FUGRO TECHNICAL SERVICES (GUANGZHOU) LIMITED
No.6, Nongye Gongsi Road
Caotang, Hualong, Panyu
Guangzhou
China

REPORT ON FIRE RESISTANCE TEST OF METAL DOORSET

Client	: HK Pro-Tech Fire Prevention Building Materials Limited
Project	: Fire Resistance Test on Metal Doorset in accordance with BS EN 1634-1:2014+A1:2018
Client Ref.	: -
Report No.	: G22094FU226158
Date of Report Issue	: 13 Oct 2023

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REPORT ON FIRE RESISTANCE TEST

1. Introduction

Fugro Technical Services (Guangzhou) Limited was commissioned by HK Pro-Tech Fire Prevention Building Materials Limited to determine the fire resistance performance of a single-acting, double-leaf and a single-acting, single-leaf metal doorset in accordance with BS EN 1634-1: 2014+A1:2018.

The doorset is required to provide a fire separating function and the test was therefore conducted in accordance with BS EN 1634-1: 2014+A1:2018, 'Fire resistance and smoke control tests for door and shutter assemblies, openable windows and elements of building hardware – Part 1: Fire resistance tests for door and shutter assemblies and openable windows'. This test report should be read in conjunction with that Standard and with BS EN 1363-1: 2020, 'Fire resistance tests – Part 1: General requirement' and BS EN 1363-2: 1999, 'Fire resistance tests – Part 2: Alternative and additional procedures'.

The specimen was received on 31 March 2023 and given a Lab. Sample I.D.: FU226158.

The test was conducted at No.8, Hougang Industrial Street, Shachong, Dalong, Panyu, Guangzhou, China on 11 April 2023.

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2. Summary

The performance of the specimen was judged against the criteria for integrity and insulation, as required by BS EN 1634-1: 2014+A1:2018, and the results obtained were as follows:

The double-leaf door:

Integrity (E)	Sustained flaming	132 minutes, no failure
	Gap gauge	132 minutes, no failure
	Cotton pad	132 minutes, no failure
Insulation (Classification I_2)	Door leaves	132 minutes, no failure
	Door frame	132 minutes, no failure
	Glazed panel	132 minutes, no failure
	Louver A	132 minutes, no failure
	Louver B	132 minutes, no failure
	Transom panel A	132 minutes, no failure

The single-leaf door:

Integrity (E)	Sustained flaming	132 minutes, no failure
	Gap gauge	132 minutes, no failure
	Cotton pad	132 minutes, no failure
Insulation (Classification I_2)	Door leaf	132 minutes, no failure
	Door frame	132 minutes, no failure
	Transom panel B	132 minutes, no failure

The test was discontinued after a period of 132 minutes at the request of the client.

Approved Signatory:

Yan Cai Sheng
Deputy General Manager

Date of Report Issued : 13 Oct 2023

3. Client Information

Client : HK Pro-Tech Fire Prevention Building Materials Limited

Client Address : Unit A, 1/F, Hang Seng Centre, 95-97 Tung Chau Street, Tai Kok Tsui, Kowloon

Manufacturer : Dongguan City Teliang Fire Doors and Windows Co., Ltd

Manufacturer Address: Room 101-102, Building No. 1 Huguang Road No. 617, Qishi Town, Dongguan City, Guangdong Province, China

4. Test Specimen

The doorset had overall nominal dimensions of 3002 mm high by 3002 mm wide by 103 mm thick. It incorporated three door leaves of overall nominal dimensions of 2608 mm high by 1314 mm wide by 60 mm thick, 2608 mm high by 600 mm wide by 60 mm thick and 2355 mm high by 941 mm wide by 60 mm thick respectively.

The perimeter door frame had overall sectional dimensions of 55 mm wide by 103 mm thick with 20 mm deep rebate. The transom and mullion had over sectional dimensions of 102 mm wide by 103 mm thick with 20 mm deep rebate on both sides. The perimeter door frame was comprised of 1 no.25 mm by 50 mm by 2 mm thick mild steel hollow section with four layers MgO board infilling, and separated by a layer of 6 + 8 mm thick MgO board on the unexposed face and two layers 15 mm thick MgO board on the exposed face with 1.2 mm thick G.M.S. The transom and mullion were comprised of 1 no.50 mm by 50 mm by 2 mm thick mild steel hollow section with three layers 15 mm thick MgO board infilling, and separated by a layer of 6 + 8 mm thick MgO board on the unexposed face and two layers 15 mm thick MgO board on the exposed face with 1.2 mm thick G.M.S. The door frame was fixed to the supporting construction by M10 x 80 mm anchor bolts with steel plate at maximum 800 mm centre to centre. The gap between the door frame and the supporting construction was filled with cement mortar.

Each leaf and each transom panel had a core construction of 21 mm thick rock wool + 3 mm thick acoustic panel + 21 mm thick rock wool and sandwiched by 6 mm thick MgO board with 1.0 mm thick G.M.S on each face. Each leaf and each transom panel rails and stiles were made of a no. 2 mm thick G.M.S C-channel with 6 layers MgO board infilling. The rebate was rebated unequal at the meeting edge of the double-leaf door.

The inactive leaf of the double-leaf door incorporated a glazed aperture of nominal sight dimensions 1800 mm high by 200 mm wide. The aperture was glazed with 45 mm thick glass panel. Glazing unit was retained with composite glazing bead of 35 mm wide by 4 mm thick. The glazing beads were fixed to the aperture frame by welded at maximum 100 mm centre to centre.

The active leaf of the double-leaf door incorporated two louvres of each nominal sight dimensions 690 mm high by 610 mm wide. The louvres were fixed to the door leaf by screws at maximum 350 mm centre to centre.

A number of 20 mm wide by 4 mm thick intumescent seal was fitted into groove on the head, left and right edges of the door frame. A number of 30 mm wide by 4 mm thick intumescent seal was fitted into groove on the head edge of each leaf of the double-leaf door. A number of 30 mm wide by 4 mm thick intumescent seal was fitted into groove on the meeting edge of the inactive leaf of the double-leaf door. A number of 30 mm wide by 4 mm thick intumescent smoke seal with fins was fitted into groove on the hinge edge of each leaf and the meeting edge of the active leaf of the double-leaf door. A number of bottom smoke seal was fitted into groove on the bottom edge of each leaf of the double-leaf door.

A number of 30 mm wide by 4 mm thick intumescent seal was fitted into groove on the head edge of the door leaf of the single -leaf door. A number of 30 mm wide by 4 mm thick intumescent smoke seal with fins was fitted into groove on the vertical edge of the door leaf of the single-leaf door. A number of 14 mm by 14 mm perimeter smoke seal was glued to the head, left and right edges of the door frame of the single-leaf door. A number of 34 mm by 15 mm door stop smoke seal was glued to the head, left and right edges of the door frame of the single-leaf door. A number of bottom smoke seal was fitted into groove on the bottom edge of the door leaf of the single-leaf door.

Each leaf of the double-leaf door was installed into the door frame by four nos. stainless steel hinges. The active leaf of the double-leaf door was provided with an overhead door closer mounted on the unexposed surface. The inactive leaf of the double-leaf door was provided with a concealed door closer mounted on the head edge of the leaf. The inactive leaf of the double-leaf door had two flush bolts at the head and bottom positions. Both flush bolts were bolted for duration the test. The active leaf of the double-leaf door was provided with a latch, which was latched but not locked for the duration of the test.

The door leaf of the single-leaf door was installed into the door frame by four nos. concealed hinges. The door leaf of the single-leaf door was provided with an overhead door closer mounted on the unexposed surface. The door leaf of the single-leaf door was provided with a latch, which was latched but not locked for the duration of the test.

A description of the test specimen is shown in Schedule of Components and Figures 1 to 3. The description is based on a detailed survey of the test specimen, an overseeing of the manufacture by the delegate of Fugro and the information supplied by the client.

Fugro Technical Services (Guangzhou) Limited was not involved in the selection of the specimen.

The doorset was installed into a prepared opening within a supporting construction to form the test construction, and shown in Figure 4. It was mounted such that door leaves opened away from the heating conditions of the test. A description of the supporting construction is shown in Specimen Supporting Construction.

Installation was conducted by the client on 31 March 2023.

After receiving, the specimen was stored in the test laboratory. Throughout this period of the storage, both the temperature and relative humidity of laboratory were measured and recorded as being within a range of from 22.4℃ to 29.6℃ and 53.3% to 89.6% respectively.

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HOKLAS 170 TEST

Schedule of Components

(Refer to Figures 1 to 3. Unless stated otherwise, all values are nominal, and all information in this Schedule of Components is supplied by the client/manufacturer.)

Item			Description
1	**Door Frame**		
	Manufacturer	:	Dongguan City Teliang Fire Doors and Windows Co., Ltd
	Material	:	25 mm x 50 mm x 2.0 mm thick mild steel hollows ** 50 mm x 50 mm x 2.0 mm thick mild steel hollows ** 6 mm + 8 mm thick MgO board ** 15 mm thick MgO board ** 1 mm thick G.M.S cladding
	Thickness	:	103 mm *
	Overall size	:	3002 mm x 3002 mm *
	Sectional dimension	:	103 mm x 55 mm * - perimeter door frame 103 mm x 102 mm * - transom and mullion
	Rebate		20 mm *
	Jambs to head jointing method	:	By welded
	Fixing methods to concrete support frame	:	Fixed to supporting construction with anchor bolts at maximum 800 mm centre to centre. *
	Fixing material	:	HILTI HRD-C 10 x 80 mm screw *
2	**Door Leaf and Transom Panel Stile & Rail**		
	Manufacturer	:	Dongguan City Teliang Fire Doors and Windows Co., Ltd
	Material	:	2.0 mm thick G.M.S C channel ** 6 layers 15 mm thick MgO board infilling **
	Density	:	7.93 g/cm^3
	Size	:	1 x (45 mm x 50 mm) - head and bottom edges of each leaf, each transom panel, glazed panel and each louver ** 1 x (45 mm x 50 mm) - left and right edges of each leaf, each transom panel, glazed panel and each louver **
	Fixing method	:	By welding

* Verified by the laboratory before the test.

** Verified by the laboratory after the test and from an additional part of the test specimen.

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Schedule of Components (cont'd)

3a **Door Leaf Core**

Supplier	:	Dongguan City Teliang Fire Doors and Windows Co., Ltd
Material	:	Rock wool
Density	:	100 kg/m^3
Thickness	:	21 mm **

3b **Door Leaf Core**

Supplier	:	Dongguan City Teliang Fire Doors and Windows Co., Ltd
Material	:	Acoustic panel
Density	:	800 kg/m^3
Thickness	:	3 mm **
Fixing method	:	By adhesive

4 **Fire Board**

Supplier	:	Dongguan City Teliang Fire Doors and Windows Co., Ltd
Brand	:	GemTree
Material	:	Magnesium oxide (MgO)
Density	:	800 -1000 kg/m^3 [1030 kg/m^3 #]
Thickness	:	6mm, 8 mm, 15 mm **
Fixing method	:	By adhesive

5 **Door Leaf Facing**

Supplier	:	Dongguan City Teliang Fire Doors and Windows Co., Ltd
Material	:	G.M.S
Thickness	:	1 mm *
Fixing method	:	By adhesive

6a **Butt Hinges for Active leaf of the Double-leaf Door**

Brand	:	Protech
Model	:	P114/2
Material	:	Stainless steel
Size		
i. Body	:	120 mm long by 16 mm diameter *
ii. Blade	:	114 mm x 114 mm x 3.0 mm thick *
Fixing method	:	By screw

6b **Butt Hinges for Inactive leaf of the Double-leaf Door**

Brand	:	Protech

* Verified by the laboratory before the test. # Measured by the laboratory.
** Verified by the laboratory after the test and from an additional part of the test specimen.

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Schedule of Components (cont'd)

Model	:	P102/2
Material	:	Stainless steel
Size		
i. Body	:	108 mm long by 14 mm diameter *
ii. Blade	:	102 mm x 102 mm x 3.0 mm thick *
Fixing method	:	By screw

6c **Concealed Hinges for Single-leaf Door**

Brand	:	Dorma
Model	:	BA-C80
Material	:	Stainless steel
Size	:	160 mm (H) x 30 mm (W) x 28 mm (D) *
Fixing method	:	By screw

7 **Door Lock (Latch)**

Brand	:	Protech
Model	:	P9001
Material	:	Stainless steel
Size	:	240 mm long x 87 mm wide x 30 mm thick *
Fixing method	:	By screw

8a **Door Closer for Single-leaf Door**

Brand	:	OUDE *
Model	:	OD-5044AW
Material	:	Aluminum alloy
Size	:	248 mm long x 72 mm wide x 44.5 mm thick *
Fixing method	:	By screw

8b **Door Closer for Active leaf of the Double-leaf Door**

Brand	:	OUDE *
Model	:	OD-5033AW
Material	:	Aluminum alloy
Size	:	206 mm long x 68 mm wide x 44.5 mm thick *
Fixing method	:	By screw

8c **Concealed Door Closer for Inactive leaf of the Double-leaf Door**

Brand	:	OUDE *
Model	:	OD2000 Series 2024AWH

* Verified by the laboratory before the test.

Schedule of Components (cont'd)

Material	:	Aluminum alloy
Size	:	230 mm long x 57 mm wide x 32 mm thick *
Fixing method	:	By screw

9a **Flush Bolt for Head Position**

Brand	:	Protech
Model	:	FB-300-S
Material	:	Stainless steel
Size	:	300 mm long x 22 mm wide x 35 mm depth *
Fixing method	:	By screw

9b **Flush Bolt for Bottom Position**

Brand	:	Protech
Model	:	FB-300-S
Material	:	Stainless steel
Size	:	250 mm long x 22 mm wide x 35 mm depth *
Fixing method	:	By screw

10a **Intumescent Seal**

Brand	:	FAN QIU
Model	:	FQ-C-2504
Size	:	25 mm x 4 mm thick
Fixing method	:	By adhesive
Application location	:	1 no. of seal applied at head of louver frame.

10b **Intumescent Seal**

Brand	:	FAN QIU
Model	:	FQ-C-3004
Size	:	30 mm x 4 mm thick *
Fixing method	:	By adhesive
Application location	:	1 no. of seal applied at louver leaf & at the glazing bead. 1 no. of seal at the head edge of the door leaf of the single-leaf door. * 1 no. of seal at the head edge of each leaf and the meeting edge of the inactive leaf of the double-leaf door. *

10c **Intumescent Seal**

Brand	:	FAN QIU
Model	:	FQ-C-2004

* Verified by the laboratory before the test.

Schedule of Components (cont'd)

Size	:	20 mm x 4 mm thick *
Fixing method	:	By adhesive
Application location	:	1 no. of seal at the head, left and right edges of the door frame of the double-leaf door. *

10d **Intumescent Seal**

Brand	:	GALLFORD
Model	:	YZ2024-1
Size	:	20 mm x 4 mm thick *
Fixing method	:	By adhesive
Application location	:	1 no. of seal at the head, left and right edges of the door frame of the single -leaf door. *

11 **Intumescent Smoke Seal with Fins**

Brand	:	FAN QIU
Model	:	FQ-CS-3004
Size	:	30 mm x 4 mm thick *
Fixing method	:	By adhesive
Application location	:	1 no. of seal at the left and right edges of the door leaf of the single-leaf door. * 1 no. of seal at the hinge edge of each leaf and the meeting edge of the active leaf of the double-leaf door. *

12 **Perimeter Smoke Seal**

Brand	:	FAN QIU
Model	:	FQ-VA017
Size	:	14 mm x 14 mm *
Fixing method	:	By adhesive
Application location	:	1 no. of seal at the head, left and right edges of the door frame of the single -leaf door. *

13 **Door Stop Smoke Seal**

Brand	:	Baimi
Model	:	BM-C18
Material	:	Aluminum alloy
Size	:	34 mm x 15 mm *
Fixing method	:	By adhesive & screw
Application location	:	1 no. of seal at the head, left and right edges of the door frame of the single -leaf door. *

* Verified by the laboratory before the test.

Schedule of Components (cont'd)

14a **Bottom Smoke Seal for Active leaf of the Double-leaf Door**

Manufacturer	:	Baimi
Brand	:	BM-A01
Model	:	Aluminum alloy
Material	:	30 mm x 14 mm *
Fixing method	:	By screw
Application location	:	1 no. of seal at the bottom edge of the active leaf of the double-leaf door. *

14b **Bottom Smoke Seal for Inactive leaf of the Double-leaf Door**

Manufacturer	:	Baimi
Brand	:	BM-A04
Model	:	Aluminum alloy
Material	:	34 mm x 15 mm *
Fixing method	:	By screw
Application location	:	1 no. of seal at the bottom edge of the inactive leaf of the double-leaf door. *

14c **Bottom Smoke Seal for Single-leaf Door**

Manufacturer	:	Baimi
Brand	:	BM-A33
Model	:	Aluminum alloy
Material	:	48 mm x 23 mm *
Fixing method	:	By screw
Application location	:	1 no. of seal at the bottom edge of the door leaf of the single-leaf door. *

15 **Louver**

Manufacturer	:	Dongguan City Teliang Fire Doors and Windows Co., Ltd
Model	:	TL-L-001
Thickness	:	1 mm thick stainless steel *
Size	:	650 mm x 730 mm x 60 mm thick *
Fixing method	:	By screw
Application location	:	2 nos. of louver at the active leaf of the double-leaf door.

16 **Smoke Shutter**

Manufacturer	:	Dongguan City Teliang Fire Doors and Windows Co., Ltd
Model	:	TL-S-001

* Verified by the laboratory before the test.

Schedule of Components (cont'd)

Thickness	:	2 mm G.M.S
Size	:	610 mm x 690 mm x 100 mm thick *
Fixing method	:	By screw
Application location	:	2 nos. of louver at the active leaf of the double-leaf door.

17 **Glass Panel**

Brand	:	PRO TECH
Model	:	PT-45-120
Thickness	:	45 mm thick *
Aperture size	:	270 mm x 1870 mm
Sight size	:	200 mm x 1800 mm *

18 **Glazing Bead**

Material	:	G.M.S
Size	:	35 mm x 4 mm thick *
Fixing method	:	By welding
Fixing frequency	:	At max. 100 mm c/c. *

* Verified by the laboratory before the test.

