | 52.2  |
| 45.0       | 111.0 | 97.2  | 100.7 | 65.1 | 67.8  | 52.6  | 47.5 | 48.2  | 50.0 | 51.9 | 56.1  |
| 50.0       | 116.3 | 97.8  | 102.1 | 72.7 | 77.1  | 56.1  | 52.9 | 53.6  | 54.2 | 59.0 | 59.8  |
| 55.0       | 127.7 | 94.2  | 103.8 | 77.0 | 89.4  | 61.9  | 57.7 | 59.6  | 59.4 | 66.1 | 64.2  |
| 60.0       | 133.9 | 94.0  | 113.4 | 78.2 | 103.6 | 67.9  | 65.0 | 69.3  | 64.7 | 74.3 | 72.0  |
| 65.0       | 130.5 | 96.4  | 127.3 | 81.7 | 88.2  | 81.7  | 75.3 | 87.3  | 73.2 | 97.2 | 95.9  |
| 70.0       | 139.8 | 101.0 | 128.4 | 86.4 | 90.3  | 94.9  | 79.4 | 92.9  | 88.7 | 84.4 | 120.1 |
| 71.0       | 143.2 | 101.7 | 129.9 | 87.9 | 91.9  | 98.4  | 80.1 | 94.2  | 92.5 | 84.4 | 126.3 |
| 72.0       | 146.7 | 102.9 | 132.5 | 89.1 | 93.2  | 102.2 | 81.1 | 97.1  | 95.7 | 83.3 | 135.4 |
| 73.0       | 151.1 | 105.2 | 135.4 | 90.4 | 95.6  | 106.1 | 81.2 | 100.5 | 99.9 | 82.8 | 146.7 |

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*Temperature outputs from unexposed surface temperature U43 to U53*

| Time (min) | U43   | U44   | U45   | U46   | U47   | U48   | U49   | U50   | U51  | U52  | U53  |
|------------|-------|-------|-------|-------|-------|-------|-------|-------|------|------|------|
| 0.0        | 26.4  | 26.0  | 26.7  | 25.5  | 24.8  | 24.7  | 26.0  | 25.6  | 25.1 | 25.9 | 25.9 |
| 5.0        | 36.5  | 26.3  | 27.0  | 25.7  | 25.2  | 24.9  | 26.1  | 26.0  | 25.3 | 26.1 | 26.2 |
| 10.0       | 41.2  | 26.6  | 27.9  | 25.8  | 25.0  | 25.9  | 26.2  | 26.0  | 25.3 | 27.0 | 26.7 |
| 15.0       | 38.3  | 26.9  | 29.7  | 26.6  | 25.5  | 27.6  | 27.0  | 27.1  | 25.6 | 31.9 | 27.4 |
| 20.0       | 38.9  | 28.8  | 34.0  | 29.2  | 27.7  | 33.2  | 30.7  | 31.5  | 26.7 | 35.9 | 30.6 |
| 25.0       | 40.9  | 32.6  | 39.1  | 36.3  | 34.7  | 40.0  | 36.9  | 38.9  | 29.5 | 40.5 | 35.2 |
| 30.0       | 44.4  | 37.2  | 44.4  | 42.9  | 41.0  | 48.0  | 43.9  | 45.3  | 33.3 | 45.3 | 39.7 |
| 35.0       | 47.7  | 41.8  | 49.4  | 48.6  | 46.4  | 53.3  | 50.0  | 50.0  | 37.2 | 49.5 | 43.9 |
| 40.0       | 51.9  | 47.1  | 54.3  | 54.8  | 51.9  | 57.0  | 56.4  | 54.8  | 41.4 | 53.1 | 47.6 |
| 45.0       | 57.4  | 52.6  | 60.1  | 60.3  | 57.3  | 61.7  | 61.9  | 59.0  | 46.0 | 56.3 | 52.4 |
| 50.0       | 63.0  | 58.5  | 65.6  | 66.8  | 62.8  | 67.8  | 66.5  | 62.2  | 52.6 | 61.1 | 57.1 |
| 55.0       | 68.8  | 63.2  | 71.4  | 74.6  | 67.1  | 76.4  | 71.9  | 67.7  | 58.3 | 67.1 | 62.7 |
| 60.0       | 77.3  | 71.1  | 77.7  | 88.5  | 78.3  | 88.5  | 83.5  | 79.0  | 64.7 | 74.2 | 67.7 |
| 65.0       | 92.1  | 81.8  | 82.8  | 102.1 | 92.6  | 100.0 | 96.2  | 93.2  | 71.8 | 78.2 | 74.0 |
| 70.0       | 117.2 | 96.9  | 95.8  | 110.9 | 99.7  | 105.9 | 101.9 | 103.9 | 78.9 | 82.8 | 83.3 |
| 71.0       | 122.4 | 101.5 | 98.6  | 112.8 | 102.6 | 107.1 | 103.2 | 105.4 | 80.6 | 84.7 | 85.8 |
| 72.0       | 128.0 | 106.4 | 101.4 | 113.4 | 104.2 | 108.1 | 104.7 | 107.2 | 82.4 | 86.6 | 87.4 |
| 73.0       | 134.6 | 110.9 | 104.2 | 115.7 | 107.8 | 110.9 | 106.3 | 109.6 | 83.8 | 88.6 | 89.1 |