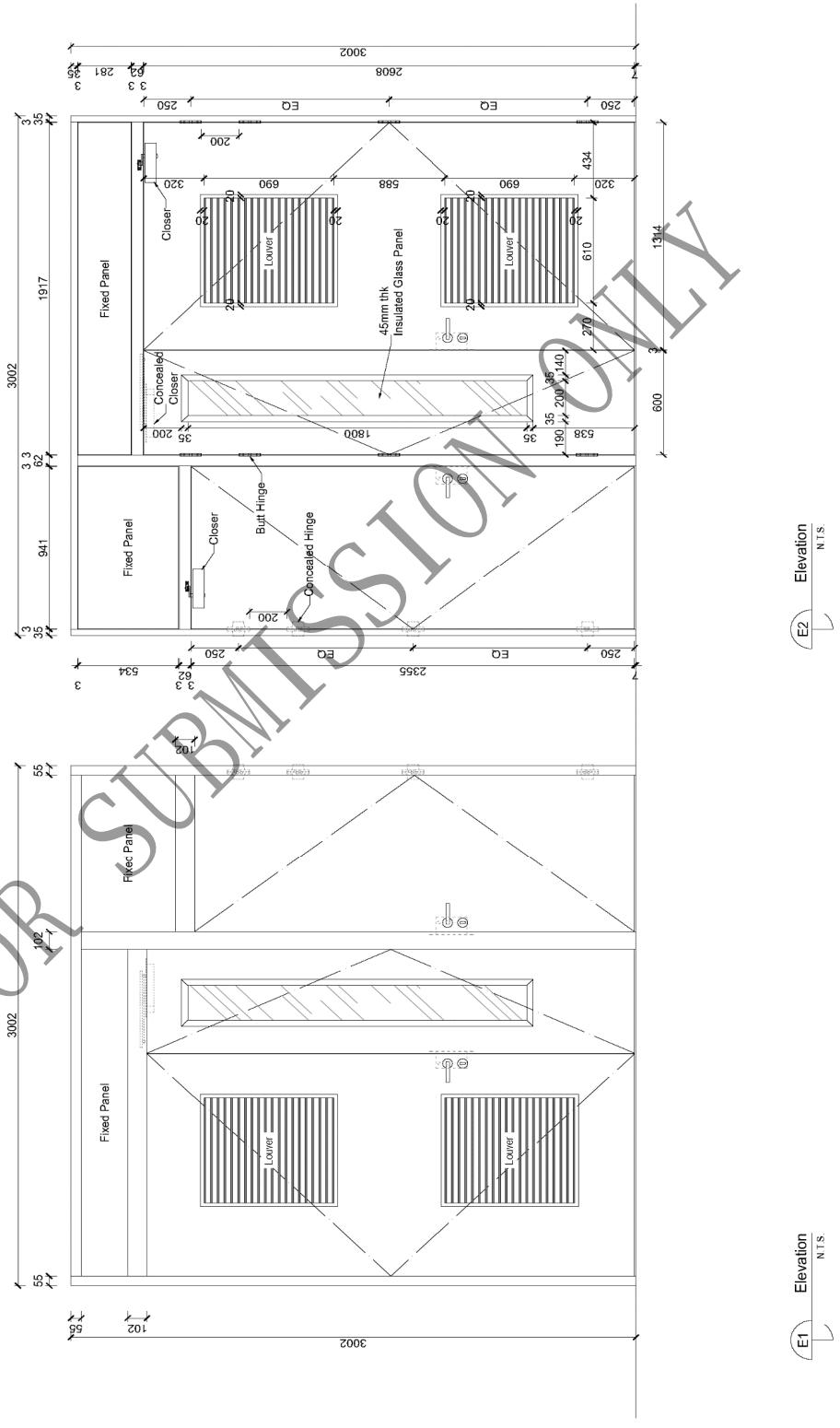


Figure 1

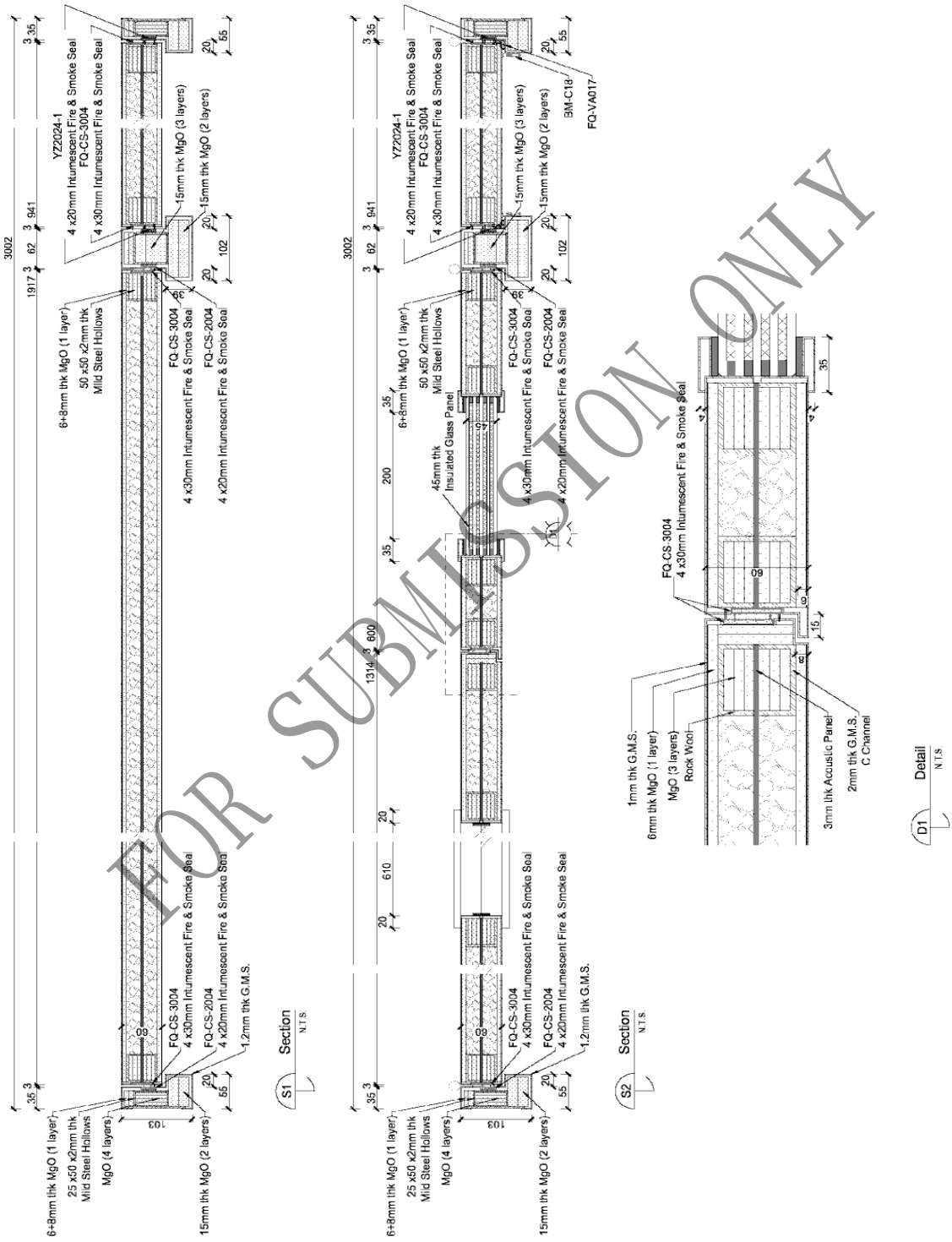


Figure 2

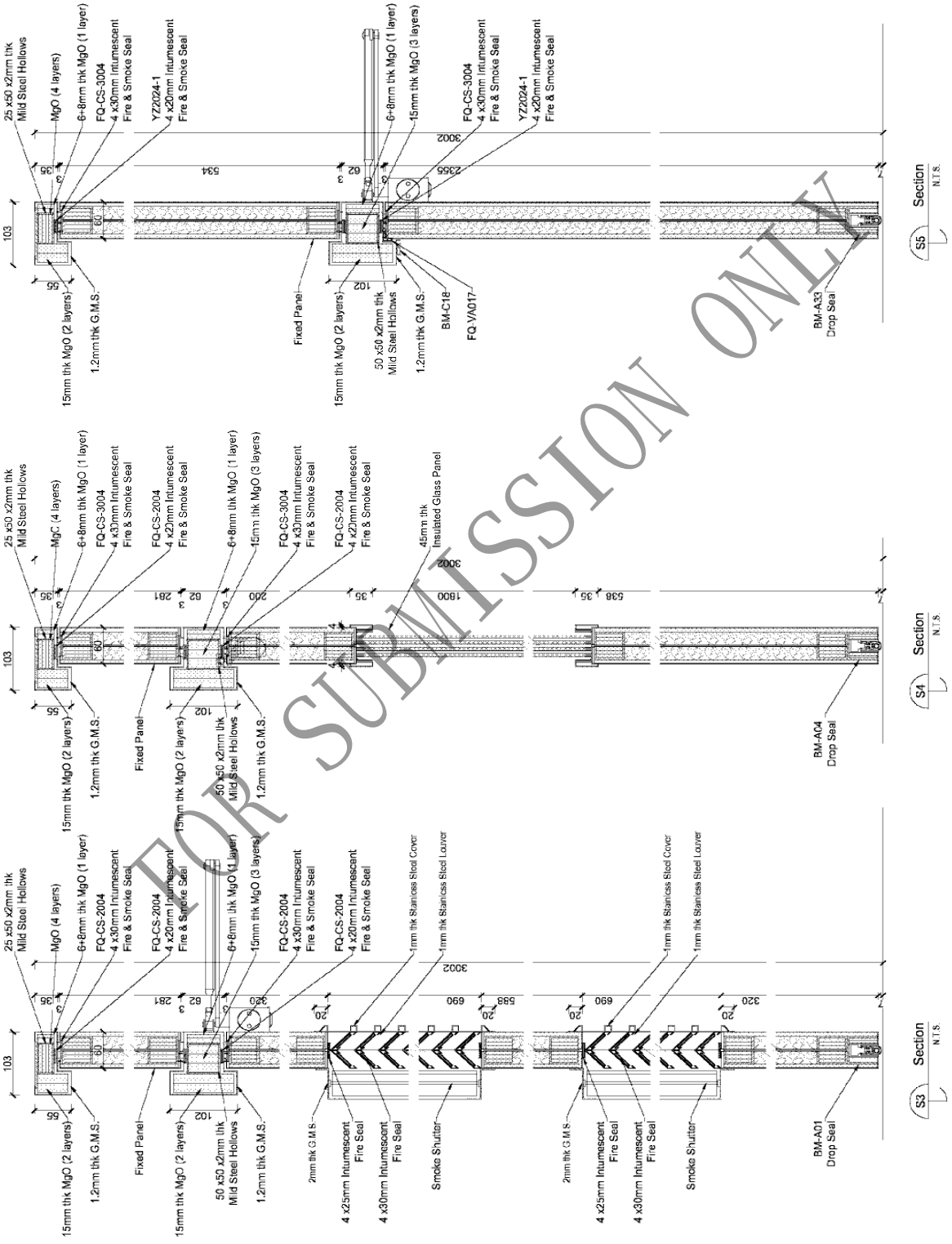
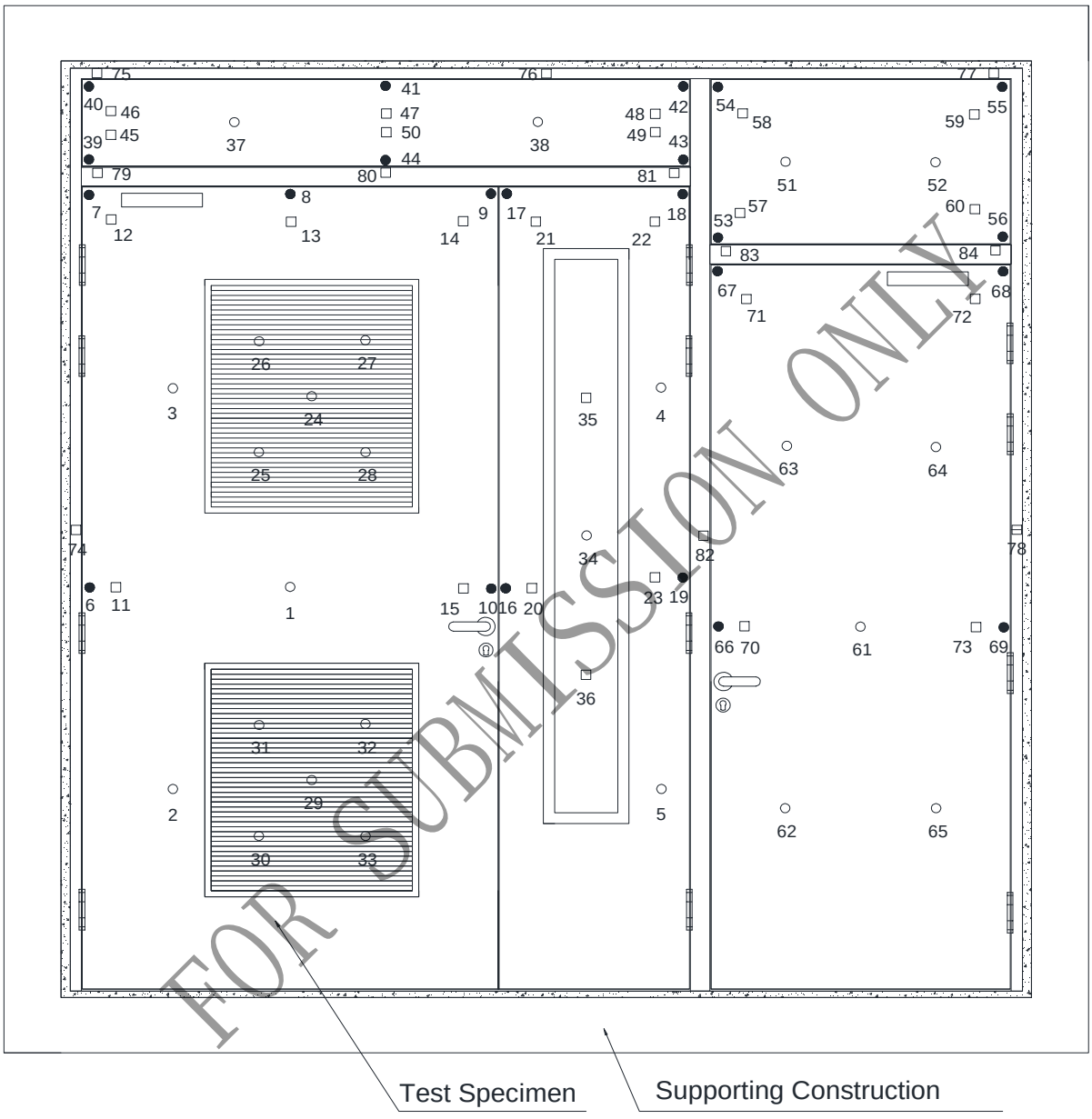


Figure 3



○ thermocouples for average and maximum temperature rise
□ thermocouples for maximum temperature rise
● additional thermocouples for maximum temperature rise (supplementary procedure)

Figure 4- Elevation Diagram of Test Construction

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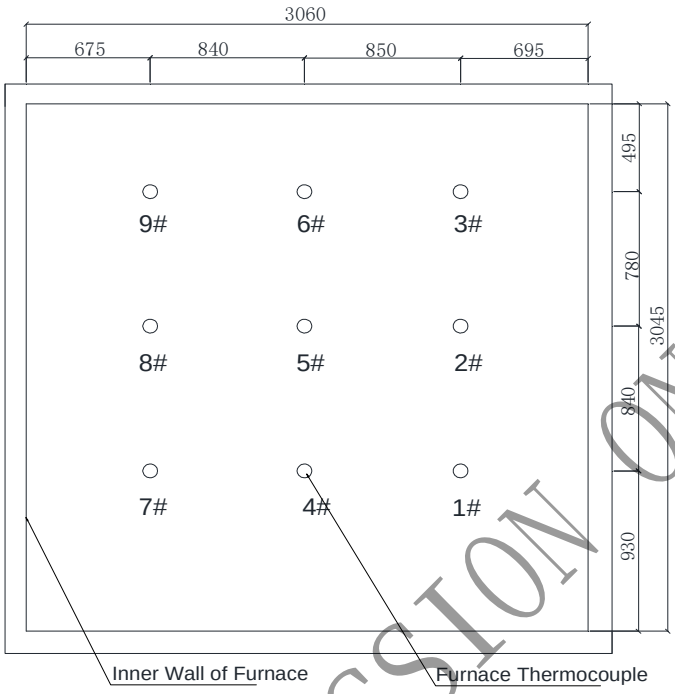
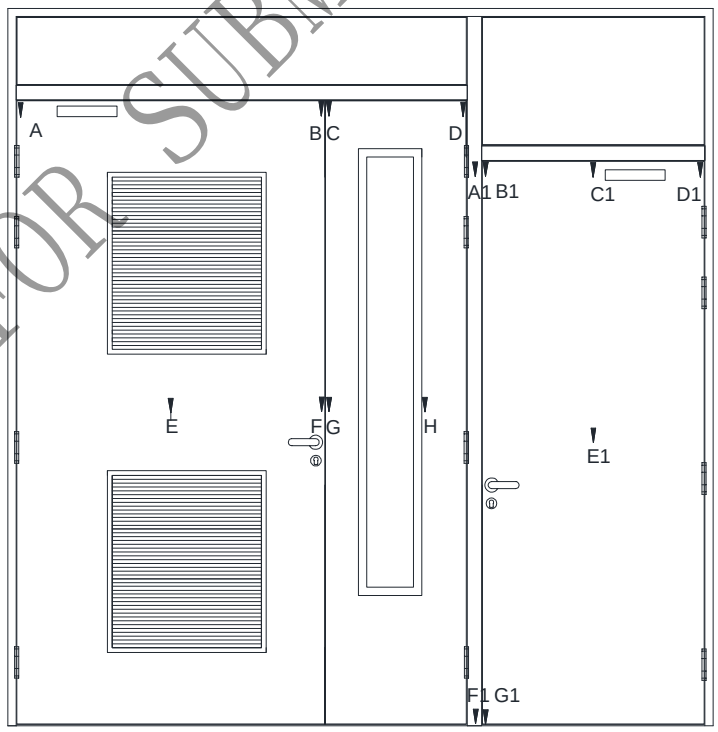


○ positions of furnace thermocouples
All dimensions are in mm.

Figure 5 - Positions of Furnace Thermocouples



▼ positions for deflection measurements

Figure 6 - Positions of Lateral Deflections Measurement

5. Equipment

Nine plate thermocouples were installed and maintained 100 mm away from the exposed surface of the specimen to monitor the furnace temperature. The positions of the furnace thermocouples are shown in Figure 5.

A pressure sensor was installed to control the furnace pressure.

Thermocouples were installed to monitor the temperature of the unexposed surface of the specimen at the following positions.

a) At twenty-three positions on the door leaves of the double-leaf door, one approximately at the centre of the door leaves and one approximately at the centre of each quarter section, four at mid-height, 100 mm in from the vertical edges, four at 100 mm in from the vertical edges and 100 mm down from the horizontal edge, one at mid-width of the active leaf, 100 mm down from the horizontal edge, four at mid-height, 25 mm in from the vertical edges, and four at 25 mm in from the vertical edges, 25 mm down from the horizontal edge, one at mid-width of the active leaf, 25 mm down from the horizontal edge.

b) At five positions on each louvre, one approximately at the centre of the louvre and one approximately at the centre of each quarter section, one at mid-width on the head horizontal frame of the louvre.

c) At three positions on the glazed panel, one approximately at the centre of the glazed panel and one approximately at the centre of each section.

d) At fourteen positions on the transom panel of the double-leaf door, one approximately at the centre of each half section, four at 100 mm in from the vertical edges and 100 mm from the horizontal edges and four at 25 mm in from the vertical edges, 25 mm from the horizontal edges, two at mid-width of the flush over panel, 25 mm in from the horizontal edge, two at mid-width of the flush over panel, 100 mm in from the horizontal edge.

e) At seven positions on the frame of the double-leaf door, one at the mid-height on each vertical member of the perimeter frame, one at the mid-width on each horizontal member, three on the horizontal members, 50 mm in from corner of frame.

f) At thirteen positions on the door leaf of the single-leaf door, one approximately at the centre of the door leaf and one approximately at the centre of each quarter section, two at mid-height, 100 mm in from the vertical edges, two at 100 mm in from the vertical edges and 100 mm down from the horizontal edge, two at mid-height, 25 mm in from the vertical edges, and two at 25 mm in from the vertical edges, 25 mm down from the horizontal edge.

g) At ten positions on the transom panel of the single-leaf door, one approximately at the centre of each half section, four at 100 mm in from the vertical edges and 100 mm from the horizontal edges and four at 25 mm in from the vertical edges, 25 mm from the horizontal edges.

h) At five positions on the frame of the single-leaf door, one at the mid-height on the right vertical member, and three on the horizontal members, 50 mm in from the corner of the frame.

i) The positions and reference numbers of the various unexposed surface thermocouples are shown in Figure 4.

A roving thermocouple was provided to measure temperature on the unexposed surface of the specimen at any position that might appear to be hotter than the temperatures indicated by the fixed thermocouples.

Cotton pads and gap gauges were provided to evaluate the integrity of the specimen.

A steel ruler was provided to measure the lateral deflections of the specimen relative to laser line. The measurement positions are shown in Figure 6.

A thermocouple was provided to monitor ambient temperature at a distance approximately 1500 mm away from the test construction.

6. Test Procedure

6.1 Pre-test examination and preparation

Prior to the fire resistance test, the doorset was subjected to 25 manually operated opening and closing cycles and measured the closing speed as specified in BS EN 16034: 2014.

Gaps, closing forces were measured as specified in BS EN 1634-1: 2014+A1:2018, Clause 10.1.2.and 10.1.3. The doorset was subjected to final setting as specified in BS EN 1634-1: 2014+A1:2018, Clause 10.1.4.

6.2 Fire resistance test

The test was conducted in accordance with the procedure specified in BS EN 1634-1: 2014+A1:2018, Clause 10.2.

The ambient temperature of test area was measured at commencement of the test.

The furnace temperature was controlled so that the average furnace temperature and tolerances complied with the requirements of BS EN 1363-1: 2020, Clause 5.1. Nine furnace thermocouples were used to determine the average furnace temperature.

The furnace pressure was controlled so that it complied with the requirements of BS EN 1363-1: 2020, Clause 5.2. The calculated furnace pressure relative to the laboratory atmosphere at the top of the doorset was 17.0 ± 3 Pa.

The temperature of the unexposed surface was monitored by means of eighty-four thermocouples fixed to the unexposed surface of the specimen. Thermocouples 1 to 5 were used to determine the average temperature of the unexposed surface of the double-leaf door. Thermocouples 61 to 65 were used to determine the average temperature of the unexposed surface of the single-leaf door. Thermocouple 34 were used to determine the average temperature of the unexposed surface of the glazed panel. Thermocouple 24 to 28 were used to determine the average temperature of the unexposed surface of the louver A. Thermocouple 29 to 33 were used to determine the average temperature of the unexposed surface of the louver B. Thermocouple 37 to 38 were used to determine the average temperature of the unexposed surface of the transom panel of the double-leaf door. Thermocouple 51 to 52 were used to determine the average temperature of the unexposed surface of the transom panel of the single-leaf door. Thermocouples 1 to 5, 11 to 15 and 20 to 23 were used to determine the maximum temperature (normal procedure) of the unexposed surface of the double-leaf door. Thermocouples 6 to 10 and 16 to 19 were used to determine the maximum temperature (supplementary procedure) of the unexposed surface of the double-leaf door. Thermocouples 61 to 65 and 70 to 73 were used to determine the maximum temperature (normal procedure) of the unexposed surface of the single-leaf door.

Thermocouples 66 to 69 were used to determine the maximum temperature (supplementary procedure) of the unexposed surface of the single-leaf door. Thermocouples 34 to 36 were used to determine the maximum temperature of the unexposed surface of the glazed panel. Thermocouples 24 to 28 were used to determine the maximum temperature of the unexposed surface of louver A. Thermocouples 29 to 33 were used to determine the maximum temperature of the unexposed surface of louver B. Thermocouples 37, 38 and 45 to 50 were used to determine the maximum temperature (normal procedure) of the unexposed surface of the transom panel of double-leaf door. Thermocouples 39 to 44 were used to determine the maximum temperature (supplementary procedure) of the unexposed surface of the transom panel of the double-leaf door. Thermocouples 51, 52 and 57 to 60 were used to determine the maximum temperature (normal procedure) of the unexposed surface of the transom panel of single-leaf door. Thermocouples 53 to 56 were used to determine the maximum temperature (supplementary procedure) of the unexposed surface of the transom panel of the single-leaf door. Thermocouples 77, 78 and 82 to 84 were used to determine the maximum temperature of the unexposed surface of the door frame of the single-leaf door. Thermocouples 74 to 76 and 79 to 82 were used to determine the maximum temperature of the unexposed surface of the door frame of the double-leaf door.

During the test, the temperatures and pressures were continuously monitored and were recorded at one minute intervals.

The roving thermocouple was also used, if considered necessary, to determine compliance with the insulation criterion.

Cotton pads and gap gauges were used to determine compliance with the integrity criteria. The specimen was also monitored for the occurrence of any sustained flaming on the unexposed surface which would result on failure to comply with the integrity criteria.

A steel ruler was used to measure the lateral deflection of the specimen during the test.

7. Test Data and Information

The closing speed of the active leaf of the double-leaf door was 233 mm/s. The closing speed of the inactive leaf of the double-leaf door was 121 mm/s. The closing speed of the door leaf of the single-leaf door was 190 mm/s.

Gaps between the door leaves and the door frame are shown in Figures 7 to 8.

The retention forces of each leaf were shown as follows:

Active leaf of double-leaf door	Push	117.3 N
	Pull	101.2 N
Inactive leaf of double-leaf door	Push	69.5 N
	Pull	70.7 N
Single leaf	Push	119.6 N
	Pull	108.8 N

* Viewed from the unexposed surface

The following data were recorded during the fire resistance test:

a) The actual average furnace temperature / time curve as well as the standard furnace temperature/ time curve, are shown in Figure 9.

b) The furnace pressures relative to laboratory atmosphere, at a height of approximately 2000 mm above the bottom of the specimen, are shown in Figure 10.

c) The average and maximum temperature rises of the unexposed surface of the specimen measured by fixed surface thermocouples are shown in Figure 11 to 14. The individual temperatures recorded on the unexposed surface of the specimen are shown in Table 1.

d) The lateral deflections of the specimen are shown in Table 2.

A summary of the observations made on the general behaviour of the specimen is given in Table 3.

The ambient air temperature in the vicinity of the test construction was 26.0℃ at the start of the test and increased by 1.2℃ at the termination of test.

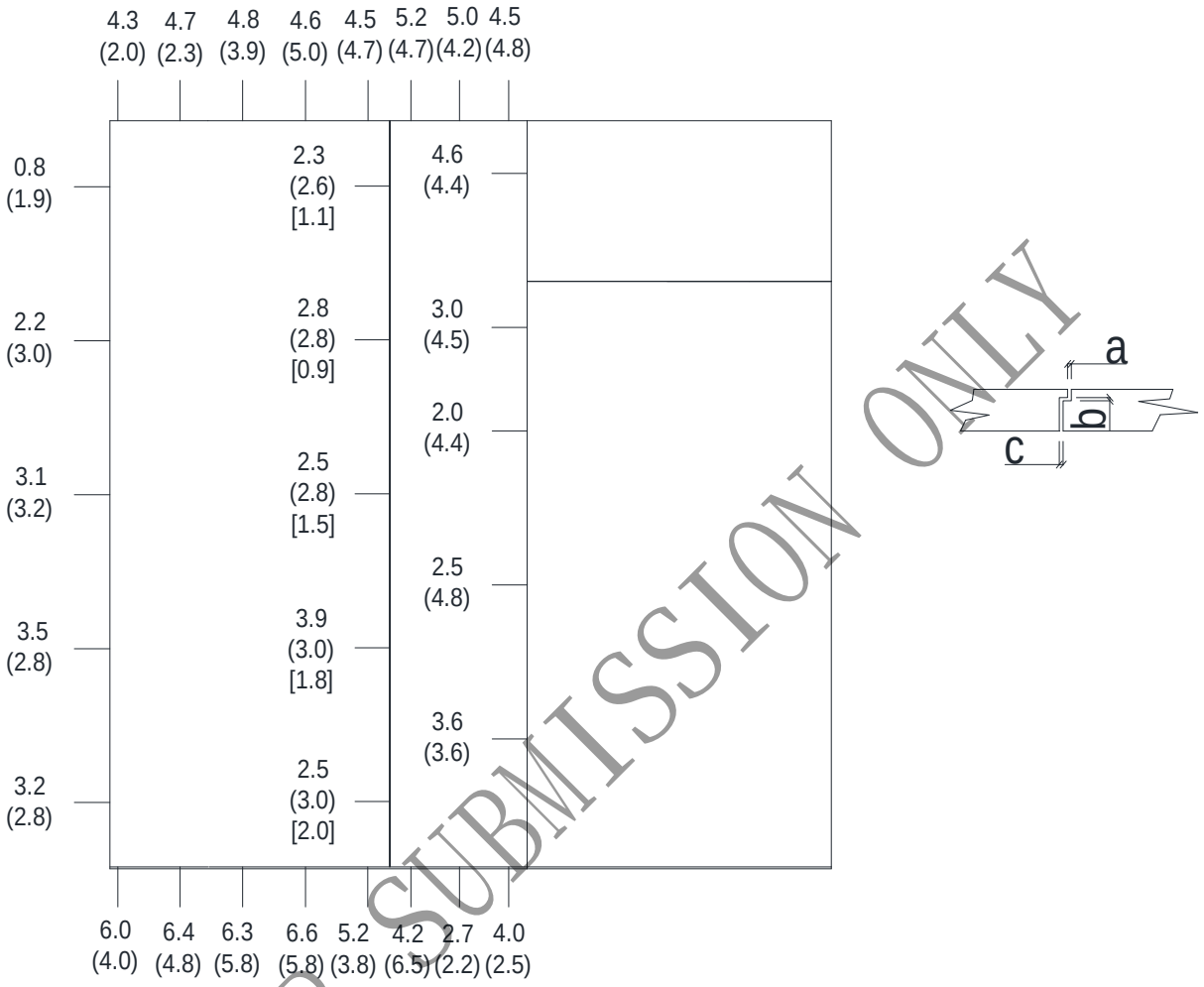


Figure 7 - Gaps measured between Door Leaves of Double-leaf Door and Door Frame as Viewed from the Unexposed Surface

All dimensions are in mm.

Dimensions shown in brackets were measured from the exposed surface.

Gap dimension (mm)	Surface	Measured value			Mean declared value
		Maximum	Minimum	Average	
Hinge edge	Exposed	4.8	1.9	3.5	Not provided
	Unexposed	4.6	0.8	2.9	3.0
Meeting edge	Exposed (a)	3.0	2.6	2.8	Not provided
	b	2.0	0.9	1.5	Not provided
	Unexposed (c)	3.9	2.3	2.8	Not provided
Head edge	Exposed	5.0	2.0	4.0	Not provided
	Unexposed	5.2	4.3	4.7	3.0
Bottom edge	Exposed	6.5	2.2	4.4	7.0
	Unexposed	6.6	2.7	5.2	7.0

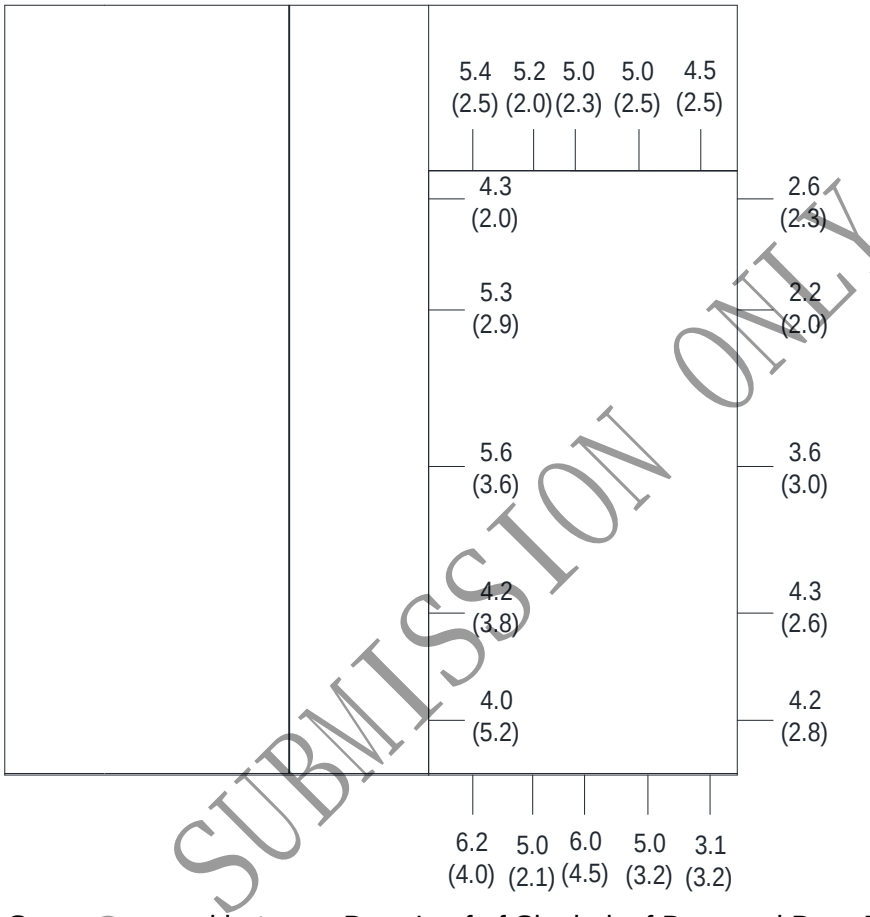


Figure 8 - Gaps measured between Door Leaf of Single-leaf Door and Door Frame as Viewed from the Unexposed Surface

All dimensions are in mm.
Dimensions shown in brackets were measured from the exposed surface.

Gap dimension (mm)	Surface	Measured value			Mean declared value
		Maximum	Minimum	Average	
Hinge edge	Exposed	3.0	3.0	2.5	Not provided
	Unexposed	4.3	2.2	3.4	3.0
Leading edge	Exposed	5.2	2.0	3.5	Not provided
	Unexposed	5.6	4.0	4.7	3.0
Head edge	Exposed	2.5	2.0	2.4	Not provided
	Unexposed	5.4	4.5	5.0	3.0
Bottom edge	Exposed	4.5	2.1	3.4	7.0
	Unexposed	6.2	3.1	5.1	7.0

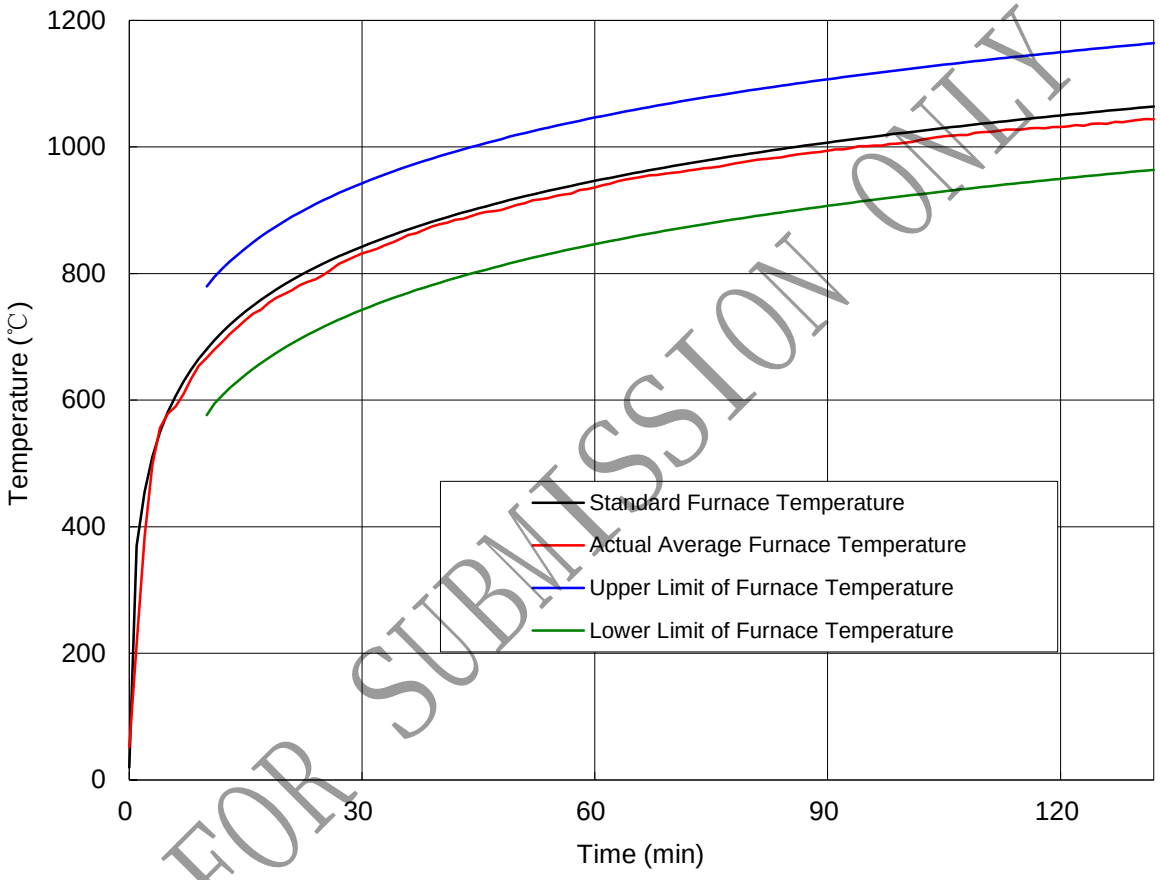


Figure 9 - Actual Average Furnace Temperature/Time Curve and Standard Furnace Temperature/Time Curve

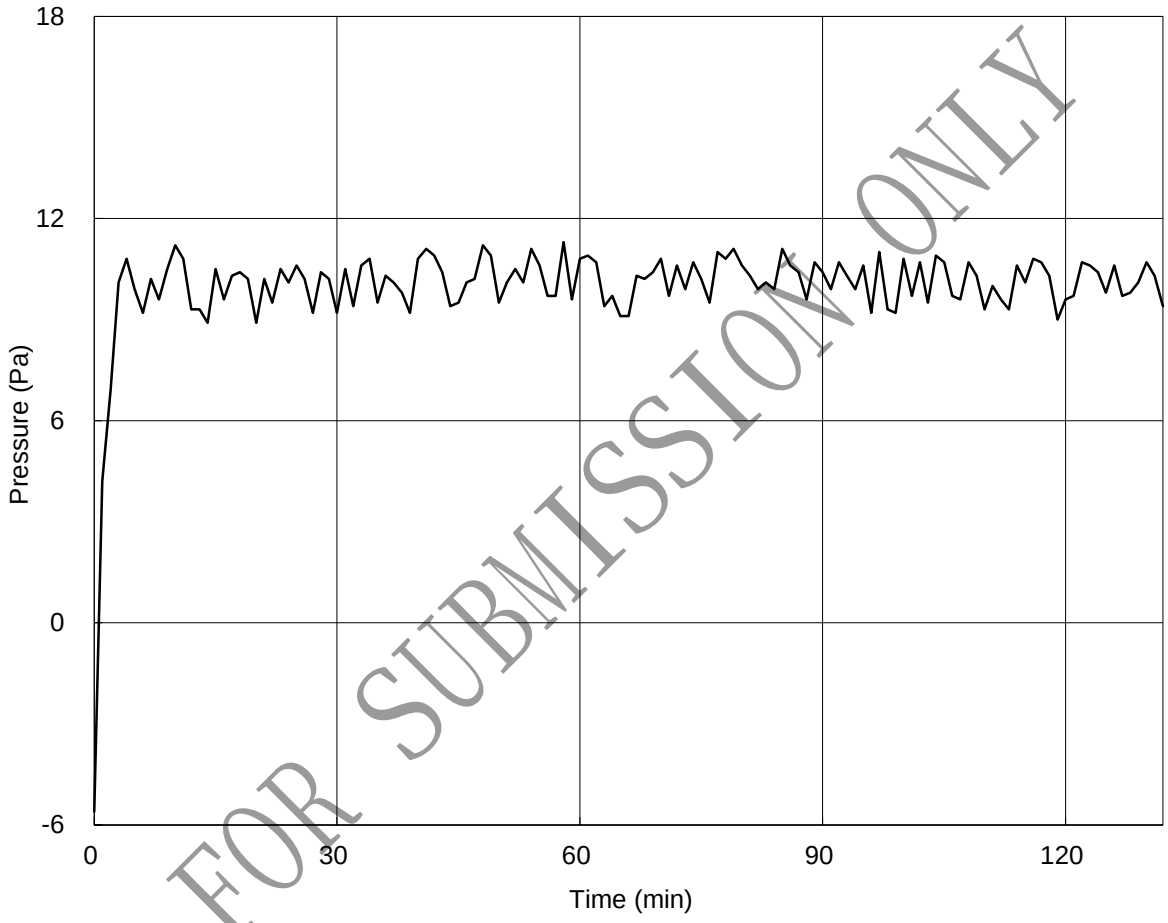


Figure 10 - Furnace Pressures Relative to the Laboratory Atmosphere

Graph showing recorded furnace pressure at 2000 mm above the bottom of the specimen.

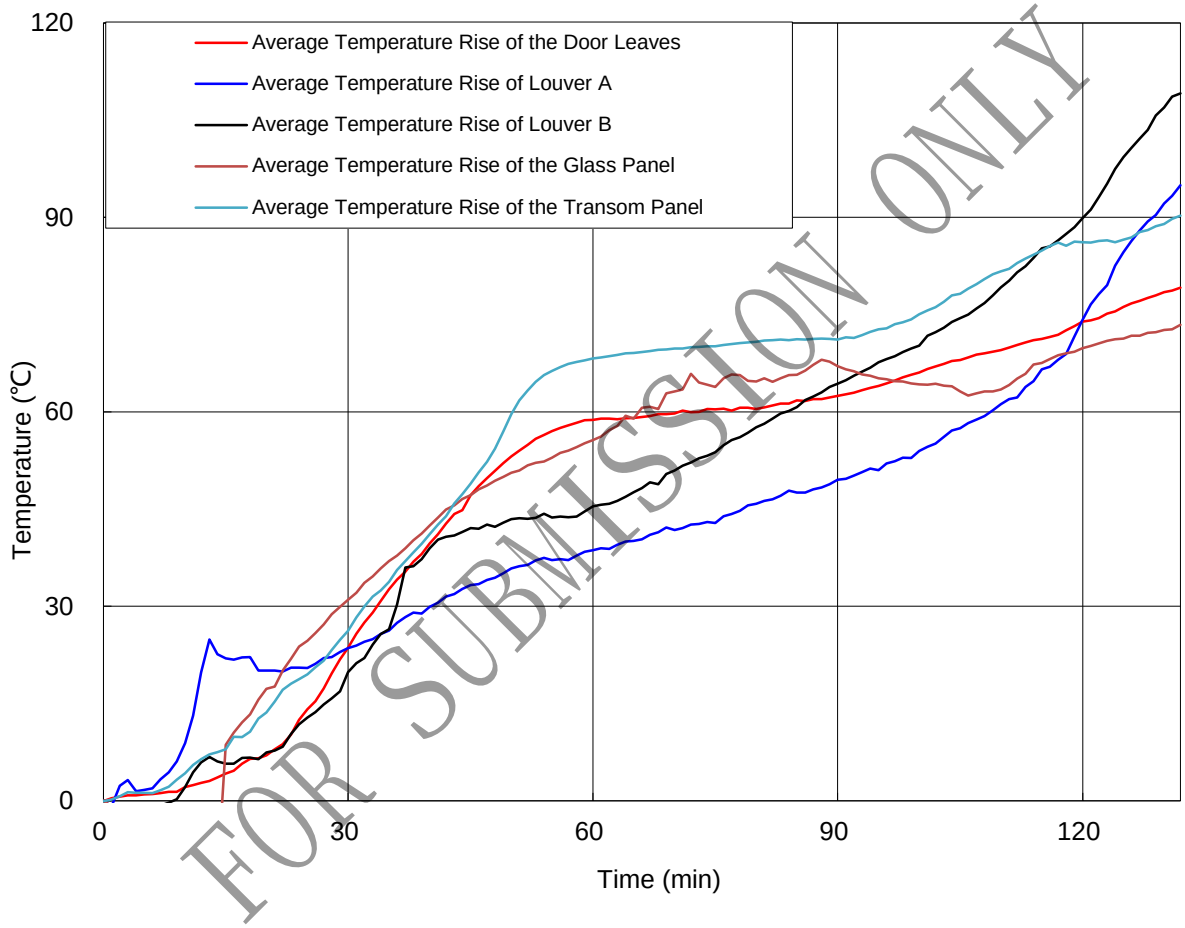


Figure 11 - Average Temperature Rises of the Unexposed Surface of the Double-leaf Door

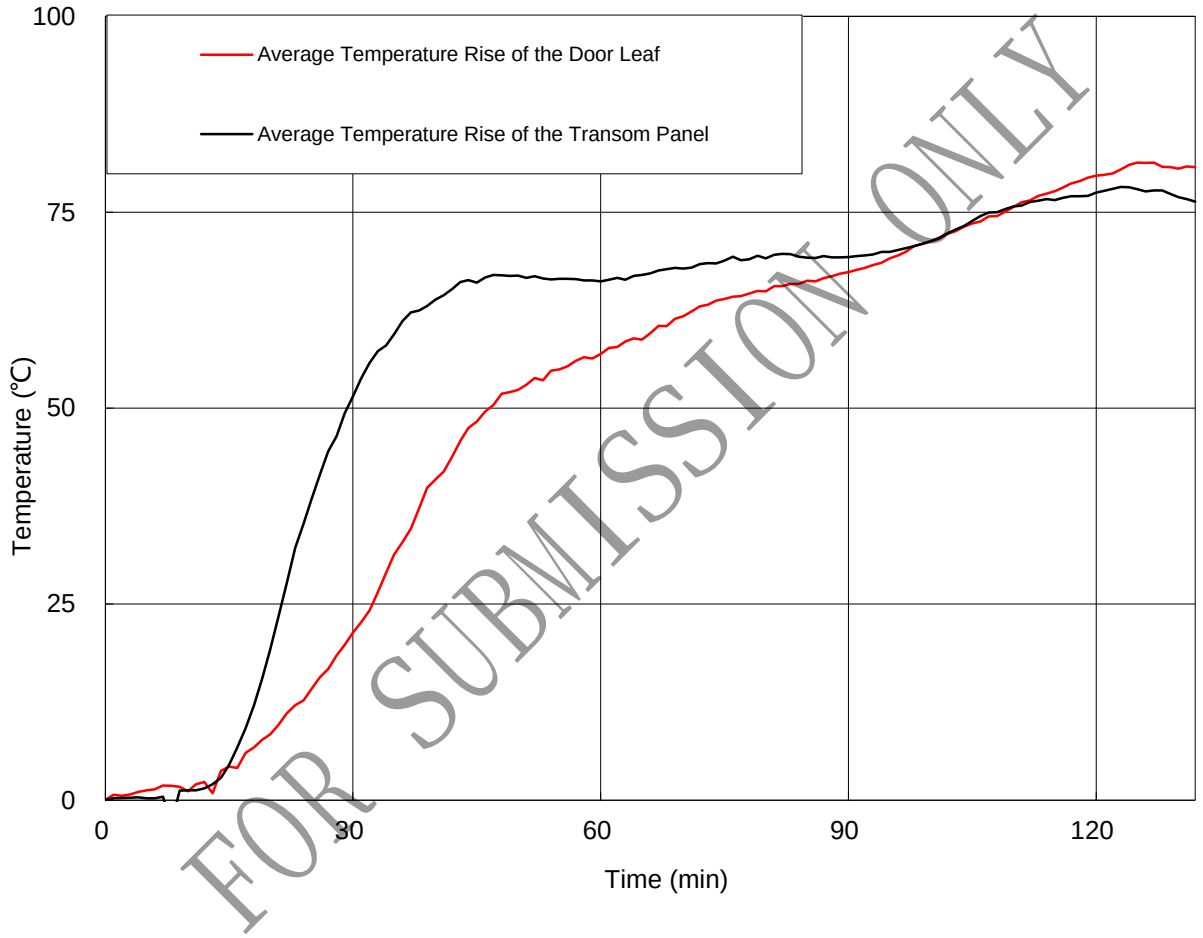


Figure 12 - Average Temperature Rises of the Unexposed Surface of the Single-leaf Door