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*Temperature outputs from unexposed surface temperature U54 to U64*

| Time (min) | U54  | U55  | U56  | U57  | U58   | U59   | U60   | U61  | U62  | U63   | U64   |
|------------|------|------|------|------|-------|-------|-------|------|------|-------|-------|
| 0.0        | 25.0 | 24.5 | 24.8 | 25.5 | 25.3  | 25.5  | 25.4  | 25.8 | 24.6 | 24.4  | 23.6  |
| 5.0        | 25.2 | 25.1 | 25.0 | 26.1 | 36.4  | 34.8  | 34.8  | 26.1 | 29.4 | 24.9  | 24.4  |
| 10.0       | 25.1 | 26.3 | 28.8 | 26.7 | 63.9  | 58.2  | 61.3  | 26.4 | 41.7 | 29.6  | 28.3  |
| 15.0       | 25.2 | 28.3 | 34.8 | 27.2 | 84.2  | 76.7  | 82.2  | 27.3 | 47.5 | 44.7  | 30.2  |
| 20.0       | 25.2 | 27.2 | 42.3 | 34.3 | 94.2  | 88.7  | 92.7  | 29.6 | 37.3 | 46.7  | 54.0  |
| 25.0       | 25.7 | 27.1 | 42.2 | 32.5 | 100.4 | 92.7  | 98.1  | 33.9 | 36.7 | 48.7  | 46.2  |
| 30.0       | 26.1 | 27.2 | 41.3 | 33.1 | 115.2 | 100.2 | 109.8 | 39.1 | 40.1 | 54.0  | 48.2  |
| 35.0       | 26.5 | 27.7 | 43.5 | 35.3 | 110.9 | 102.8 | 114.1 | 43.7 | 44.3 | 58.5  | 50.9  |
| 40.0       | 27.4 | 28.2 | 44.3 | 37.4 | 111.5 | 102.7 | 107.0 | 48.7 | 48.4 | 62.9  | 54.3  |
| 45.0       | 28.5 | 28.9 | 45.3 | 39.8 | 118.9 | 101.4 | 109.8 | 53.6 | 52.2 | 67.8  | 60.4  |
| 50.0       | 30.1 | 29.8 | 47.2 | 41.3 | 133.1 | 103.3 | 113.1 | 60.2 | 56.6 | 72.8  | 66.9  |
| 55.0       | 31.4 | 30.7 | 47.8 | 42.6 | 143.6 | 101.9 | 114.7 | 66.4 | 61.3 | 77.4  | 71.8  |
| 60.0       | 32.7 | 31.8 | 48.1 | 44.1 | 135.1 | 100.7 | 109.4 | 73.0 | 64.4 | 84.1  | 78.0  |
| 65.0       | 34.4 | 32.9 | 52.6 | 45.0 | 141.0 | 102.0 | 111.8 | 80.1 | 67.8 | 92.0  | 85.9  |
| 70.0       | 36.4 | 34.0 | 56.4 | 46.5 | 155.5 | 103.4 | 114.4 | 88.0 | 71.9 | 104.9 | 98.8  |
| 71.0       | 36.9 | 34.3 | 58.9 | 47.2 | 159.6 | 104.4 | 113.0 | 90.4 | 72.7 | 109.4 | 102.3 |
| 72.0       | 37.2 | 34.4 | 61.4 | 47.7 | 163.6 | 105.1 | 113.9 | 93.0 | 73.5 | 114.1 | 106.9 |
| 73.0       | 37.5 | 34.8 | 62.1 | 47.8 | 167.9 | 105.8 | 113.5 | 95.4 | 74.6 | 119.4 | 111.4 |

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### 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.