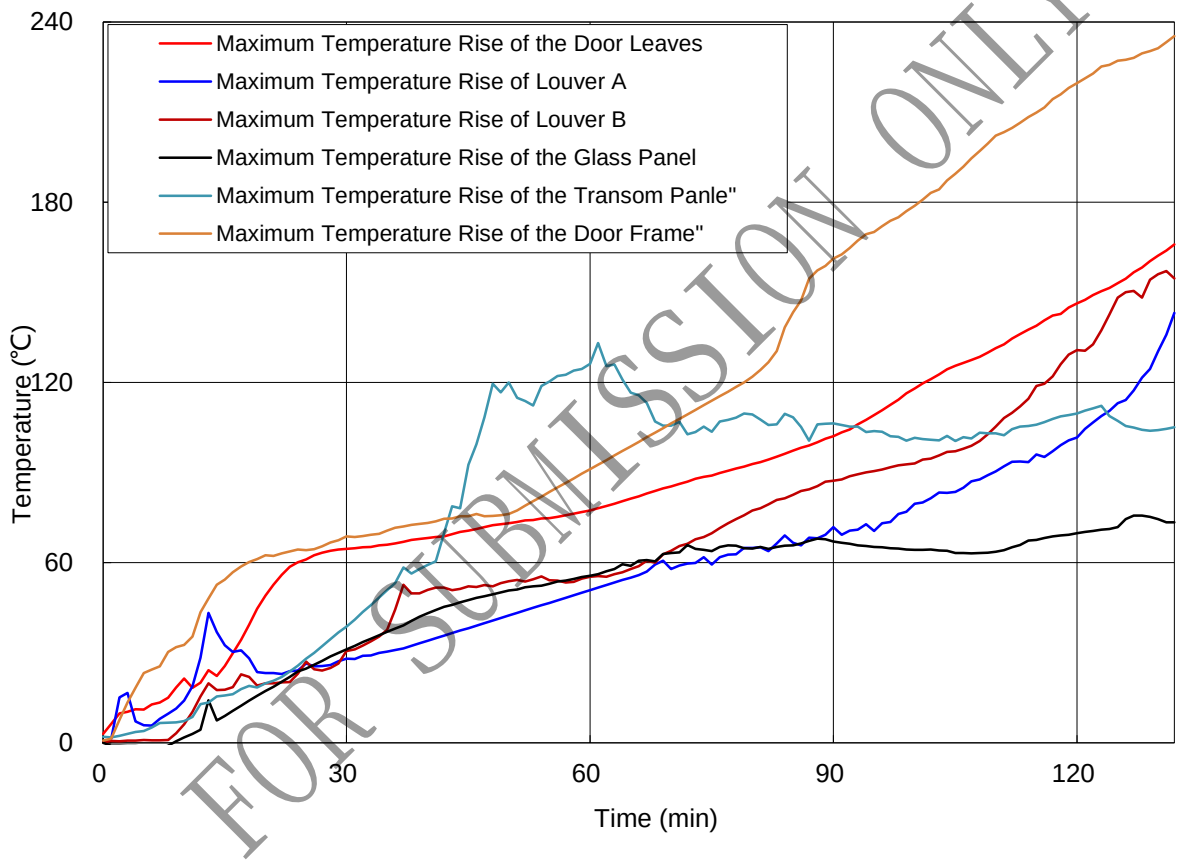


Figure 13 - Maximum Temperature Rises (Normal Procedure) of the Unexposed Surface of the Double-leaf Door Measured by Fixed Surface Thermocouples

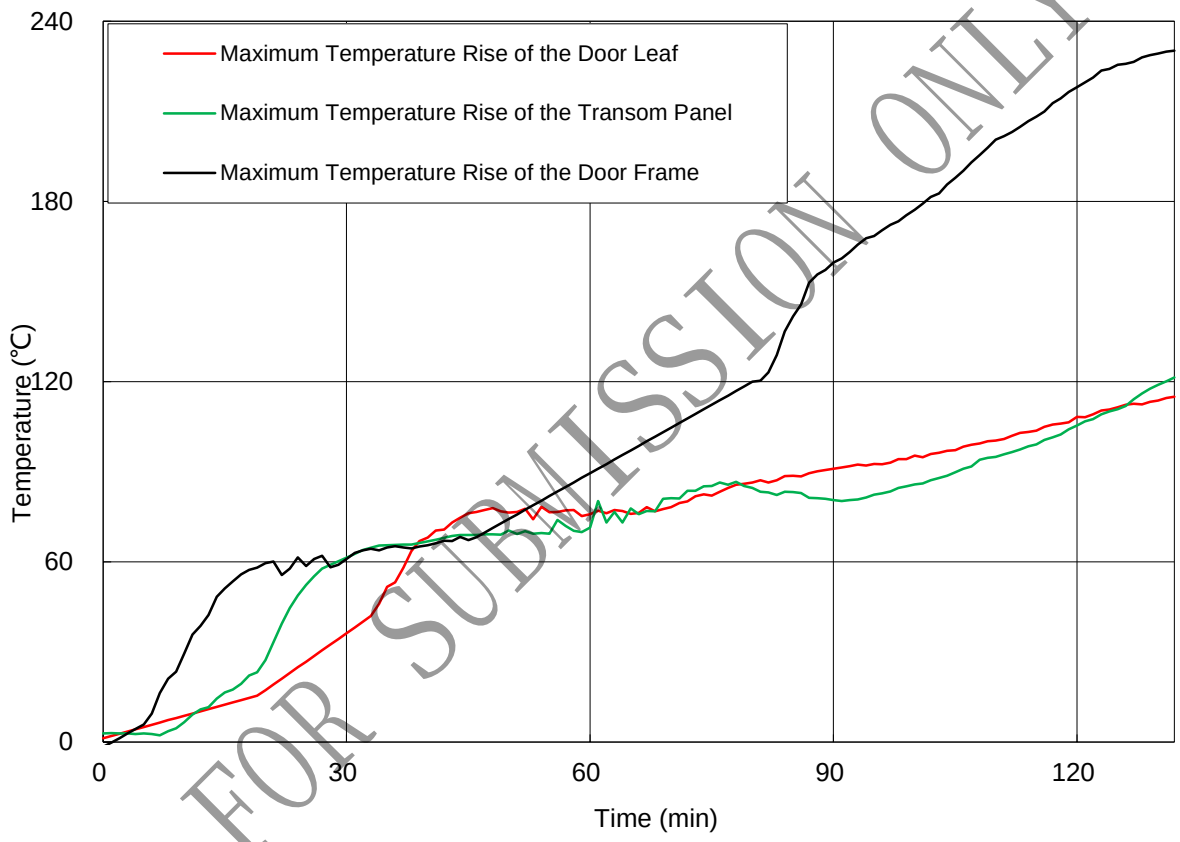


Figure 14 - Maximum Temperature Rises (Normal Procedure) of the Unexposed Surface of the Single-leaf Door Measured by Fixed Surface Thermocouples

FUGRO TECHNICAL SERVICES (GUANGZHOU) LIMITED
No.6, Nongye Gongsi Road
Caotang, Hualong, Panyu
Guangzhou
China

Table 1 Individual Temperatures Recorded on the Unexposed Surface of the Specimen

Time (mins)	Thermocouple No.										
	1	2	3	4	5	6	7	8	9	10	11
0	25.0	24.6	25.2	26.3	24.2	25.2	25.0	25.9	25.7	25.5	25.0
5	25.4	27.8	25.7	26.5	24.8	26.2	31.1	30.3	32.2	25.6	27.3
10	26.9	29.4	25.7	29.2	24.8	21.0	39.2	35.7	42.9	46.4	30.2
15	29.2	30.3	26.0	31.8	29.1	60.6	51.2	41.2	54.0	60.8	35.4
20	32.3	31.3	27.6	34.6	34.7	65.5	63.2	46.6	65.1	83.1	40.6
25	44.7	32.3	31.1	43.2	44.7	56.5	75.2	52.1	76.1	88.9	45.8
30	70.7	33.2	36.6	52.4	50.6	50.9	82.5	57.5	85.3	88.8	51.0
35	84.4	37.0	44.7	62.5	59.9	60.0	86.1	63.0	91.4	92.0	59.1
40	86.1	44.6	52.7	74.0	66.5	67.7	89.8	68.4	92.0	93.9	65.5
45	87.8	52.8	61.8	81.7	77.0	68.4	96.4	73.9	92.1	94.4	71.5
50	88.2	61.6	72.7	84.2	84.4	70.8	97.0	79.3	92.4	95.1	77.6
55	87.9	70.6	79.9	84.7	87.6	74.6	98.9	84.8	93.8	95.6	83.0
60	87.9	76.0	82.1	84.1	89.1	78.3	100.7	90.2	96.8	95.8	85.7
65	86.5	78.3	82.4	82.9	90.7	85.5	104.0	94.8	100.0	97.2	87.3
70	86.3	78.8	82.9	84.4	91.8	87.1	108.8	96.8	104.6	99.9	87.7
75	86.8	78.7	83.4	86.7	91.8	85.7	114.3	99.3	109.3	104.4	87.4
80	85.2	78.3	83.2	87.9	93.1	90.4	120.2	101.6	113.9	111.4	88.1
85	87.8	78.3	82.6	90.6	95.0	92.3	126.6	106.6	118.2	115.6	87.5
90	87.5	78.5	82.8	92.4	96.6	98.5	135.9	112.1	124.6	118.0	88.7
95	87.4	79.3	85.0	95.2	98.6	102.5	143.9	118.2	130.0	120.2	91.9
100	88.3	81.7	86.9	98.0	101.0	108.2	151.7	126.1	132.7	125.5	94.3
105	88.1	83.0	89.1	101.5	103.8	112.5	158.7	138.1	131.7	131.4	96.1
110	88.0	83.5	90.3	105.2	106.2	117.9	164.5	151.0	132.1	142.4	98.3
115	87.5	84.5	90.9	109.3	109.5	124.2	170.6	159.4	133.0	174.3	100.7
120	90.9	86.1	91.8	112.8	113.4	134.1	179.0	167.7	133.4	160.8	103.5
121	91.0	86.3	91.5	113.3	114.0	136.3	180.4	168.8	134.4	157.0	103.8
122	91.2	86.5	91.4	114.1	114.7	137.6	184.1	170.1	135.6	154.0	104.6
123	92.2	86.9	91.5	115.1	115.7	140.0	185.9	171.7	136.5	153.2	105.1
124	92.6	87.0	91.4	115.4	116.5	141.4	187.7	172.8	138.5	153.3	105.6
125	94.0	87.5	91.1	116.4	117.4	144.6	189.8	174.7	140.0	154.3	106.3
126	94.2	87.5	91.5	117.7	118.2	145.3	191.8	176.3	140.8	156.8	106.6
127	94.0	87.8	91.7	118.4	119.1	148.0	193.4	177.7	141.1	159.8	107.2
128	93.8	88.2	92.4	119.0	120.0	149.1	195.2	178.8	141.7	163.0	108.0
129	93.5	88.3	92.7	119.9	121.0	150.0	196.8	179.8	142.3	166.3	108.5
130	93.3	88.7	92.7	121.1	122.0	152.0	198.6	181.6	142.8	167.7	109.2
131	93.1	88.9	92.5	121.5	122.9	151.4	200.3	183.2	142.9	168.4	110.0
132	93.0	89.2	92.2	123.0	123.9	152.0	202.6	184.9	143.4	169.0	110.6

FUGRO TECHNICAL SERVICES (GUANGZHOU) LIMITED
No.6, Nongye Gongsi Road
Caotang, Hualong, Panyu
Guangzhou
China

Table 1 Individual Temperatures Recorded on the Unexposed Surface of the Specimen(cont'd)

Time (mins)	Thermocouple No.										
	12	13	14	15	16	17	18	19	20	21	22
0	25.3	24.7	25.5	26.4	26.3	28.4	28.6	28.1	27.1	27.1	27.3
5	27.9	28.5	25.9	26.8	27.2	40.7	40.0	36.1	27.1	27.8	28.8
10	30.8	33.3	31.1	28.8	91.3	58.5	53.2	42.0	46.5	37.3	34.9
15	35.5	41.7	33.6	33.8	83.4	65.1	63.7	52.8	41.7	50.7	44.7
20	40.2	50.1	38.0	46.9	78.1	67.5	72.6	55.3	48.6	74.1	63.6
25	44.9	58.5	50.3	66.4	79.8	69.2	94.3	58.1	58.8	86.1	82.1
30	54.9	66.9	66.1	78.6	86.0	76.3	94.2	69.3	70.3	89.7	88.7
35	64.9	78.0	76.9	89.4	93.1	83.6	95.0	75.5	80.9	90.9	91.1
40	71.7	85.8	84.1	93.3	93.2	92.9	95.1	82.8	88.9	93.1	92.1
45	82.9	88.2	87.0	93.9	98.0	115.1	90.9	85.1	90.7	95.7	91.7
50	87.4	89.3	88.6	94.6	102.2	123.6	89.1	85.0	94.8	98.2	92.5
55	89.4	89.5	89.5	94.5	105.6	132.3	88.8	83.6	97.8	99.9	93.8
60	90.0	89.4	88.3	94.4	112.5	142.9	89.4	83.7	101.0	102.5	94.9
65	90.4	89.9	88.5	94.1	116.6	153.2	92.3	86.3	104.2	106.4	97.0
70	86.8	90.6	89.0	93.9	125.8	163.6	97.4	90.7	105.6	110.4	99.8
75	87.4	90.2	88.3	93.9	135.8	175.4	102.6	96.0	107.2	114.1	102.5
80	87.9	89.9	89.3	94.0	142.2	187.4	105.4	99.6	102.7	117.9	105.0
85	88.8	92.8	89.8	96.2	149.6	195.1	111.8	106.8	102.4	122.4	108.0
90	91.1	95.0	91.0	98.2	155.8	206.2	116.3	113.1	104.0	127.2	109.7
95	93.1	95.7	93.7	98.3	159.1	217.2	121.2	119.9	106.5	134.2	110.6
100	96.2	96.0	95.7	99.3	162.0	229.1	125.4	126.2	109.2	143.0	113.7
105	99.8	98.0	97.3	101.4	164.2	239.5	128.5	132.6	112.4	150.6	118.8
110	103.1	100.8	100.3	103.9	167.8	247.2	135.6	139.8	116.4	156.5	125.5
115	109.7	103.6	102.2	111.0	176.8	255.0	147.0	148.7	120.7	163.9	137.6
120	113.5	108.5	107.0	108.7	179.0	259.7	157.9	156.5	125.9	171.4	148.2
121	114.0	109.0	107.8	107.7	179.4	253.8	161.0	159.4	127.4	172.6	150.2
122	115.2	109.9	108.3	107.0	181.6	250.2	163.1	161.8	129.1	174.2	151.7
123	116.3	110.5	109.1	106.5	183.5	240.8	165.5	164.3	130.9	175.4	153.4
124	117.2	111.2	109.6	106.3	185.0	228.6	168.1	166.4	133.1	176.5	155.2
125	118.3	112.5	109.7	106.5	181.6	217.5	171.0	169.2	134.2	178.1	156.8
126	119.2	113.9	110.4	106.9	179.0	215.2	173.2	171.3	134.5	179.6	158.4
127	120.5	115.0	110.5	107.5	180.7	214.7	174.7	173.0	135.1	181.7	159.7
128	121.8	115.4	111.0	108.3	182.0	216.6	177.0	175.8	136.1	183.3	161.4
129	123.1	116.0	111.6	109.1	177.5	217.7	178.4	176.9	135.5	185.5	162.9
130	124.4	117.3	112.5	110.1	172.8	219.4	179.9	178.5	135.3	187.3	164.4
131	125.7	118.4	112.7	110.7	170.6	221.7	182.4	180.2	135.7	189.0	165.7
132	127.2	119.6	113.1	111.2	169.8	223.8	184.4	182.0	136.6	191.0	167.1

Table 1 Individual Temperatures Recorded on the Unexposed Surface of the Specimen(cont'd)

Time (mins)	Thermocouple No.										
	23	24	25	26	27	28	29	30	31	32	33
0	28.1	28.2	27.6	28.3	27.8	27.8	27.1	26.9	27.1	27.3	26.8
5	36.2	32.4	25.1	33.8	30.8	25.6	27.2	25.1	27.9	26.0	23.8
10	40.8	36.6	33.7	42.0	38.4	33.0	29.0	33.2	31.4	27.9	24.0
15	47.0	40.8	60.4	51.4	52.0	44.6	30.3	44.7	33.8	30.2	24.4
20	50.0	45.0	50.6	49.7	51.1	43.5	31.1	46.8	36.5	32.0	25.7
25	53.2	49.2	45.5	54.3	50.2	42.7	37.0	46.4	54.1	34.9	26.6
30	63.5	53.5	47.8	53.2	55.9	46.9	50.7	54.4	57.6	41.5	30.0
35	71.6	57.7	50.8	52.9	58.3	51.2	52.9	60.2	64.6	54.4	35.2
40	79.5	61.9	57.1	53.8	60.9	55.4	70.0	65.1	77.9	71.2	45.4
45	83.3	66.1	59.7	55.3	63.9	60.9	73.1	65.5	79.1	75.1	52.5
50	84.6	70.3	62.1	58.5	65.9	61.8	75.3	67.7	80.8	72.0	56.4
55	85.2	74.5	62.5	58.1	68.8	61.3	76.6	68.6	81.1	68.4	58.6
60	85.5	78.7	64.5	58.5	68.9	62.1	79.1	71.6	82.3	67.0	61.9
65	87.1	82.9	66.0	59.3	71.0	60.7	82.1	74.2	84.9	68.6	63.2
70	90.5	85.7	69.0	62.5	69.9	61.3	86.5	77.0	90.9	71.6	63.7
75	93.3	87.2	70.0	63.8	71.1	61.6	89.0	78.3	96.8	76.2	63.5
80	95.6	92.8	73.0	66.8	73.4	62.6	92.3	81.8	104.4	80.8	63.8
85	98.8	94.5	75.4	68.8	75.2	63.3	95.5	83.6	109.6	86.0	64.0
90	101.9	99.7	77.9	69.6	76.4	63.6	99.8	86.3	114.3	91.2	65.0
95	104.8	98.4	80.7	72.7	78.2	64.5	103.4	88.3	117.5	97.9	66.1
100	108.9	107.5	83.3	73.1	79.8	65.6	105.8	90.2	120.0	103.0	67.0
105	112.9	111.4	85.9	82.9	80.1	66.5	114.4	91.5	124.1	111.4	66.0
110	117.5	118.2	87.4	89.6	82.5	67.7	118.0	93.1	132.3	119.7	68.0
115	123.1	123.9	90.1	90.8	88.3	79.3	121.5	96.7	145.8	128.5	68.6
120	129.0	129.5	93.0	99.5	103.4	84.9	123.3	100.4	157.7	134.9	68.1
121	131.7	132.4	95.7	100.9	106.2	87.1	126.2	102.8	157.5	136.5	68.1
122	133.5	134.6	96.7	101.6	108.7	88.8	128.1	105.5	159.7	138.5	68.8
123	135.8	136.7	98.4	103.5	110.6	88.1	129.9	107.5	164.3	140.7	68.8
124	137.8	138.4	99.6	112.8	114.0	87.6	131.3	109.2	169.6	143.2	69.2
125	140.5	140.9	101.1	114.0	118.8	87.8	133.0	108.9	175.2	146.3	68.2
126	142.1	142.0	102.1	117.0	122.7	87.5	134.4	108.9	177.0	149.2	69.2
127	143.6	145.2	103.2	115.0	127.1	89.0	134.9	110.5	177.4	153.2	70.0
128	145.5	149.5	105.7	114.0	126.9	90.3	136.1	113.6	175.2	156.6	71.0
129	146.6	152.4	106.1	114.2	129.4	89.2	136.5	114.7	181.2	159.8	71.4
130	148.0	158.2	106.6	114.2	133.4	87.8	137.3	114.9	183.0	162.5	72.2
131	149.8	163.7	108.0	109.7	136.2	88.6	138.9	116.8	184.1	165.6	72.7
132	151.6	171.0	109.0	108.8	138.6	87.1	139.8	117.3	181.6	168.7	73.5

Table 1 Individual Temperatures Recorded on the Unexposed Surface of the Specimen(cont'd)