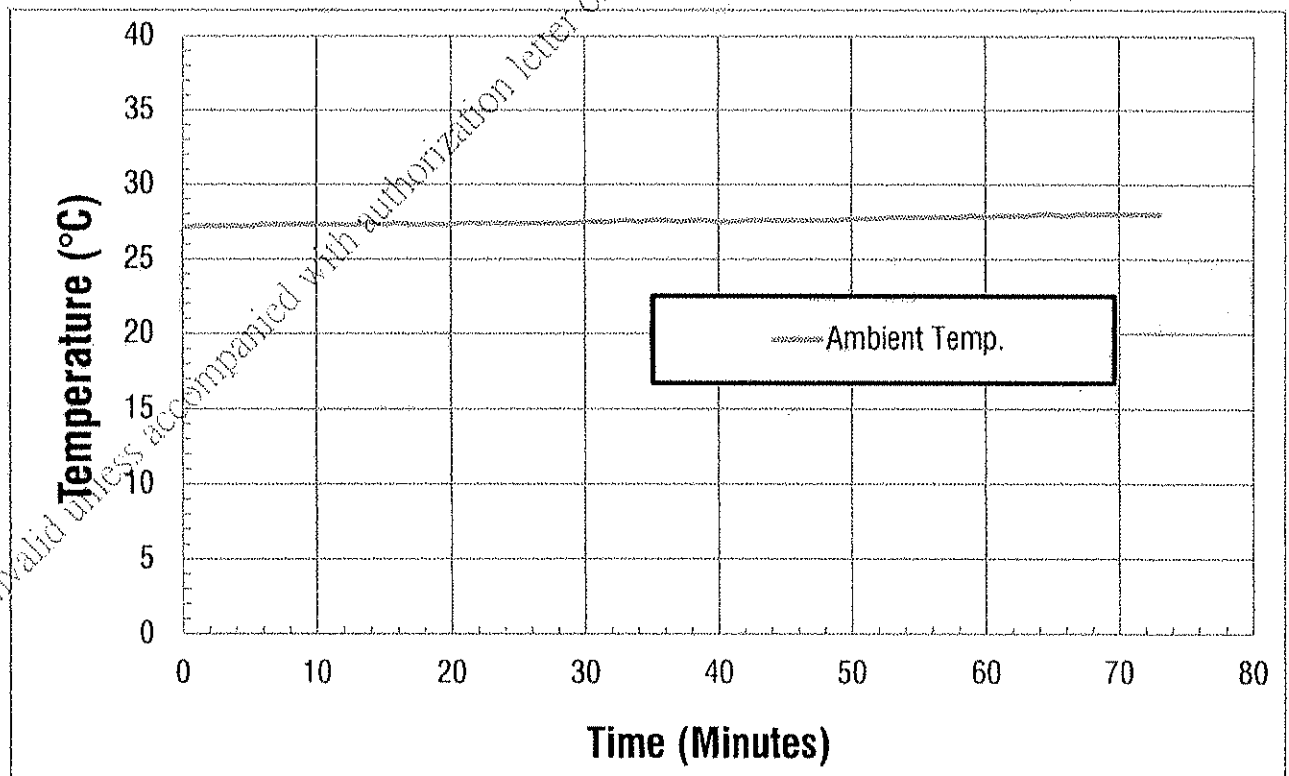
| Time (min) | Pressure | Time (min) | Pressure |
|------------|----------|------------|----------|
| 6.0        | 0.2      | 45.0       | -1.6     |
| 10.0       | 0.3      | 50.0       | 0.2      |
| 15.0       | -0.7     | 55.0       | -0.4     |
| 20.0       | -0.3     | 60.0       | 0.3      |
| 25.0       | 0.0      | 65.0       | 0.3      |
| 30.0       | 0.1      | 70.0       | 0.0      |
| 35.0       | 0.2      | 73.0       | -0.1     |
| 40.0       | -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 27.1°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 -25 mm at D5 at 60 minute of test; maximum deflection measured on Door B was +24 mm at D15 at 60 minute of test.