Time (mins)	Thermocouple No.										
	34	35	36	37	38	39	40	41	42	43	44
0	26.2	23.0	23.3	23.6	23.3	23.0	22.0	24.5	24.4	26.0	25.4
5	24.9	23.2	23.4	25.2	24.2	31.9	29.3	25.4	28.9	30.3	26.2
10	20.0	28.0	27.2	28.3	27.2	38.4	40.8	28.9	50.2	48.7	32.6
15	34.8	35.2	34.6	33.3	29.6	44.9	64.7	34.1	72.6	56.9	64.2
20	43.5	43.5	42.6	36.2	38.0	51.5	77.5	41.5	75.6	66.7	74.9
25	50.9	50.8	49.7	42.0	44.0	58.0	78.6	49.8	75.2	69.0	85.0
30	57.2	57.3	55.8	48.1	51.2	64.5	82.4	60.4	81.2	73.3	89.2
35	63.2	62.9	60.9	55.5	59.0	71.1	85.6	70.4	92.2	81.6	92.1
40	68.6	69.4	66.5	63.3	65.9	73.6	90.4	79.8	98.6	88.5	133.6
45	73.3	73.8	71.0	71.5	73.3	73.5	92.0	89.5	103.0	90.8	186.2
50	76.8	76.9	74.1	82.9	83.5	75.5	93.5	93.9	67.0	97.3	152.9
55	79.1	79.1	76.1	89.4	90.2	81.2	96.9	96.8	77.8	97.3	144.6
60	81.9	81.1	78.0	91.7	91.8	80.9	99.0	100.3	83.0	97.5	152.8
65	85.1	82.9	79.9	92.8	92.4	80.8	100.3	105.3	85.3	102.7	173.2
70	89.3	83.6	81.1	93.8	92.7	82.8	101.1	107.7	95.6	109.6	164.9
75	90.0	85.5	82.1	94.3	92.9	86.5	104.8	110.8	101.9	116.4	144.2
80	90.9	87.1	83.4	94.7	93.8	92.5	111.9	114.4	106.9	122.8	148.6
85	91.9	88.3	85.1	95.9	93.5	92.8	112.3	117.7	113.2	128.2	145.6
90	93.3	88.3	86.5	96.8	92.5	95.7	114.5	124.8	114.4	131.5	145.0
95	91.4	87.9	86.3	98.6	93.9	103.4	116.3	133.0	117.8	136.6	151.9
100	90.5	88.4	86.4	101.3	95.8	109.5	118.1	139.1	121.4	141.6	158.7
105	89.4	89.3	86.8	104.8	98.7	114.9	121.2	149.0	125.7	144.3	165.3
110	89.6	89.8	87.2	108.4	102.0	120.3	126.5	155.0	130.5	148.5	172.9
115	93.8	91.6	88.1	109.6	107.2	126.0	132.1	164.9	133.5	149.7	179.2
120	96.0	94.2	89.4	113.3	106.0	131.7	139.0	173.3	139.6	156.3	183.2
121	96.4	94.7	89.5	113.6	105.6	132.9	140.0	173.9	139.8	157.4	183.3
122	96.8	95.3	90.1	114.2	105.5	134.1	140.8	175.4	142.1	158.9	183.3
123	97.2	96.2	90.7	115.0	104.9	135.5	141.9	175.7	143.9	160.9	183.0
124	97.4	97.1	91.3	116.1	103.2	136.2	142.7	175.0	143.3	160.8	181.7
125	97.5	98.0	91.8	117.8	102.3	137.1	144.0	173.9	144.7	160.1	181.5
126	97.9	100.7	92.6	119.0	101.8	138.3	145.0	172.1	145.9	158.8	181.6
127	97.9	101.9	93.6	120.2	102.3	139.2	146.1	172.7	150.2	157.7	181.9
128	98.4	101.9	94.7	120.9	102.2	139.7	147.0	171.6	152.3	157.1	181.9
129	98.5	101.4	95.8	121.7	102.6	140.9	147.7	172.5	159.2	156.2	182.0
130	98.8	100.7	97.1	122.4	102.5	142.0	148.8	172.5	160.2	155.6	182.2
131	98.9	99.7	98.8	123.1	103.4	143.0	150.5	173.4	162.7	155.4	182.8
132	99.7	99.0	99.4	124.0	103.6	144.2	151.9	172.6	163.0	155.4	183.6

Table 1 Individual Temperatures Recorded on the Unexposed Surface of the Specimen(cont'd)

Time (mins)	Thermocouple No.										
	45	46	47	48	49	50	51	52	53	54	55
0	25.5	23.0	22.9	20.0	24.0	24.2	23.9	24.3	24.5	26.3	25.5
5	27.5	23.9	23.4	20.5	24.4	24.6	24.0	24.6	29.6	31.5	35.1
10	30.4	27.2	25.5	28.3	30.8	28.0	24.8	25.9	34.7	36.6	55.9
15	34.5	31.9	31.3	37.1	39.2	36.0	26.0	31.2	39.8	41.8	84.3
20	40.3	37.0	35.1	38.7	43.3	37.7	35.4	51.3	45.0	47.0	86.9
25	42.8	41.4	38.4	34.5	51.5	45.5	48.6	76.4	50.1	52.2	92.3
30	51.1	50.5	47.2	0.0	62.2	55.6	65.6	85.5	55.2	57.4	94.0
35	58.3	58.9	57.2	61.8	74.3	64.7	78.9	88.2	60.3	62.6	95.0
40	64.7	70.4	77.3	74.0	82.7	77.0	85.0	90.9	65.4	67.8	95.3
45	69.2	80.1	116.1	94.9	87.2	86.6	87.2	93.0	70.5	73.0	96.3
50	78.2	88.2	143.5	112.2	89.6	90.2	88.7	93.3	75.7	78.2	97.4
55	86.6	93.8	143.8	107.5	90.3	91.9	87.8	93.4	80.8	83.4	98.7
60	90.5	93.7	149.6	90.2	91.0	92.6	86.6	93.9	85.9	93.4	100.7
65	91.6	93.9	140.0	88.9	92.2	93.6	87.6	94.6	91.0	96.2	102.6
70	91.8	93.3	129.1	92.0	93.5	95.4	88.9	94.9	96.1	98.4	105.2
75	92.1	93.0	127.1	93.3	95.0	96.9	89.9	96.0	101.2	99.2	108.1
80	91.6	93.5	132.9	93.3	95.6	98.3	90.3	96.1	109.9	101.3	113.2
85	91.5	92.9	131.8	95.0	97.2	100.0	90.6	96.0	118.9	105.5	118.3
90	92.3	93.3	129.9	95.9	98.2	101.3	90.6	96.1	129.3	114.1	123.5
95	92.9	93.4	127.3	97.4	101.0	104.0	91.8	96.2	139.6	124.4	131.5
100	94.2	94.5	125.0	99.0	102.6	106.7	93.8	97.0	146.5	132.7	141.6
105	96.3	96.4	124.0	99.7	104.0	108.9	97.7	98.3	159.4	137.7	150.2
110	98.6	98.8	126.5	101.7	105.6	113.3	100.2	99.4	160.1	140.5	154.5
115	100.9	101.5	129.4	105.2	108.6	118.2	101.0	100.3	169.8	144.2	160.5
120	103.7	104.6	133.1	109.0	111.7	123.0	102.2	101.0	184.7	147.1	168.6
121	104.3	105.3	134.1	109.9	112.3	123.2	102.4	101.3	187.3	148.0	170.3
122	105.0	106.2	134.8	110.5	113.2	123.3	102.6	101.5	189.3	149.0	171.7
123	105.8	107.2	135.7	111.4	114.1	122.9	103.1	101.5	192.6	150.2	173.0
124	106.2	107.8	132.2	111.7	114.5	121.8	103.0	101.5	194.5	150.2	174.9
125	107.0	108.6	130.6	112.3	115.0	120.6	102.5	101.6	196.6	149.6	176.6
126	107.6	109.2	129.0	113.2	115.6	120.3	101.9	101.5	199.2	149.1	178.0
127	108.0	109.8	128.4	113.6	115.3	119.7	101.9	101.9	204.0	148.9	179.6
128	109.0	110.6	127.8	114.0	115.5	119.3	101.8	101.9	208.9	149.0	181.1
129	109.7	111.2	127.3	114.9	115.5	119.2	101.8	101.0	212.7	148.5	182.8
130	110.2	111.7	127.6	115.9	116.4	119.7	101.7	100.3	216.9	148.3	184.7
131	110.9	112.4	128.0	116.3	117.0	120.2	101.8	99.8	223.5	148.2	186.2
132	111.6	113.2	128.5	116.9	117.6	120.6	101.5	99.4	228.2	148.2	187.6

Table 1 Individual Temperatures Recorded on the Unexposed Surface of the Specimen(cont'd)

Time (mins)	Thermocouple No.										
	56	57	58	59	60	61	62	63	64	65	66
0	27.8	24.9	24.8	24.5	27.0	25.9	28.0	27.2	26.5	26.1	24.2
5	33.7	25.4	24.9	25.0	27.0	25.8	31.7	27.3	26.6	28.3	24.0
10	39.6	30.7	30.0	28.6	20.3	19.1	35.5	27.3	26.6	30.6	25.2
15	49.3	40.6	39.6	36.6	20.8	26.5	39.2	29.1	27.3	32.8	34.2
20	66.0	46.9	47.6	49.3	35.9	32.8	42.9	33.7	31.0	35.0	48.8
25	82.0	56.1	52.3	61.8	45.5	43.4	46.7	40.6	36.6	37.3	54.3
30	92.9	65.7	59.1	84.7	72.9	56.3	50.4	49.3	44.6	39.5	49.3
35	93.8	74.3	68.6	89.6	83.3	78.4	54.1	61.2	54.7	41.8	42.5
40	95.7	84.3	79.0	90.3	85.7	94.7	57.9	75.5	65.8	44.0	34.7
45	98.4	87.5	85.6	91.1	87.0	102.9	61.6	79.0	85.2	46.2	36.4
50	98.9	86.9	94.6	91.3	87.8	103.1	65.3	87.2	91.1	48.5	82.3
55	100.5	87.2	93.4	91.1	87.8	103.2	69.1	92.8	92.4	50.7	86.6
60	104.1	87.4	95.5	91.4	88.4	102.6	72.8	95.8	94.0	52.9	88.6
65	107.5	88.7	101.9	92.0	89.6	102.6	76.5	97.6	95.3	55.2	90.7
70	110.9	89.4	105.3	93.0	89.3	104.1	81.2	103.2	96.3	57.4	93.0
75	115.3	91.9	109.3	94.0	90.6	104.9	85.6	106.2	96.8	59.7	97.6
80	121.9	94.3	108.7	95.5	91.9	103.9	87.2	107.2	97.8	61.9	104.7
85	129.0	97.7	107.3	97.1	94.6	105.3	87.9	108.7	98.7	64.1	113.3
90	138.2	101.4	104.7	99.0	95.2	105.9	88.3	109.9	99.7	66.4	121.1
95	146.5	104.7	106.4	101.0	96.3	106.3	89.6	112.5	101.1	69.4	128.0
100	150.4	109.2	109.9	103.9	100.8	107.4	90.9	114.2	103.9	73.4	134.4
105	157.1	113.9	113.3	106.0	107.2	110.5	92.5	116.3	107.6	74.4	143.1
110	161.1	119.0	118.8	107.7	113.9	112.8	94.4	117.6	111.1	75.9	151.5
115	161.6	123.2	120.4	110.1	115.5	116.0	95.3	118.9	114.6	77.1	162.7
120	151.9	129.5	121.9	113.4	121.5	119.2	95.4	119.9	118.4	78.9	170.5
121	151.7	130.9	122.4	114.6	123.6	120.1	95.6	120.2	119.2	77.2	172.0
122	151.2	131.7	122.6	114.8	121.6	120.8	95.8	120.2	120.0	76.4	172.8
123	150.3	133.2	123.3	115.0	121.0	121.5	95.8	120.0	120.8	77.8	174.2
124	150.6	134.2	123.7	116.0	120.5	122.3	95.6	120.0	121.7	79.1	175.9
125	151.6	134.9	123.9	117.0	120.0	122.5	95.6	120.1	122.5	79.4	177.2
126	151.6	136.0	123.8	117.6	119.9	122.7	95.4	119.6	123.2	79.0	177.6
127	152.7	138.2	123.9	118.5	121.1	122.9	95.1	118.2	123.8	80.1	178.8
128	153.2	140.2	124.3	119.5	122.8	122.9	95.0	116.1	124.5	78.8	180.2
129	154.9	141.8	124.6	120.7	123.9	123.4	94.9	115.6	125.2	78.1	181.0
130	157.1	143.0	124.7	121.9	124.8	123.6	94.7	114.9	125.7	77.2	181.7
131	158.5	144.2	125.2	123.2	125.5	124.5	94.5	115.0	126.2	77.6	182.9
132	159.5	145.5	125.2	124.0	126.6	124.9	94.4	114.4	125.7	77.8	183.7

Table 1 Individual Temperatures Recorded on the Unexposed Surface of the Specimen(cont'd)

Time (mins)	Thermocouple No.										
	67	68	69	70	71	72	73	74	75	76	77
0	23.1	25.4	24.6	27.9	23.5	23.9	24.5	24.4	24.6	24.8	23.6
5	30.4	30.8	24.5	28.0	23.7	23.9	23.8	24.5	28.2	25.2	27.7
10	62.2	36.2	24.9	28.4	26.9	25.7	27.0	44.8	37.6	29.1	47.1
15	64.2	41.5	31.0	34.5	32.1	28.6	30.3	73.9	65.3	37.1	77.8
20	67.9	46.9	55.8	44.0	39.9	34.0	36.9	75.3	76.5	49.1	86.3
25	42.6	52.3	72.5	53.5	48.1	43.3	46.9	81.4	80.1	76.5	84.6
30	37.3	57.7	82.3	62.9	60.3	60.1	47.3	89.1	88.8	92.4	87.6
35	45.1	63.1	85.8	72.4	68.3	72.3	55.9	88.7	87.4	94.4	91.5
40	55.8	68.4	85.6	81.9	76.2	79.3	38.0	85.6	91.0	96.5	92.3
45	58.9	71.5	88.0	89.9	84.1	82.9	41.0	79.7	92.6	97.5	93.9
50	74.3	74.4	89.4	90.1	88.9	84.2	43.0	52.8	4.0	98.0	95.1
55	81.5	73.9	89.7	86.2	90.3	84.3	52.2	65.4	54.0	98.6	96.9
60	89.1	74.0	91.6	92.9	90.2	85.6	56.8	62.2	77.2	99.4	97.2
65	98.1	71.4	93.9	97.8	90.6	85.9	57.4	79.0	97.3	100.0	98.3
70	107.9	70.7	92.3	104.9	88.1	86.3	54.6	84.3	97.1	100.7	101.2
75	114.6	70.9	91.8	108.7	88.8	86.0	56.5	93.4	98.2	101.6	102.5
80	121.7	73.8	96.8	113.1	78.5	86.5	57.7	92.4	109.8	102.7	105.1
85	130.6	85.5	101.5	115.3	85.8	87.0	57.0	107.6	122.5	104.5	109.3
90	140.3	96.4	108.2	117.7	88.0	87.7	54.8	118.5	128.0	108.1	115.9
95	148.9	102.2	116.7	119.3	88.9	87.8	53.6	131.1	135.9	113.1	124.9
100	157.6	108.2	121.9	122.1	90.6	88.9	65.5	138.5	140.0	123.0	135.1
105	163.7	113.3	128.9	123.9	93.0	91.0	68.3	151.5	149.7	132.8	146.0
110	169.7	118.6	132.9	127.1	96.0	93.2	67.9	160.8	159.1	142.9	155.6
115	174.9	126.0	138.3	130.3	99.4	96.4	65.7	168.0	167.2	152.5	167.2
120	179.0	132.2	146.5	134.9	102.3	100.5	70.0	177.0	176.1	162.9	176.4
121	179.7	133.9	147.6	134.9	103.2	101.5	66.0	178.4	176.8	165.0	177.3
122	180.7	136.6	149.1	135.8	103.7	102.4	71.8	180.3	178.3	167.4	179.2
123	182.0	138.1	151.2	137.0	104.4	102.9	66.7	182.5	178.9	169.7	180.9
124	182.4	139.8	153.6	137.4	105.0	103.9	66.3	183.2	180.9	172.4	182.8
125	183.3	141.9	154.8	138.1	105.8	104.9	71.1	182.3	183.1	175.4	185.4
126	183.5	142.8	155.2	139.0	105.9	105.2	68.5	183.8	185.3	177.8	187.0
127	184.4	144.5	153.2	139.3	106.6	106.2	69.8	186.4	185.7	179.8	188.9
128	185.5	145.2	155.3	139.1	107.4	107.4	67.6	188.2	185.1	181.8	190.4
129	186.5	146.6	156.2	139.9	108.0	108.3	71.5	190.2	185.6	183.6	191.8
130	186.9	148.2	158.6	140.4	108.5	109.3	72.7	191.1	185.9	185.7	193.5
131	187.6	149.3	162.0	141.3	109.2	110.2	73.0	192.6	188.0	187.7	195.4
132	187.7	150.5	163.5	141.8	109.6	111.3	71.1	193.6	189.0	189.4	196.8

FUGRO TECHNICAL SERVICES (GUANGZHOU) LIMITED
No.6, Nongye Gongsi Road
Caotang, Hualong, Panyu
Guangzhou
China

Table 1 Individual Temperatures Recorded on the Unexposed Surface of the Specimen(cont'd)

Time (mins)	Thermocouple No.						
	78	79	80	81	82	83	84
0	25.1	25.9	25.0	23.7	25.0	23.0	23.7
5	25.0	48.3	27.8	29.8	32.6	32.2	25.2
10	25.9	57.7	43.5	54.1	40.2	56.1	42.9
15	30.5	66.9	68.1	79.4	47.8	70.4	46.0
20	36.6	79.8	74.1	87.5	55.4	80.0	57.4
25	42.7	88.3	80.8	89.2	63.0	85.3	50.8
30	48.8	93.8	87.0	90.0	70.6	84.2	60.3
35	54.9	95.7	91.2	91.2	78.2	73.6	60.5
40	61.0	98.3	94.2	92.2	85.8	83.6	69.8
45	67.1	100.6	95.1	93.0	93.4	74.5	65.2
50	73.2	101.3	95.0	94.5	101.0	80.6	64.2
55	79.3	103.8	95.2	97.5	108.6	80.1	63.3
60	85.5	106.4	98.6	102.6	116.2	86.2	60.6
65	91.6	111.7	108.5	110.7	123.8	102.2	62.2
70	97.7	119.7	116.7	120.9	131.4	116.0	67.5
75	103.8	131.1	125.6	133.1	139.0	132.4	80.0
80	109.9	142.0	134.8	147.0	146.6	143.0	90.7
85	116.0	150.1	144.0	159.2	168.5	154.3	96.8
90	122.1	163.1	152.9	171.5	186.3	165.5	107.6
95	128.2	176.7	163.9	181.9	195.2	175.3	156.3
100	134.9	188.9	173.5	191.5	203.9	185.7	118.4
105	141.4	199.5	182.3	203.3	214.6	196.1	123.1
110	147.0	209.6	190.2	212.9	227.3	208.6	128.6
115	154.4	220.0	197.3	222.8	234.9	220.2	134.9
120	161.3	231.0	204.8	235.5	244.8	231.4	139.0
121	162.8	233.3	205.8	237.2	246.3	233.3	139.1
122	164.6	236.0	207.3	239.5	247.9	235.2	139.2
123	165.9	238.6	208.3	241.0	250.2	236.7	140.4
124	167.2	241.4	209.6	243.9	250.8	238.5	141.9
125	167.3	244.2	211.3	246.7	252.2	240.5	143.9
126	168.5	247.0	212.8	248.3	252.5	242.3	146.0
127	169.8	249.3	213.9	250.6	253.2	242.7	146.5
128	170.8	250.8	214.9	252.9	254.6	243.6	149.0
129	172.5	253.5	216.1	254.8	255.4	244.2	148.3
130	173.9	255.9	216.8	256.3	255.9	244.7	149.9
131	175.5	257.9	217.9	258.3	256.6	245.3	152.2
132	176.8	260.5	218.9	260.1	256.9	246.2	153.9

Table 2 Lateral Deflections of the Specimen as Viewed from the Unexposed Surface

Time (mins)	Deflections (mm)									
	A	B	C	D	E	F	G	H	I	J
0	0	0	0	0	0	0	0	0	0	0
20	2	7	8	7	15	15	27	12	-1	5
40	13	15	19	10	31	33	49	27	-7	7
60	13	18	23	14	43	51	59	40	-5	12
80	16	18	17	18	51	55	69	46	-2	18
100	16	5	27	18	54	63	70	56	2	15
110	15	5	30	18	53	63	70	57	5	15
120	16	5	32	20	53	63	71	60	5	15

Time (mins)	Deflections (mm)						
	A1	B1	C1	D1	E1	F1	G1
0	0	0	0	0	0	0	0
20	3	3	2	3	4	1	-6
40	16	7	6	4	11	4	-8
60	20	15	10	4	18	9	-8
80	24	17	15	6	21	6	-8
100	28	22	18	8	23	1	-8
110	35	27	21	9	27	1	-8
120	38	29	26	12	32	1	-8

Positive deflections indicate movement towards the heat source.

Table 3 Observations Made during the Test

Unless stated otherwise, all observations made from the unexposed side.

Time (min:sec)	Observations
00:00	The test commences.
01:22	Smoke release is visible from louver A of the double-leaf door. Smoke release is visible from the head edge of the single-leaf door.
02:10	Banging noise is heard from the glass panel. Colour of the glass panels start to blur. Smoke release is visible from the head edge of the double-leaf door.
03:45	The inner layer of the glass panel drop from the specimen.
05:40	Smoke release increase from the specimen.
06:42	Smoke release is visible from the meeting edge of the double-leaf door and the left edge of the single-leaf door.
08:14	Smoke release is visible from the left edge of the double-leaf door.
08:22	Smoke release is visible from louver B of the double-leaf door. Smoke release is visible from the perimeter edge of the transom panel of the double-leaf door.
12:31	Smoke release is visible from the bottom edge of the single-leaf door. Smoke release is visible from the perimeter edge of the transom panel of the single-leaf door.
18:16	Smoke release is visible from the bottom and right edges of the double-leaf door. Smoke release is visible from the right edge of the single-leaf door.
25:42	Black discolouration is visible at the head frame of the inactive leaf of the double-leaf door, and the bottom edge of the single-leaf door.
30:00	No integrity or insulation failure has occurred.
57:24	Smoke release is visible from the head edge of the glass panel. Black discolouration is visible at the position of thermocouple 16.
60:00	No integrity or insulation failure has occurred.

Table 3 Observations Made during the Test (cont'd)

Unless stated otherwise, all observations made from the unexposed side.