| Position \ Time (min) |     | 0  | 10 | 20  | 30  | 40  | 50  | 60  |
|-----------------------|-----|----|----|-----|-----|-----|-----|-----|
| Door A                | D1  | +0 | +0 | +0  | +0  | +0  | +0  | +2  |
|                       | D2  | +0 | +0 | +0  | -2  | -5  | -10 | -14 |
|                       | D3  | +0 | +2 | +3  | +5  | +6  | +10 | +20 |
|                       | D4  | +0 | +1 | +2  | +4  | +2  | +0  | +6  |
|                       | D5  | +0 | +0 | -3  | -8  | -14 | -22 | -25 |
|                       | D6  | +0 | +4 | +4  | +2  | -1  | -3  | -3  |
|                       | D7  | +0 | +1 | +2  | +5  | +7  | +9  | +13 |
|                       | D8  | +0 | +2 | +4  | +9  | +7  | +7  | +9  |
|                       | D9  | +0 | +2 | +8  | +1  | +0  | -1  | +1  |
|                       | D10 | +0 | +6 | +10 | +12 | +17 | +20 | +23 |
|                       | D11 | +0 | +2 | +2  | +2  | +2  | +2  | +3  |
| Door B                | D12 | +0 | +1 | -3  | +2  | +2  | +5  | +6  |
|                       | D13 | +0 | +1 | +0  | +0  | +0  | +0  | +0  |
|                       | D14 | +0 | +6 | +5  | +3  | +2  | +5  | +11 |
|                       | D15 | +0 | +7 | +14 | +17 | +19 | +20 | +24 |
|                       | D16 | +0 | +5 | +10 | +11 | +12 | +15 | +16 |
|                       | D17 | +0 | +2 | +10 | +13 | +15 | +15 | +15 |
|                       | D18 | +0 | +2 | +3  | +3  | +3  | +3  | +3  |

## 6.8 Observations

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

Photos taken during the test period are also attached.

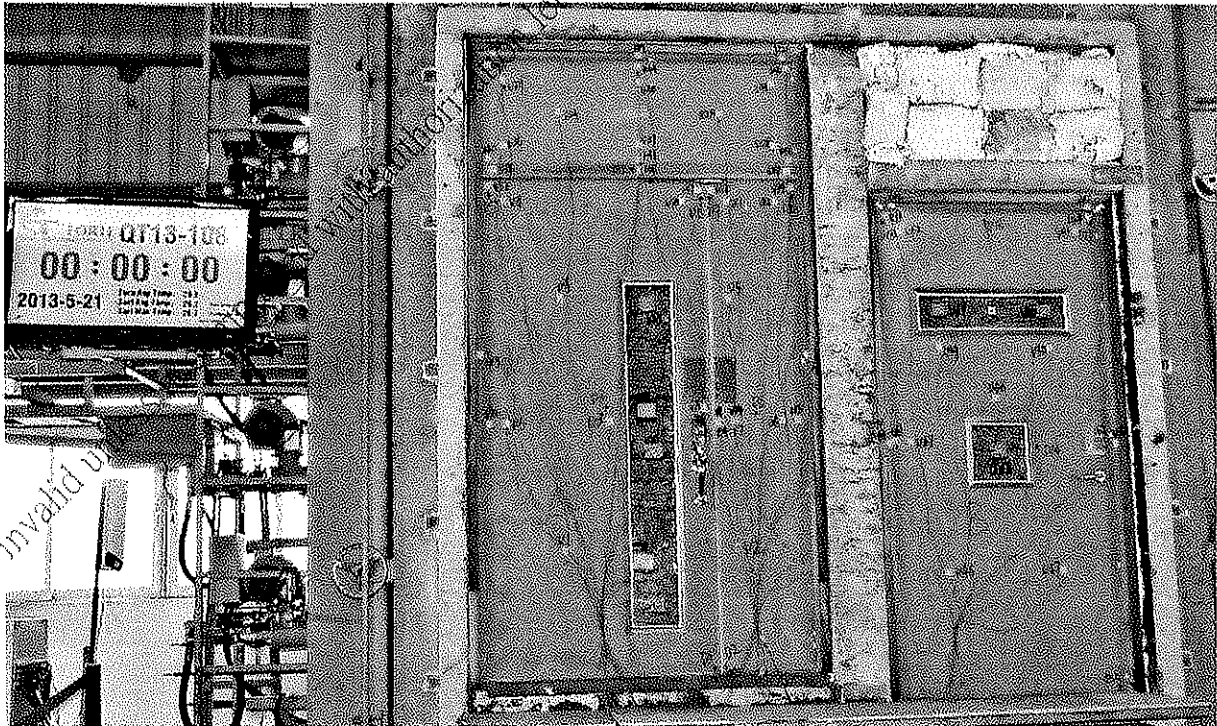
| Time (min. sec) | Observation (from unexposed side)  |
|-----------------|--|
| 00.00           | Test Started.  |
| 01.09           | <b>Door A:</b> Smoke was released from the top of meeting edge.<br><b>Door B:</b> Smoke was released from the top edge of door leaf.   |
| 01.57           | <b>Door A &amp; B:</b> The interlayer of the glass panes started to react. The glass panes turned into white color.  |
| 03.24           | <b>Door A &amp; B:</b> More smoke was released from the edges of the door leaves.  |
| 05.23           | <b>Door A &amp; B:</b> The glass panes turned into slight brown in color.<br><b>Door A:</b> The amount of smoke released from the top of meeting edge and the edge near door lock increased.<br><b>Door B:</b> Smoke was continuously released from the door edge next to the door lock and the conceal door closer. |
| 08.17           | <b>Door A:</b> Smoke was continuously released from the top corners, top of meeting edge, door lock positions and also the top left corner of the overhead panel.<br><b>Door B:</b> More smoke was released from the edge next to door lock and the conceal door closer.   |
| 11.22           | <b>Door A &amp; B:</b> The glass panes turned back to white in color.<br><b>Door A:</b> The amount of smoke reduced.<br><b>Door B:</b> Smoke was released from the top left corner, the conceal door closer and the door lock positions.   |
| 17.52           | <b>Door A:</b> Smoke was released from the door lock.<br><b>Door B:</b> The area along the door edge around conceal door closer was darkened.  |
| 22.32           | <b>Door B:</b> The amount of smoke released from the edges of the door leaf reduced.   |
| 25.40           | <b>Door A:</b> Smoke was released from the top of meeting edge and the door lock. The meeting edge next to door lock was darkened.   |
| 28.34           | <b>Door A &amp; B:</b> The glass panes turned deeper in color.   |
| 29.24           | <b>Door B:</b> Cotton fibre pad test was carried out over the conceal door closer position. No flaming or glowing on the cotton pad was observed.  |
| 30.00           | <b>Door A and Door B: No integrity failure had occurred.</b>   |
| 31.25           | <b>Door A:</b> Unexposed surface of the glass pane cracked.<br><b>Door B:</b> Unexposed surface of the lower glass pane cracked.   |