Time (min:sec)	Observations
64:25	Black discolouration is visible at the position of the hinges of the double-leaf door.
81:42	Black discolouration is visible at the right edge of the transom panel of the double-leaf door.
89:51	The temperature of thermocouple 17 records as 205.2℃.
90:00	No integrity or insulation failure has occurred.
99:57	The temperature of thermocouple 82 records as 205.2℃.
120:00	No integrity or insulation failure has occurred.
127:11	The temperature of thermocouple 53 records as 204.8℃.
132:30	Test is terminated.

8. Performance Criteria

The performance of the specimen was assessed against the criteria for integrity and insulation in accordance with BS EN 1634-1: 2014+A1:2018. The performance criteria for failure were given as follows:

Integrity (E): The test specimen continues to maintain its separating function during the test without either:

a) causing the ignition of a cotton pad when applied; or

b) permitting the penetration of a gap gauge as follows:

i) whether the 6 mm gap gauge can be passed through the test specimen such that the gauge projects into the furnace, and can be moved a distance of 150 mm along the gap; or

ii) whether the 25 mm gap gauge can passed through the specimen such that the gauge projects into the furnace; or

c) resulting in sustained flaming for a period of time greater than 10 seconds.

Insulation (I): The test specimen continues to maintain its separating function during the test without developing temperatures on its unexposed surface which either:

a) increase the average temperature above the initial average temperature by more than 140ºC; or

b) increase at any perimeter frame member of the doorset or openable window above the initial average temperature by more than 360ºC; and any other location (including the roving thermocouple) above the initial average temperature by more than 180ºC. [Normal procedure – Classification I_2].

The performance criteria “insulation” shall automatically be assumed not to be satisfied when the “integrity” criterion ceases to be satisfied.

9. Conclusion

A specimen of a single-acting, double-leaf, and a single-acting, single-leaf metal doorset has been subjected to a fire resistance test in accordance with BS EN 1634-1: 2014+A1:2018.

The fire resistance performance of the specimen was judged against the criteria for integrity and insulation, and the specimen satisfied the performance requirements for the following period:

The double-leaf door:

Integrity (E)	Sustained flaming	132 minutes, no failure
	Gap gauge	132 minutes, no failure
	Cotton pad	132 minutes, no failure
Insulation (Classification I_2)	Door leaves	132 minutes, no failure
	Door frame	132 minutes, no failure
	Glazed panel	132 minutes, no failure
	Louver A	132 minutes, no failure
	Louver B	132 minutes, no failure
	Transom panel A	132 minutes, no failure

The single-leaf door:

Integrity (E)	Sustained flaming	132 minutes, no failure
	Gap gauge	132 minutes, no failure
	Cotton pad	132 minutes, no failure
Insulation (Classification I_2)	Door leaf	132 minutes, no failure
	Door frame	132 minutes, no failure
	Transom panel B	132 minutes, no failure

The test was discontinued after a period of 132 minutes at the request of the client.

10. Field of Direct Application of Test Results

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

Materials and construction - General: Unless otherwise stated in the following text, the materials and construction of the doorset or openable window shall be the same as that tested. The number of leaves and the mode of operation (e.g. sliding, single action or double action) shall not be changed.

Specific restrictions on materials and construction:

a) Metal constructions: The dimensions of metal wrap around frames may be increased to accommodate increased supporting construction thickness. The thickness of the metal may also be increased by up to 25%. The type of metal shall not be changed from that tested. The number of stiffening elements for uninsulated doors and the number and type of fixings of such members within the panel fabrication may be increased proportionally with the increase in size but shall not be reduced.

b) Glazed constructions: The type of glass and the edge fixing technique, including type and number of fixings per metre of perimeter, shall not be changed from those tested. The number of glazed apertures and each of the dimensions (width and height) of glass may be decreased by a maximum of 25% in proportion with door size reductions but shall not be increased. The distance between the edge of glazing and the perimeter of the door leaf, or the distance between glazed apertures shall not be reduced.

Decorative finished: Paint finish are acceptable and may be added to door leaves or frames.

Decorative laminates: Decorative laminates and timber veneers up to 1.5 mm thickness may be added to the faces (but not the edges) of doors.

Fixings: The number of fixings per unit length used to attach doorset to supporting constructions may be increased but shall not be decreased and the distance between fixings may be reduced but shall not be increased.

Building hardware: The number of hinges and dog bolts may be increased but shall not be decreased.

Permissible size variations - General: Doorsets of sizes different from those of the tested specimen are permitted within certain limitations but the variations are dependent on product type and the length of time that the performance criteria are fulfilled.

Specific size variations: Unlimited size reduction is permitted for all types except insulated metal doors where a reduction to 50% width and 75% height of the tested specimen is the limit of variation. Size increase may be permitted, depending on the required classification period, in line with 13.3 of BS EN 1634-1:2014+A1:2018.

Other changes: For smaller doorset sizes the relative positioning of movement restrictors (e.g. hinges, latches, etc) shall remain the same as tested or any change to the distances between them will be limited to the same percentage reduction as the decrease of test specimen size.

Asymmetrical doorsets - General: BS EN 1363-1 states that for separating elements required to be fire resisting from both sides, two test specimens shall be tested (one from each direction) unless the element is fully symmetrical, i.e. the construction of the doorset is identical on both sides of a centre line when viewed in plan (from above). However, in some cases it is possible to develop rules whereby the fire resistance of an asymmetrical door assembly tested in one direction can apply when the fire exposure is from the other direction. The possibility to develop such rules increases if the consideration is limited to certain types of door assembly and on the criteria being applicable (e.g. integrity only doors). The following rules represent the minimum level of common agreement which shall be followed. The rationale behind the rules is given in Annex C of BS EN 1634-1: 2014+A1:2018.

Specific rules: The doorset was asymmetrical and was tested such that the door leaf opened away from the heating conditions of the test. The doorset conformed with the specific rules given in 13.4.2 of BS EN 1634-1: 2014+A1:2018 which gives details of the applicability of the test results of doorset tested in one direction to cover the opposite direction.

Supporting constructions - General: The fire resistance of a door assembly tested in one form of standard supporting construction may or may not apply when it is mounted in other types of construction. However, in some cases it is possible for the result of a test on a particular type of door assembly tested in one form of standard supporting construction to be applicable to that door assembly when mounted in a different type of standard supporting construction.

Specific rules: For insulated metal door leaves hung in metal frames, there is no applicability of results in rigid standard supporting construction to flexible constructions or vice versa. To cover rigid and flexible types, tests shall be undertaken in each type of standard supporting construction.

11. Limitation

The results only relate to the behaviour of the specimen of the element of construction under the particular conditions of the test. They are not intended to be the sole criteria for assessing the potential fire performance of the element in use, nor do they reflect the actual behaviour in fires.

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, constructional details, edge or end conditions other than those allowed under the field of direct application in the relevant test method is not cover by this report.

Because of the nature of fire resistance testing and 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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Guangzhou
China

Appendix A - Test Photographs

Photo 1 - The unexposed surface of the specimen before the test

Photo 2 - The unexposed surface of the specimen during the test

Photo 3 - The unexposed surface of the specimen during the test

Photo 4 - The unexposed surface of the specimen during the test

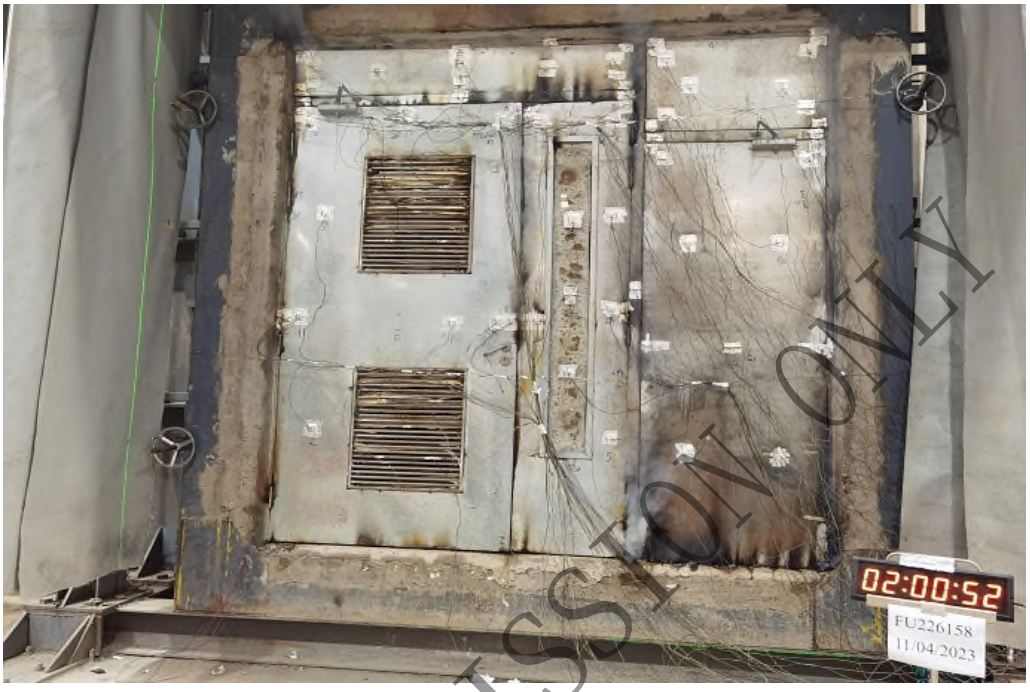

Photo 5 - The unexposed surface of the specimen during the test

Photo 6 - The unexposed surface of the specimen after the test

Photo 7 - The unexposed surface of the specimen after the test

** End of Report **

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No.6, Nongye Gongsi Road
Caotang, Hualong, Panyu
Guangzhou
China

REPORT ON SMOKE CONTROL TEST OF METAL DOORSET

Client	: HK Pro-Tech Fire Prevention Building Materials Limited
Project	: Smoke Control Test on Metal Doorset in accordance with BS EN 1634-3: 2004
Client Ref.	: --
Report No.	: G23308FU236217
Date of Report Issue	: 12 Mar 2024

FUGRO TECHNICAL SERVICES (GUANGZHOU) LIMITED
No.6, Nongye Gongsi Road
Caotang, Hualong, Panyu
Guangzhou
China

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No.6, Nongye Gongsi Road
Caotang, Hualong, Panyu
Guangzhou
China

REPORT ON SMOKE CONTROL TEST

1. Introduction

Fugro Technical Services (Guangzhou) Limited was commissioned by HK Pro-Tech Fire Prevention Building Materials Limited to determine the smoke leakage performance of two identical specimens of a single-acting, single-leaf, metal doorset with a transom panel in accordance with BS EN 1634-3: 2004.

The doorsets were required to provide a smoke leakage separating function at ambient together with medium temperature and the test was therefore conducted in accordance with BS EN 1634-3: 2004, 'Fire resistance and smoke control tests for door and shutter assemblies, openable windows and elements of building hardware – Part 3: Smoke control test for door and shutter assemblies'.

The specimens were received on 30 November 2023 and given Lab. Sample I.D.: FU236217 and FU236218.

The tests of FU236217 and FU236218 were conducted on 5 December 2023 and 8 December 2023 respectively.

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2. Summary

The results of the specimens were obtained and summarized as follows:

FU236217:

No. of test	Face exposed to pressure	Temperature	Leakage rate Q_{spec} (m^3/h) at pressure difference of			Linear leakage rate Q_l ($m^3/h/m$) at pressure difference of	
			10 Pa	25 Pa	50Pa	10 Pa	25 Pa
1	Open inwards	Ambient (threshold sealed)	3.78	7.29	11.55	0.60	1.15
2	Open inwards	Ambient	4.91	8.82	13.44		
3	Open inwards	Medium	3.21	5.48	7.26		

FU236218:

No. of test	Face exposed to pressure	Temperature	Leakage rate Q_{spec} (m^3/h) at pressure difference of			Linear leakage rate Q_l ($m^3/h/m$) at pressure difference of	
			10 Pa	25 Pa	50Pa	10 Pa	25 Pa
1	Open outwards	Ambient (threshold sealed)	1.91	3.47	5.76	0.30	0.55
2	Open outwards	Ambient	3.93	6.55	11.52		
3	Open outwards	Medium	1.21	2.15	4.30		

The performance of the specimens were assessed against the criteria for S_a and S_m, and the specimens satisfied the performance requirement of S_a and S_m of BS EN 1634-3: 2004.

Approved Signatory:

Yan Cai Sheng
Deputy General Manager

Date of Report Issued : 12 Mar 2024

3. Client Information

Client : HK Pro-Tech Fire Prevention Building Materials Limited

Client Address : A, 1/F, Hang Seng Centre, 95-97 Tung Chau Street, Tai Kok Tsui, Kowloon

Manufacturer : Dongguan City Teliang Fire Doors and Windows Co., Ltd

Manufacturer Address: Room 101-102, Building No. 1 Huguang Road No. 617, Qishi Town, Dongguan City, Guangdong Province, China

4. Test Specimen

Each doorset had overall nominal dimensions of 3002 mm high by 1183 mm wide by 103 mm thick. It incorporated a door leaf of overall nominal dimension of 2608 mm high by 1107mm wide by 60 mm thick.

The perimeter door frame had overall sectional dimensions of 55 mm wide by 103 mm thick with 20 mm deep rebate. The transom had overall sectional dimensions of 102 mm wide by 103 mm thick with 20 mm deep rebate on both sides. The perimeter door frame was comprised of 25 mm by 50 mm by 2 mm thick mild steel hollow section with four layers of MgO board infilling, and separated by a layer of 6 + 8 mm thick MgO board and two layers of 15 mm thick MgO board with 1.2 mm thick G.M.S. The transom was comprised of 50 mm by 50 mm by 2 mm thick mild steel hollow section with three layers of 15 mm thick MgO board infilling, and separated by a layer of 6 + 8 mm thick MgO board and two layers of 15 mm thick MgO board with 1.2 mm thick G.M.S. The door frame was fixed to the supporting construction by M10 x 80 mm screw at maximum 1050 mm centre to centre. The gap between the door frame and the supporting construction was filled with acrylic intumescent sealant on both sides.

The leaf and the transom panel had a core construction of 21 mm thick rock wool + 3 mm thick acoustic panel + 21 mm thick rock wool and sandwiched by 6 mm thick MgO board with 1.0 mm thick G.M.S on each face. The leaf and the transom panel rails and stiles were made of 2 mm thick G.M.S C-channel with 6 layers MgO board infilling.

A number of 20 mm wide by 4 mm thick intumescent fire and smoke seal with fins was fitted into groove on the head, left and right edges of the door frame. A number of 20 mm wide by 4 mm thick intumescent fire and smoke seal with fins was fitted into groove on the perimeter frame of the transom panel. A number of 30 mm wide by 4 mm thick intumescent fire and smoke seal with fins was fitted into groove on the head, left and right edges of the door leaf. A number of 30 mm wide by 4 mm thick intumescent fire and smoke seal with fins was fitted into groove on the perimeter of the transom panel. A number of 30 mm x 14 mm drop seal was fitted into groove on the bottom of door leaf.

The door leaf was hung within a door frame by four nos. of stainless steel butt hinges. The door leaf was provided with an overhead door closer mounted on the surface. The door leaf was provided with a latch, which was latched but not locked for the duration of the test.

A description of the test specimen is shown in Schedule of Components and Figure 1. The description is based on a detailed survey of the test specimens, an additional of the test specimen and the information supplied by the client.

Fugro Technical Services (Guangzhou) Limited was not involved in the selection of the specimens.

The doorsets were installed into a prepared opening within a hollow panel wall to form the test construction, and shown in Figure 2 and 3. It was mounted such that specimen FU236217 opened toward the test chamber and specimen FU236218 opened away from the test chamber. The hollow panel wall was constructed by hollow steel section with single layer gypsum board on both sides.

Installation of specimen FU236217 and FU236218 were conducted by client on 2 December 2023 and 6 December 2023 respectively.

After installation, the doorsets to be tested were checked for operability in the test frame by operating from fully closed to fully open to the maximum possible or at least 90 degrees for 25 cycles in accordance with BS EN 16034:2004.

After receiving, the specimens were stored in the test laboratory. Throughout this period of the storage, both the temperature and relative humidity of laboratory were measured and recorded as being within a range of from 18.8°C to 21.5°C and 42.0% to 69.0% (FU236217), and 18.8℃ to 24.9℃ and 42.0% to 78.5% (FU236218) respectively.

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HOKLAS 170 TEST

Schedule of Components

(Refer to Figure 1. Unless stated otherwise, all values are nominal, and all information in this Schedule of Components is supplied by the client.)

Item			Description
1a	**Intumescent Fire and Smoke Seal with Fins**		
	Brand	:	FAN QIU
	Model	:	FQ-CS-2004
	Size	:	20 mm x 4 mm thick *
	Fixing method	:	By adhesive
	Application location	:	1 no. of seal at the head, left and right edges of the door frame. * 1 no. of seal at the perimeter frame of the transom panel.
1b	**Intumescent Fire and Smoke Seal with Fins**		
	Brand	:	FAN QIU
	Model	:	FQ-CS-3004
	Size	:	30 mm x 4 mm *
	Fixing method	:	By adhesive
	Application location	:	1 no. of seal at the head, left and right edges of the door leaf. * 1 no. of seal at the perimeter of the transom panel.
2	**Bottom Smoke seal**		
	Manufacturer	:	Baimi
	Brand	:	BM-A01
	Material	:	Aluminum alloy
	Size	:	30 mm x 14 mm *
	Fixing method	:	By screw
	Application location	:	1 no. of seal at the bottom edge of the door leaf. *
3	**Door Frame**		
	Manufacturer	:	Dongguan City Teliang Fire Doors and Windows Co., Ltd
	Material	:	25 mm x 50 mm x 2.0 mm thick mild steel hollows 50 mm x 50 mm x 2.0 mm thick mild steel hollows 6 mm + 8 mm thick MgO board 15 mm thick MgO board 1.2 mm thick G.M.S cladding

* Verified by the laboratory.

Schedule of Components (cont'd)

Thickness	:	103 mm *
Overall size	:	1183 mm x 3002 mm *
Sectional dimension	:	103 mm x 55 mm * - perimeter door frame 103 mm x 102 mm * - transom
Rebate	:	20 mm *
Jambs to head jointing method	:	By welded
Fixing methods to support frame	:	Fixed to supporting construction with screw at maximum 1050 mm centre to centre. *
Fixing material	:	HILTI HRD-C 10 x 80 mm screw *

4 **Door Leaf and Transom Panel Stile & Rail**

Manufacturer	:	Dongguan City Teliang Fire Doors and Windows Co., Ltd
Material	:	2.0 mm thick G.M.S C channel 6 layers 15 mm thick MgO board infilling
Density	:	7.93 g/cm^3
Size	:	1 x (45 mm x 50 mm) - head and bottom edges of the door leaf and the transom panel * 1 x (45 mm x 50 mm) - left and right edges of the door leaf and the transom panel *
Fixing method	:	By welding

5a **Door Leaf Core**

Supplier	:	Dongguan City Teliang Fire Doors and Windows Co., Ltd
Material	:	Rock wool
Density	:	100 kg/m^3
Thickness	:	21 mm *

5b **Door Leaf Core**

Supplier	:	Dongguan City Teliang Fire Doors and Windows Co., Ltd
Material	:	Acoustic panel
Density	:	800 kg/m^3
Thickness	:	3 mm *
Fixing method	:	By adhesive

6 **Fire Board**

Supplier	:	Dongguan City Teliang Fire Doors and Windows Co., Ltd
Brand	:	GemTree
Material	:	Magnesium oxide (MgO)

* Verified by the laboratory.

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Schedule of Components (cont'd)

Density	:	800 -1000 kg/m^3
Thickness	:	6mm, 8 mm, 15 mm *
Fixing method	:	By adhesive

7 **Door Leaf Facing**

Supplier	:	Dongguan City Teliang Fire Doors and Windows Co., Ltd
Material	:	G.M.S
Thickness	:	1 mm *
Fixing method	:	By adhesive

8 **Butt Hinges**

Brand	:	Protech
Model	:	P102/2
Material	:	Stainless steel
Size		
i. Body	:	108 mm long by 14 mm diameter *
ii. Blade	:	102 mm x 102 mm x 3.0 mm thick *
Fixing method	:	By screw

9 **Door Lock (Latch)**

Brand	:	Protech
Model	:	P9001
Material	:	Stainless steel
Size	:	240 mm long x 87 mm wide x 30 mm thick *
Fixing method	:	By screw

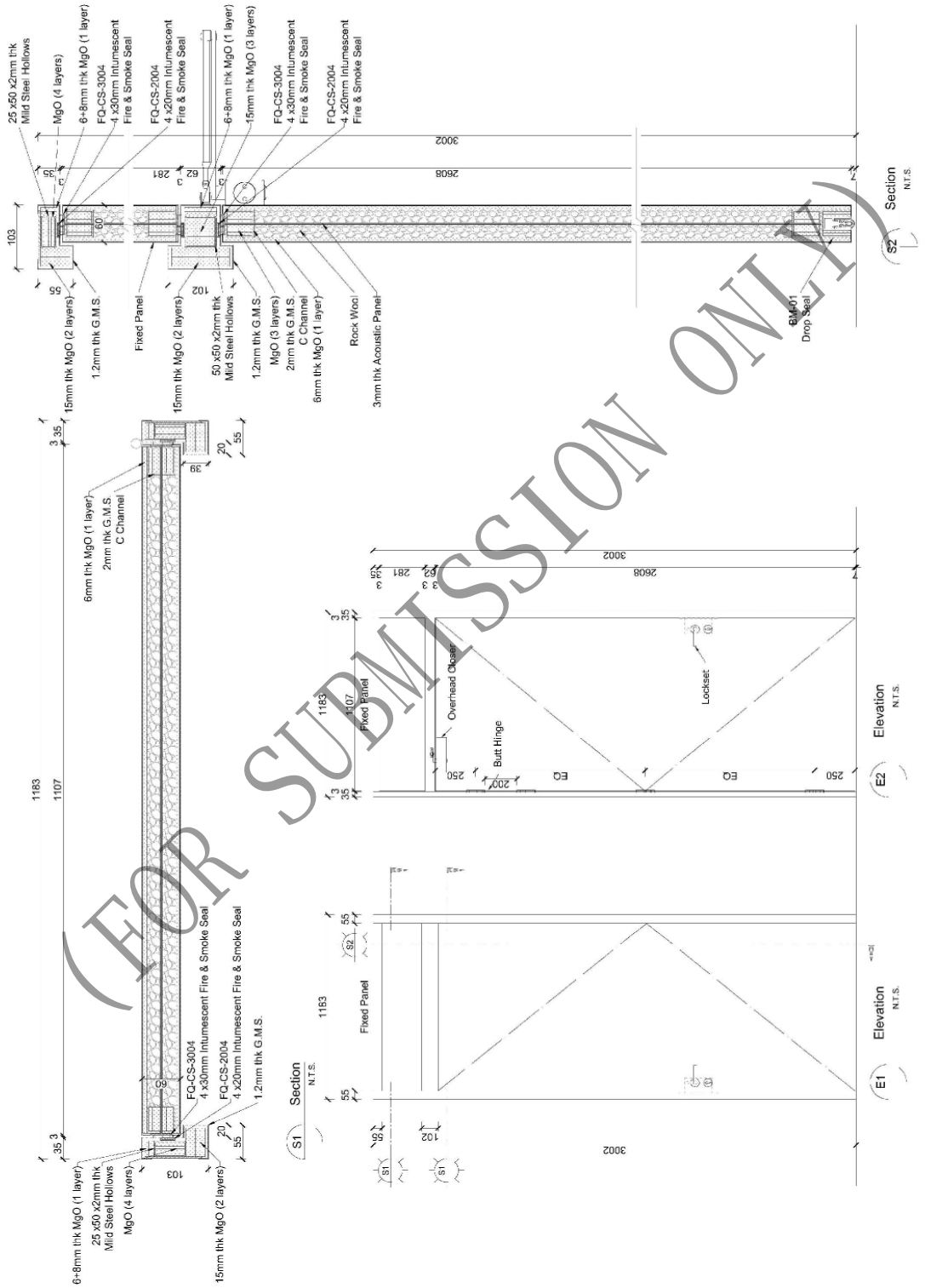
10 **Door Closer**

Brand	:	OUDE *
Model	:	OD-5044AW
Material	:	Aluminum alloy
Size	:	248 mm long x 72 mm wide x 44.5 mm thick *
Fixing method	:	By screw

* Verified by the laboratory.