| Time (min-sec) | Observation (from unexposed side)  |
|----------------|--|
| 35.01          | <b>Door A:</b> The meeting edge of active leaf moved inwards the furnace and separated from the inactive leaf. Smoke was released from the meeting edge next to door lock and the region was darkened. |
| 36.05          | <b>Door B:</b> Smoke was released from the top left corner and the conceal door closer position.   |
| 46.42          | <b>Door A:</b> More cracks on the unexposed surface of the glass pane.<br><b>Door B:</b> Smoke was released from the top left corner and the conceal door closer.                                      |
| 48.22          | <b>Door A:</b> Cotton fibre pad test was carried out at the meeting edge next to door lock. No flaming or glowing on the cotton pad was observed.  |
| 49.28          | <b>Door B:</b> Cotton fibre pad test was carried out at the top left corner of the door leaf. No flaming or glowing on the cotton pad was observed.  |
| 53.16          | <b>Door A:</b> The meeting edge of active leaf further separated from the inactive leaf. The meeting edge around door lock position was further darkened.  |
| 55.06          | <b>Door B:</b> Smoke was released from the top left corner and the conceal door closer. The top left corner was darkened.  |
| 56.03          | <b>Door A:</b> Cotton fibre pad test was carried out at the meeting edge next to door lock. No flaming or glowing on the cotton pad was observed.  |
| 57.04          | <b>Door B:</b> Cotton fibre pad test was carried out at the top left corner of the door leaf. No flaming or glowing on the cotton pad was observed.  |
| <b>60.00</b>   | <b>Door A and Door B: No integrity failure had occurred.</b>   |
| 60.07          | <b>Door A:</b> Glowing red spots was observed at the meeting edge next to door lock. The region around the door lock was deeply darkened.  |
| 61.34          | <b>Door A:</b> Cotton fibre pad test was carried out at the meeting edge next to door lock. No flaming or glowing on the cotton pad was observed.  |
| 62.07          | <b>Door A:</b> Smoke was released from the cracks on glass pane.   |
| 63.49          | <b>Door B:</b> Cotton fibre pad test was carried out at the top left corner of the door leaf. No flaming or glowing on the cotton pad was observed.  |
| 65.09          | <b>Door B:</b> Smoke was released from the top right corner of the top glazed element.   |
| <b>66.27</b>   | <b>Door A:</b> Sustained flaming was observed at the meeting edge next to door lock.<br><b>INTEGRITY FAILURE OCCURRED on DOOR A</b>  |
| 68.13          | <b>Door B:</b> Cotton fibre pad test was carried out at the top left corner of the door leaf. No flaming or glowing on the cotton pad was observed.  |
| 72.32          | <b>Door B:</b> Cotton fibre pad test was carried out at the top left corner of the door leaf. No flaming or glowing on the cotton pad was observed.  |
| <b>73.51</b>   | <b>Test was terminated at request of the Sponsor.</b>  |