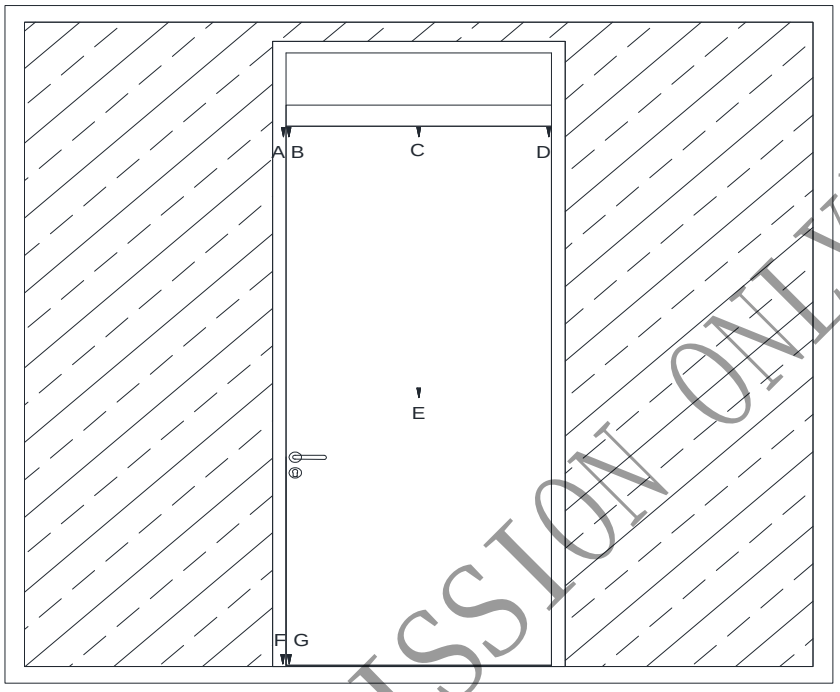
Client Ref. : --

Report No. : G23308FU236217



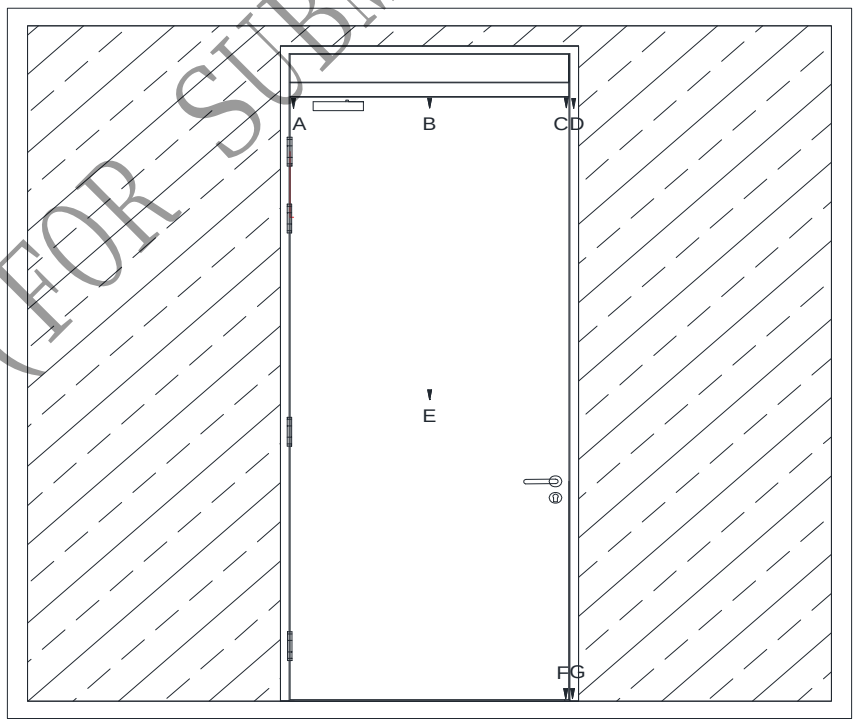
All dimensions are in mm.

Figure 1



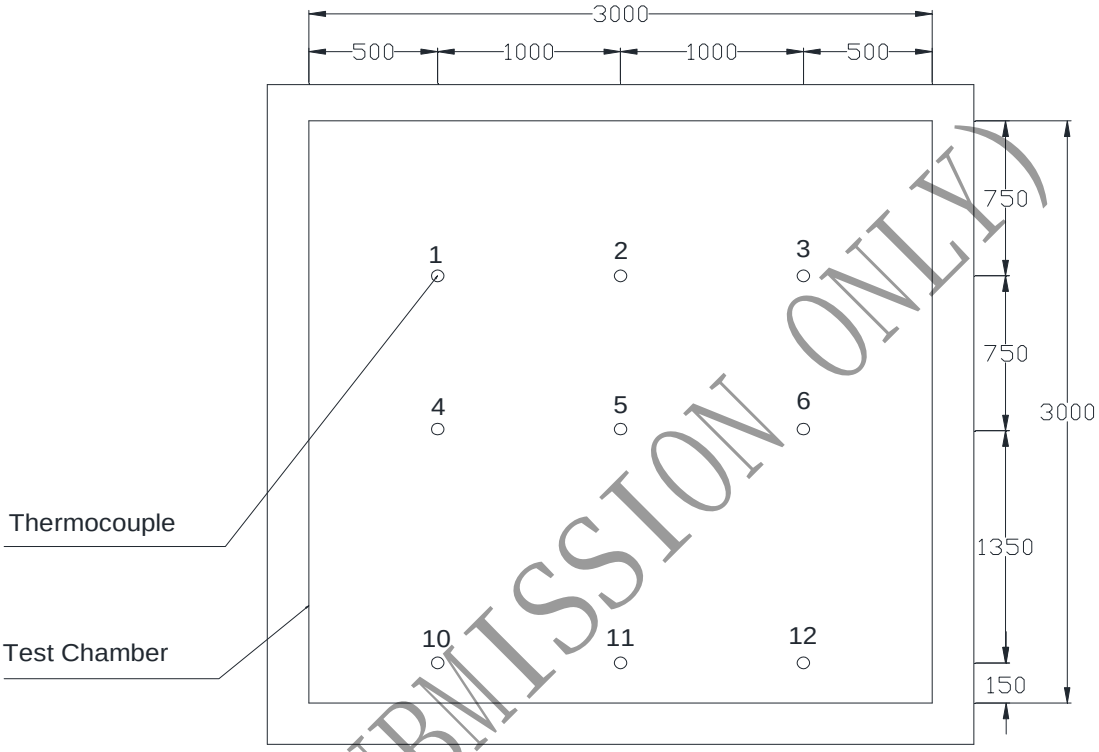
▼ positions for deflection measurements

Figure 2 - Elevation Diagram of Test Construction of Specimen FU236217



▼ positions for deflection measurements

Figure 3 - Elevation Diagram of Test Construction of Specimen FU236218



○ locations of thermocouples
All dimensions are in mm.

Figure 4 - Locations of Thermocouples

5. Equipment

Nine bare metal type thermocouples were positioned (100±50) mm away from the exposed face of the test construction to monitor the air temperature inside the test chamber. The locations of the thermocouples are shown in Figure 4.

A pressure measuring device head was mounted in the test chamber at the centre of the test specimen (100±50) mm away from the inside face of the test specimen to measure the static pressure of the test chamber.

An air flow instrumentation was installed to measure the volume, Q_t, and the temperature of air supplied to the apparatus to compensate for the total leakage.

A steel ruler was provided to measure the lateral deflections of the specimens relative to a laser line. The measurement positions are shown in Figure 2 and 3.

6. Test Procedure

6.1 Pre-test examination and preparation

Prior to the smoke control test, the doorset was opened to an angle of 30° and closed 10 times to ensure the assembly operates normally as specified in BS EN 1634-3:2004, Clause 10.1.1.

Gaps, retention forces were measured as specified in BS EN 1634-3: 2004, Clause 6.4 and 10.1.2.

6.2 Smoke leakage test

The test was conducted in accordance with the procedure specified in BS EN 1634-3: 2004, Clause 10.2.

For ambient temperature tests, the leakage rate through the specimen was measured at pressure differences of 10 Pa, 25 Pa, 50 Pa, or at the pressure difference specified by the sponsor. During measurement of the leakage rate, the pressure difference was maintained for 2 min and the value of Q_t established at the end of this period using:

$$Q_{spec} = Q_t^{(20)} - (Q_{app}^{(20)} + Q_{sup/assoc}^{(20)})$$

$$Q_l = Q_{spec}^{(20)} / \text{"length of gap"}$$

Where the symbols and designation are defined as follows:

Symbols	Unit	Designation
Q	m^3/h	leakage rate
Q_{app}	m^3/h	apparatus leakage rate
$Q_{sup/assoc}$	m^3/h	supporting / associated construction leakage rate
Q_{spec}	m^3/h	test specimen leakage rate
Q_t	m^3/h	total leakage rate
Q_l	$m^3/h/m$	linear leakage rate

For medium temperature tests, the average air temperature close to the face of the door was raised from ambient temperature to the temperature of (200±20) ℃ in (30±5) min. The temperature distribution over the face of the door was controlled to (200±40) ℃ as measured by each thermocouple. The leakage rate through the specimen was measured at pressure differences of 10 Pa, 25 Pa, 50 Pa, or at the pressure difference specified by the sponsor. During measurement of the leakage rate, the pressure difference was maintained for 2 min and the value of Q_t established at the end of this period using:

$$Q_{spec} = Q_t^{(200)} - (Q_{app}^{(200)} + Q_{sup/assoc}^{(200)})$$

A steel ruler was used to measure the lateral deflection of the specimen during the test.

7. Test Data and Information

The closing speed of the door leaf of specimen FU236217 was 187.0 mm/s. The closing speed of the door leaf of specimen FU236218 was 132.84 mm/s.

The gaps between the door leaf and the door frame are shown in Figure 5 and 6. The length of gap was 6.329 m.

The retention forces of the door leaf were shown as follows:

Specimen	Push	Pull
FU236217	115.6 N	116.3 N
FU236218	69.8 N	75.6 N

The following data were recorded during the smoke leakage test:

a) The actual average air temperature/ time curve as well as the standard air temperature/ time curve, are shown in Figure 7 and 8.

b) The lateral deflections of the specimen are shown in Table 1 and 2.

A summary of the observations made on the general behaviour of the specimen is given in Table 3 and 4.

The ambient air temperature in the vicinity of the test construction was 21.2℃ and 20.8℃ at the start of the test of specimens FU236217 and FU236218 respectively.

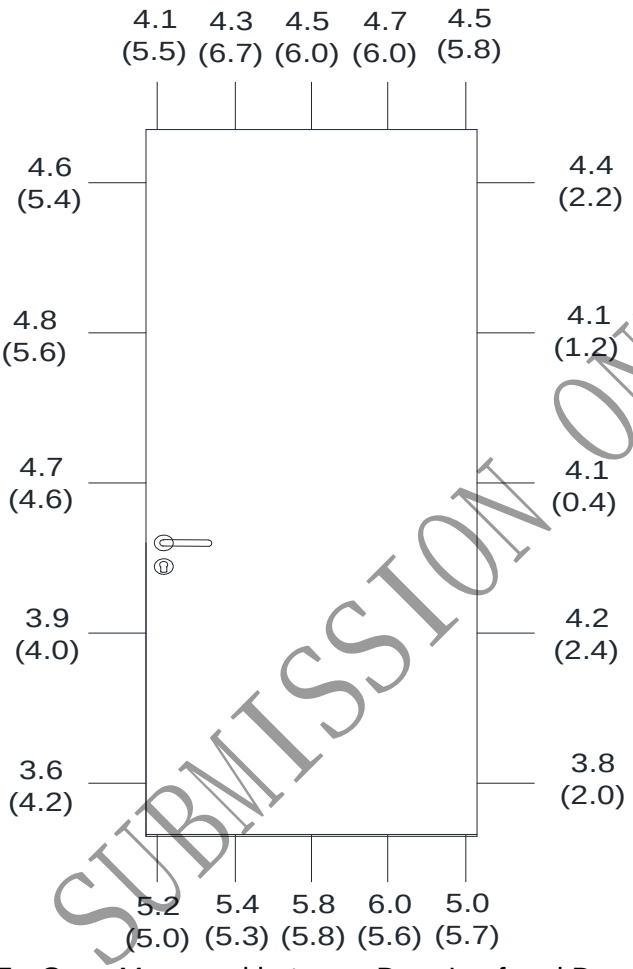


Figure 5 - Gaps Measured between Door Leaf and Door Frame as Viewed from the Unexposed Face of Specimen FU23217

All dimensions are in mm.

Dimensions shown in brackets were measured from the exposed face.

Gap dimension (mm)	Surface	Measured value		
		Maximum	Minimum	Average
Leading edge	Exposed	5.6	4.0	4.8
	Unexposed	4.8	3.6	4.3
Hinge edge	Exposed	2.4	0.4	1.6
	Unexposed	4.4	3.8	4.1
Head edge	Exposed	6.7	5.5	6.0
	Unexposed	4.7	4.5	4.4
Bottom edge	Exposed	5.8	5.0	5.5
	Unexposed	6.0	5.2	5.5

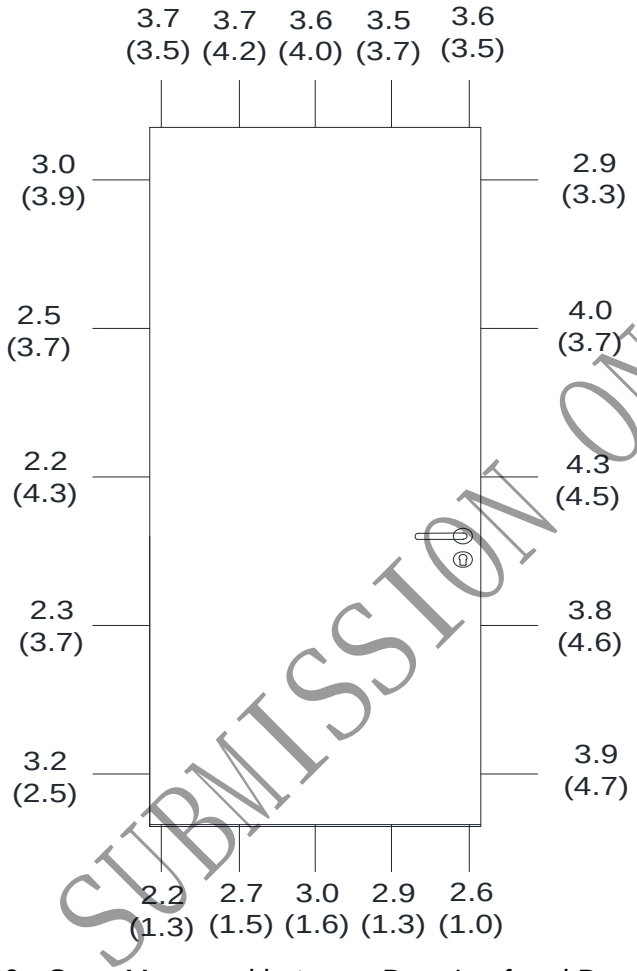


Figure 6 - Gaps Measured between Door Leaf and Door Frame as Viewed from the Unexposed Face of Specimen FU236218

All dimensions are in mm.

Dimensions shown in brackets were measured from the exposed face.

Gap dimension (mm)	Surface	Measured value		
		Maximum	Minimum	Average
Leading edge	Exposed	4.7	3.3	4.2
	Unexposed	4.3	2.9	3.8
Hinge edge	Exposed	4.3	2.5	3.6
	Unexposed	3.2	2.2	2.6
Head edge	Exposed	4.2	3.5	3.8
	Unexposed	3.7	3.5	3.6
Bottom edge	Exposed	1.6	1.0	1.3
	Unexposed	3.0	2.2	2.7

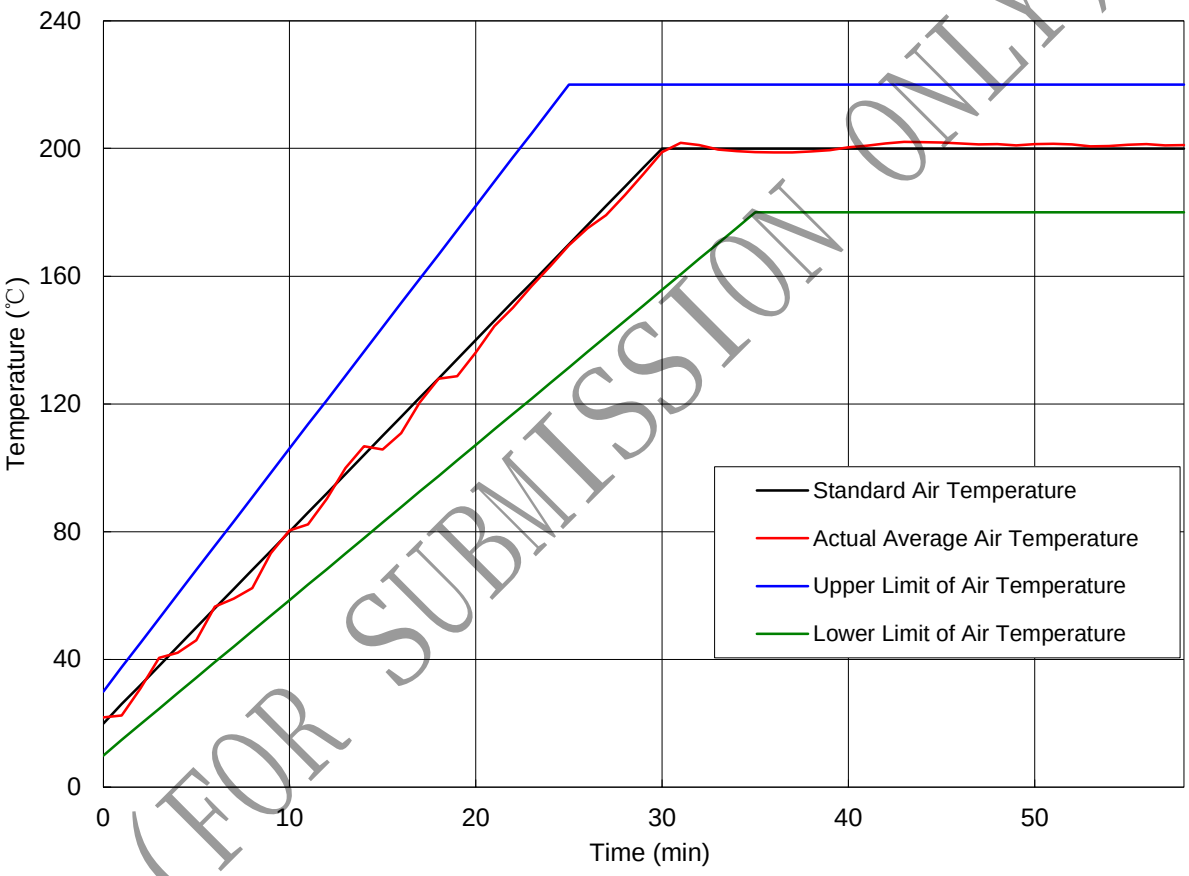


Figure 7 - Actual Average Air Temperature/Time Curve and Standard Air Temperature/Time Curve of Specimen FU236217