6.9 Photos



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



**Photo 2.** Unexposed surface of the specimens before the commencement of test. (Left: Door A; Right: Door B)





**Photo 3.** Unexposed surface of the specimens at 30 minute of test.



**Photo 4.** Unexposed surface of the specimens at 60 minute of test.



**Photo 5.** Unexposed surface of the specimens at 73 minute of test.



**Photo 6.** Exposed surface of the specimens after test.



## 7. Test Results

### 7.1 Door A

The test on Door A was terminated after a test period of 73 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 |                         |
|---|---|--|-------------------------|
| <b>Integrity (E)</b>  |   |  |                         |
| 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  | 66 minutes                             |                         |
| Gap Gauge   | Ø6 mm<br>Penetration of the gauge into the furnace through the specimens and movable along a 150 mm gap   | 73 minutes (No Failure)                |                         |
|   | Ø25 mm<br>Penetration of the gauge into the furnace through the specimens   |  |                         |
| Cotton Pad  | Ignition of the cotton pad  | 73 minutes (No Failure)                |                         |
| Performance Criteria  |   | Elapsed Time before Failure Occurrence |                         |
| <b>Insulation (I)</b>   |   |  |                         |
| 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 | 66 minutes                             |                         |
| Average Temperature Rise  | An increase of the average temperature of unexposed surface of the specimens above the initial average temperature by more than 140 °C          | [Door Leaves and Framework]            | 73 minutes (No Failure) |
|   |   | [Overhead Panel]                       | 73 minutes (No Failure) |
|   |   | [Glazed Element]                       | 73 minutes (No Failure) |
| Maximum Temperature Rise [Supplementary Procedure, I <sub>1</sub> ] | An increase of temperature at any other point of the specimens above the initial average temperature by more than 180 °C                        | [Door Leaves and Framework]            | 72 minutes              |
|   |   | [Overhead Panel]                       | 73 minutes (No Failure) |
|   |   | [Glazed Element]                       | 73 minutes (No Failure) |

7.2 Door B

The test on Door B was terminated after a test period of 73 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  |  |                            |
|--|--|---|--|----------------------------|
| <b>Integrity (E)</b>   |  |   |  |                            |
| 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  | 73 minutes (No Failure)                |                            |
| Gap Gauge  | Ø6 mm  | Penetration of the gauge into the furnace through the specimens and movable along a 150 mm gap  | 73 minutes (No Failure)                |                            |
|  | Ø25 mm   | Penetration of the gauge into the furnace through the specimens   |  |                            |
| Cotton Pad   |  | Ignition of the cotton pad  | 73 minutes (No Failure)                |                            |
| Performance Criteria   |  | Elapsed Time before Failure Occurrence  |  |                            |
| <b>Insulation (I)</b>  |  |   |  |                            |
| 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 | 73 minutes<br>(No Failure)             |                            |
| Average Temperature Rise   | An increase of the average temperature of unexposed surface of the specimens above the initial average temperature by more than 140 °C |   | [Door Leaf and Door Frame]             | 73 minutes<br>(No Failure) |
|  |  |   | [Glazed Elements]                      | 73 minutes<br>(No Failure) |
| Maximum Temperature Rise<br>[Supplementary Procedure, I <sub>1</sub> ] | An increase of temperature at any other point of the specimens above the initial average temperature by more than 180 °C               |   | [Door Leaf and Door Frame]             | 73 minutes<br>(No Failure) |
|  |  |   | [Glazed Elements]                      | 73 minutes<br>(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.

**END OF REPORT**