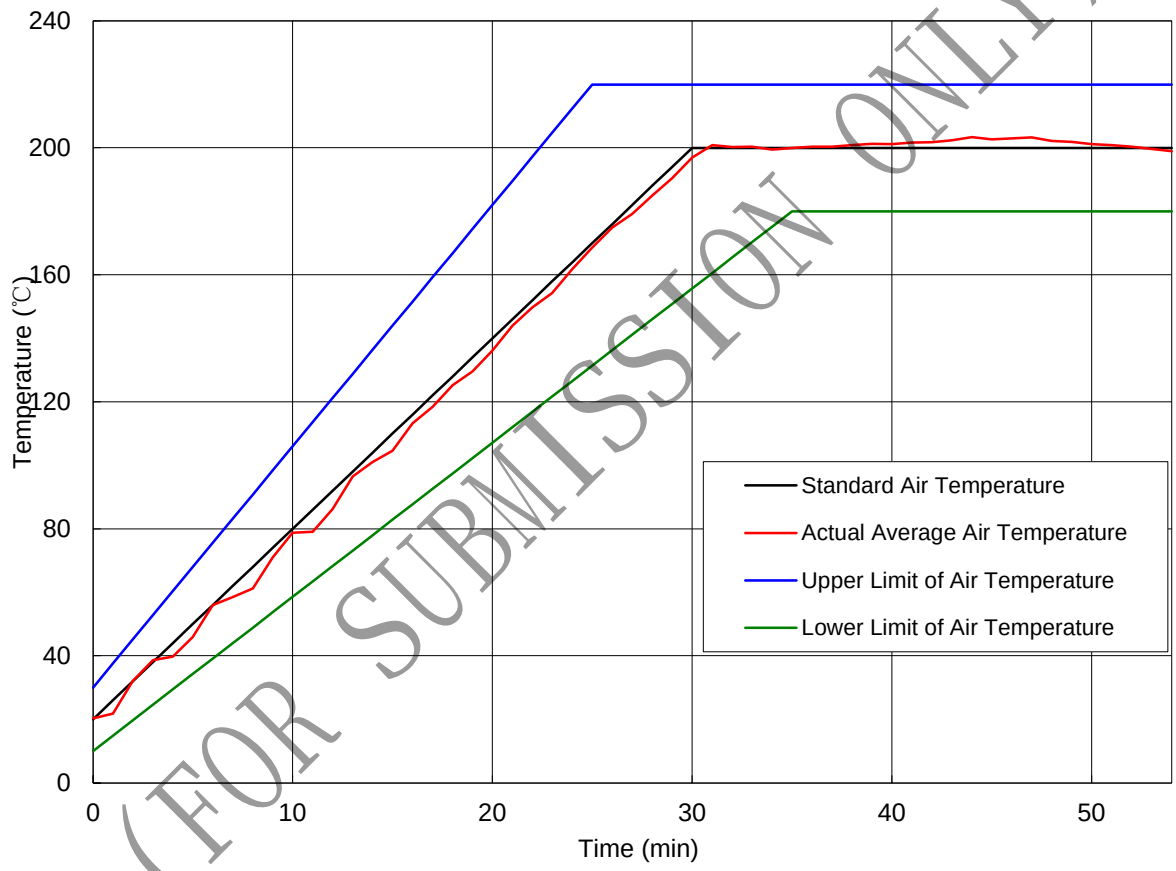


Figure 8 - Actual Average Air Temperature/Time Curve and Standard Air Temperature/Time Curve of Specimen FU236218

Table 1 Lateral Deflections of Specimen FU236217 as Viewed from the Unexposed Face

Ambient temperature test							
Pressure	Deflections (mm)						
	A	B	C	D	E	F	G
0 Pa	0	0	0	0	0	0	0
10 Pa	0	0	0	0	0	0	0
25 Pa	0	0	0	0	0	0	0
50 Pa	0	0	0	0	0	0	0

Medium temperature test

Medium temperature test							
Time or Pressure	Deflections (mm)						
	A	B	C	D	E	F	G
0 Pa	0	0	0	0	0	0	0
10 min	0	0	2	0	3	0	0
20 min	0	0	4	0	3	0	2
30 min	1	0	2	1	8	0	3
10 Pa	1	0	2	1	8	1	3
25 Pa	1	0	2	1	8	2	3
50 Pa	2	0	2	1	8	2	3

Positive deflections indicate movement towards the heat source.

Table 2 Lateral Deflections of Specimen FU236218 as Viewed from the Unexposed Face

Ambient temperature test							
Pressure	Deflections (mm)						
	A	B	C	D	E	F	G
0 Pa	0	0	0	0	0	0	0
10 Pa	0	0	0	0	0	0	0
25 Pa	0	0	-1	0	0	0	0
50 Pa	0	0	-1	0	0	0	0

Medium temperature test

Medium temperature test							
Time or Pressure	Deflections (mm)						
	A	B	C	D	E	F	G
0 Pa	0	0	0	0	0	0	0
10 min	1	1	0	0	0	1	0
20 min	1	2	0	0	5	3	0
30 min	1	2	0	1	5	1	1
10 Pa	1	2	0	1	5	0	1
25 Pa	1	2	0	1	5	-1	1
50 Pa	2	2	0	1	6	-2	2

Positive deflections indicate movement towards the heat source.

Table 3 Observations of Specimen FU236217 Made during and after the test

Ambient temperature test	
No significant change of the specimen was observed.	
Medium temperature test **a) Druing the test**	
Time (min:sec)	Observations
00:00	The test commences.
30:00	No significant change was visible to the specimen.
35:41	Smoke release was visible from the left edge of the doorset.
58:13	Test is terminated.
b) After the test	
Damages on the specimen	The intumescent fire and smoke seal with fins harden at the head, left and right edges of the door frame.
	The intumescent fire and smoke seal with fins harden at the head, left and right edges of the door leaf.
	No significant change was visible to the bottom smoke seal.
Operability	The door leaf was able to be opened manually.

Table 4 Observations of Specimen FU236218 Made during and after the test

Ambient temperature test	
No significant change of the specimen was observed.	
Medium temperature test **a) Druing the test**	
Time (min:sec)	Observations
00:00	The test commences.
30:00	No significant change was visible to the specimen.
39:32	Smoke release was visible from the left edge of the doorset.
54:21	Test is terminated.
b) After the test	
Damages on the specimen	The intumescent fire and smoke seal with fins harden at the head, left and right edges of the door frame.
	The intumescent fire and smoke seal with fins harden at the head, left and right edges of the door leaf.
	No significant change was visible to the bottom smoke seal.
Operability	The door leaf was able to be opened manually.

8. Performance Criteria

The definitions of smoke leakage S_a and S_m are stated in BS EN 1634-3: 2004.

3.1.4 Smoke leakage S_a

Ambient temperature smoke leakage classification as defined in 7.5.6.3.1 of BS EN 13501-2:2003;

3.1.5 Smoke leakage S_m

Ambient plus medium temperature (200℃) smoke leakage classification as defined in 7.5.6.3.1 of BS EN 13501-2:2003.

BS EN 13501-2:2003, 'Fire classification of construction products and building elements – Part 2: Classification using data from fire resistance tests, excluding ventilation services'.

7.5.6.3.1 Smoke leakage

This is the ability of the element to reduce or eliminate the passage of smoke from one side of the door to the other. The following performance levels are defined:

a) smoke leakage S_m – when the maximum leakage rate measured at both ambient temperature and 200℃ and up to a pressure of 50 Pa does not exceed 20 m^3/h for a single leaf doorset, or 30 m^3/h for a double leaf doorset;
b) smoke leakage S_a – when the maximum leakage rate measured at ambient temperature, and up to a pressure of 25 Pa only, does not exceed 3 m^3/h per meter length of gap between the fixed and moveable components of the doorset (e.g. between the door leaf and door frame), excluding leakage at the threshold.

9. Conclusion

Two identical specimens of a single-acting, single-leaf, metal doorset has been subjected to smoke control test in accordance with BS EN 1634-3: 2004. The results of the specimens were obtained and summarized as follows:

FU236217:

No. of test	Face exposed to pressure	Temperature	Leakage rate Q_{spec} (m^3/h) at pressure difference of			Linear leakage rate Q_l ($m^3/h/m$) at pressure difference of	
			10 Pa	25 Pa	50Pa	10 Pa	25 Pa
1	Open inwards	Ambient (threshold sealed)	3.78	7.29	11.55	0.60	1.15
2	Open inwards	Ambient	4.19	8.82	13.44		
3	Open inwards	Medium	3.21	5.48	7.26		

FU236218:

No. of test	Face exposed to pressure	Temperature	Leakage rate Q_{spec} (m^3/h) at pressure difference of			Linear leakage rate Q_l ($m^3/h/m$) at pressure difference of	
			10 Pa	25 Pa	50Pa	10 Pa	25 Pa
1	Open outwards	Ambient (threshold sealed)	1.91	3.47	5.76	0.30	0.55
2	Open outwards	Ambient	3.93	6.55	11.52		
3	Open outwards	Medium	1.21	2.15	4.30		

The performance of the specimens were assessed against the criteria for S_a and S_m, and the specimens satisfied the performance requirement of S_a and S_m of BS EN 1634-3: 2004.
Remarks: Decision rule: Simple acceptance (guard band =0).

10. Field of Direct Application of Test Results

The field of direct application of test results is restricted to the allowable changes which a sponsor may make to the tested specimen following a successful smoke leakage test. These variations can be introduced automatically without the need for the sponsor to seek additional evaluation, calculation or approval.

The field of direct application of test results is conducted in accordance with the rules specified in 13 of BS EN 1634-3: 2004.

11. Limitation

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, constructional details, edge or end conditions other than those allowed under the field of direct application in the relevant test method is not cover by this report.

Because of the nature of fire resistance testing and 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.

FUGRO TECHNICAL SERVICES (GUANGZHOU) LIMITED
No.6, Nongye Gongsi Road
Caotang, Hualong, Panyu
Guangzhou
China

Appendix A - Test Photographs
FU236217:

Photo 1 - The exposed face of the specimen before medium temperature test

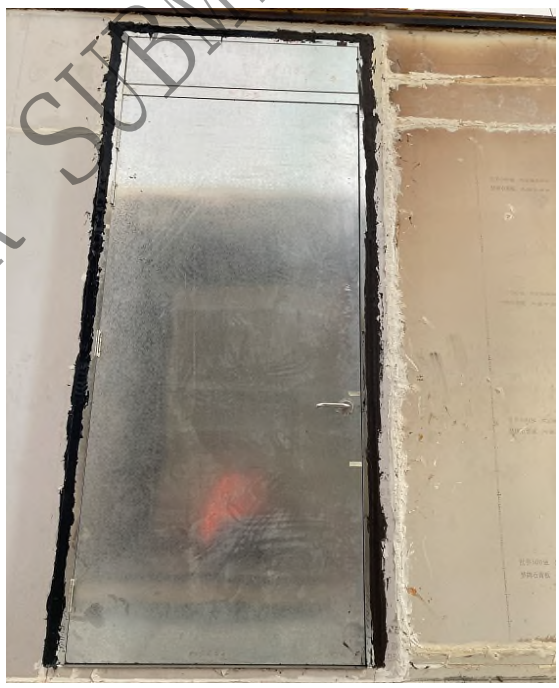


Photo 2 - The exposed face of the specimen after medium temperature test

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Caotang, Hualong, Panyu
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Photo 3 - The top left corner of doorset after medium temperature test

Photo 4 - The top right corner of doorset after medium temperature test

Photo 5 - The bottom left corner of doorset after medium temperature test

Photo 6 - The bottom right corner of doorset after medium temperature test

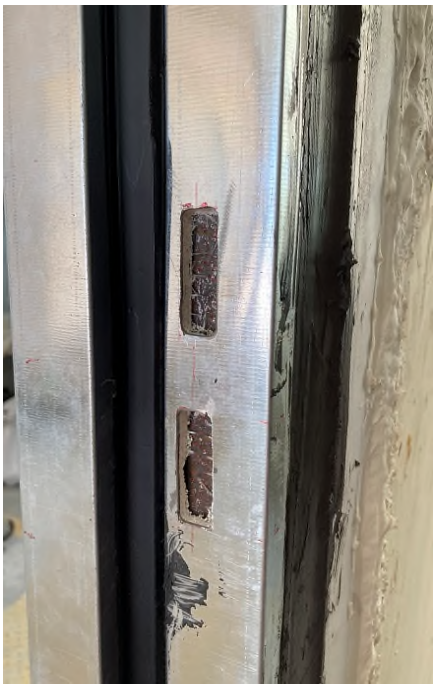

Photo 7 - The position of strike plate after medium temperature test

Photo 8 - The position of latch after medium temperature test

Photo 9 - The head edge of door leaf after medium temperature test

Photo 10 - The bottom edge of door leaf after medium temperature test

** End of Report **

FUGRO TECHNICAL SERVICES (GUANGZHOU) LIMITED
No.6, Nongye Gongsi Road
Caotang, Hualong, Panyu
Guangzhou
China

REPORT ON SMOKE CONTROL TEST OF METAL DOORSET

Client : HK Pro-Tech Fire Prevention Building Materials Limited

Project : Smoke Control Test on Metal Doorset in accordance with BS EN 1634-3: 2004

Client Ref. : --

Report No. : G23308FU236219

Date of Report Issue : 12 Mar 2024

FUGRO TECHNICAL SERVICES (GUANGZHOU) LIMITED
No.6, Nongye Gongsi Road
Caotang, Hualong, Panyu
Guangzhou
China

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FUGRO TECHNICAL SERVICES (GUANGZHOU) LIMITED
No.6, Nongye Gongsi Road
Caotang, Hualong, Panyu
Guangzhou
China

REPORT ON SMOKE CONTROL TEST

1. Introduction

Fugro Technical Services (Guangzhou) Limited was commissioned by HK Pro-Tech Fire Prevention Building Materials Limited to determine the smoke leakage performance of two identical specimens of a single-acting, double-leaf, metal doorset with a transom panel, a glazed panel and two louvers in accordance with BS EN 1634-3: 2004.

The doorsets were required to provide a smoke leakage separating function at ambient together with medium temperature and the test was therefore conducted in accordance with BS EN 1634-3: 2004, 'Fire resistance and smoke control tests for door and shutter assemblies, openable windows and elements of building hardware – Part 3: Smoke control test for door and shutter assemblies'.

The specimens were received on 30 November 2023 and given Lab. Sample I.D.: FU236219 and FU236220.

The tests of FU236219 and FU236220 were conducted on 6 December 2023 and 8 December 2023 respectively.

2. Summary

The results of the specimens were obtained and summarized as follows:

FU236219:

No. of test	Face exposed to pressure	Temperature	Leakage rate Q_{spec} (m^3/h) at pressure difference of			Linear leakage rate Q_l ($m^3/h/m$) at pressure difference of	
			10 Pa	25 Pa	50Pa	10 Pa	25 Pa
1	Open inwards	Ambient (threshold sealed)	2.90	5.55	8.22	0.28	0.54
2	Open inwards	Ambient	6.92	13.22	20.54		
3	Open inwards	Medium	5.86	13.29	16.23		

FU236220:

No. of test	Face exposed to pressure	Temperature	Leakage rate Q_{spec} (m^3/h) at pressure difference of			Linear leakage rate Q_l ($m^3/h/m$) at pressure difference of	
			10 Pa	25 Pa	50Pa	10 Pa	25 Pa
1	Open outwards	Ambient (threshold sealed)	3.11	6.62	10.05	0.30	0.65
2	Open outwards	Ambient	7.67	15.75	24.56		
3	Open outwards	Medium	3.08	9.94	14.04		

The performance of the specimens were assessed against the criteria for S_a and S_m, and the specimens satisfied the performance requirement of S_a and S_m of BS EN 1634-3: 2004.

Approved Signatory:

Yan Cai Sheng
Deputy General Manager

Date of Report Issued : 12 Mar 2024

3. Client Information

Client : HK Pro-Tech Fire Prevention Building Materials Limited

Client Address : A, 1/F, Hang Seng Centre, 95-97 Tung Chau Street, Tai Kok Tsui, Kowloon

Manufacturer : Dongguan City Teliang Fire Doors and Windows Co., Ltd

Manufacturer Address: Room 101-102, Building No. 1 Huguang Road No. 617, Qishi Town, Dongguan City, Guangdong Province, China

4. Test Specimen

Each doorset had overall nominal dimensions of 3002 mm high by 2500 mm wide by 103 mm thick. It incorporated two door leaves of overall nominal dimensions of 2608 mm high by 1314 mm wide by 60 mm thick and 2608 mm high by 1107 mm wide by 60 mm thick respectively.

The perimeter door frame had overall sectional dimensions of 55 mm wide by 103 mm thick with 20 mm deep rebate. The transom had overall sectional dimensions of 102 mm wide by 103 mm thick with 20 mm deep rebate on both sides. The perimeter door frame was comprised of 25 mm by 50 mm by 2 mm thick mild steel hollow section with four layers of MgO board infilling, and separated by a layer of 6 + 8 mm thick MgO board and two layers 15 mm thick MgO board with 1.2 mm thick G.M.S. The transom was comprised of 50 mm by 50 mm by 2 mm thick mild steel hollow section with three layers of 15 mm thick MgO board infilling, and separated by a layer of 6 + 8 mm thick MgO board and two layers of 15 mm thick MgO board with 1.2 mm thick G.M.S. The door frame was fixed to the supporting construction by M10 x 80 mm screw at maximum 1050 mm centre to centre. The gap between the door frame and the supporting construction was filled with acrylic intumescent sealant on both sides.

The door leaves and transom panel had a core construction of 21 mm thick rock wool + 3 mm thick acoustic panel + 21 mm thick rock wool and sandwiched by 6 mm thick MgO board with 1.0 mm thick G.M.S on each face. The door leaves and transom panel rails and stiles were made of 2 mm thick G.M.S C-channel with 6 layers MgO board infilling. The rebate was unrebated (plain or square edges) at the meeting edge of the door.

The inactive leaf incorporated a glazed aperture of nominal sight dimensions 1800 mm high by 200 mm wide. The aperture was glazed with 44 mm thick insulated glass panel. Glazing unit was retained with composite glazing bead of 35 mm wide by 4 mm thick. The glazing beads were fixed to the aperture frame by welded at maximum 100 mm centre to centre.

The active leaf incorporated two louvers of each nominal sight dimensions 690 mm high by 610 mm wide. The louvers were fixed to the door leaf by screws at maximum 350 mm centre to centre.

A number of 20 mm wide by 4 mm thick intumescent fire and smoke seal with fins was fitted into groove on the head, left and right edges of the door frame. A number of 20 mm wide by 4 mm thick intumescent fire and smoke seal with fins was fitted into groove on the perimeter frame of the transom panel. A number of 30 mm wide by 4 mm thick intumescent fire and smoke seal with fins was fitted into groove on the head, meeting and hinge edges of each leaf. A number of 30 mm wide by 4 mm thick intumescent fire seal and smoke seal with fins was fitted into groove on the perimeter frame of the transom panel. A number of 30 mm x 14 mm drop seal was fitted into groove on the bottom of active leaf. A number of 34 mm x 15 mm drop seal was fitted into groove on the bottom of inactive leaf.

The active leaf was hung within a door frame by four nos. of stainless steel butt hinges. The inactive leaf was hung within a door frame by four nos. of concealed hinges. The active leaf was provided with an overhead door closer mounted on the surface. The inactive leaf was provided with a concealed door closer mounted on the head edge of the leaf. The inactive leaf had two flush bolts at the head and bottom positions. Both flush bolts were bolted for duration the test. The active leaf was provided with a latch, which was latched but not locked for the duration of the test.

A description of the test specimen is shown in Schedule of Components and Figures 1 to 3. The description is based on a detailed survey of the test specimens, an additional of the test specimen and the information supplied by the client.

Fugro Technical Services (Guangzhou) Limited was not involved in the selection of the specimens.

The doorsets were installed into a prepared opening within a hollow panel wall to form the test construction, and shown in Figure 4 and 5. It was mounted such that specimen FU236219 opened toward the test chamber and specimen FU236220 opened away from the test chamber. The hollow panel wall was constructed by hollow steel section with single layer gypsum board on both sides.

Installation of specimen FU236219 and FU236220 were conducted by client on 2 December 2023 and 7 December 2023 respectively.

After installation, the doorsets to be tested were checked for operability in the test frame by operating from fully closed to fully open to the maximum possible or at least 90 degrees for 25 cycles in accordance with BS EN 16034:2014.

After receiving, the specimens were stored in the test laboratory. Throughout this period of the storage, both the temperature and relative humidity of laboratory were measured and recorded as being within a range of from 18.8°C to 21.7°C and 42.0% to 71.6% (FU236219), and 18.8℃ to 24.9℃ and 42.0% to 78.5% (FU236220) respectively.

Schedule of Components

(Refer to Figure 1 to 3. Unless stated otherwise, all values are nominal, and all information in this Schedule of Components is supplied by the client.)

Item			Description
1a	**Intumescent Seal**		
	Brand	:	FAN QIU
	Model	:	FQ-C-2504
	Size	:	25 mm x 4 mm thick
	Fixing method	:	By adhesive
	Application location	:	1 no. of seal applied at head of louver frame.
1b	**Intumescent Seal**		
	Brand	:	FAN QIU
	Model	:	FQ-C-3004
	Size	:	30 mm x 4 mm thick *
	Fixing method	:	By adhesive
	Application location	:	1 no. of seal applied at louver leaf & at the glazing bead.
2a	**Intumescent Smoke Seal with Fins**		
	Brand	:	FAN QIU
	Model	:	FQ-CS-2004
	Size	:	20 mm x 4 mm thick *
	Fixing method	:	By adhesive
	Application location	:	1 no. of seal at the head, left and right edges of the door frame. * 1 no. of seal at the perimeter frame of the transom panel.
2b	**Intumescent Smoke Seal with Fins**		
	Brand	:	FAN QIU
	Model	:	FQ-CS-3004
	Size	:	30 mm x 4 mm thick *
	Fixing method	:	By adhesive
	Application location	:	1 no. of seal at the head, meeting and hinge edges of each leaf. * 1 no. of seal at the perimeter frame of the transom panel.
3a	**Bottom Smoke Seal for Active leaf**		
	Manufacturer	:	Baimi

* Verified by the laboratory.

Schedule of Components (cont'd)

Brand	:	BM-A01
Model	:	Aluminum alloy
Material	:	30 mm x 14 mm *
Fixing method	:	By screw
Application location	:	1 no. of seal at the bottom edge of the active leaf. *

3b **Bottom Smoke Seal for Inactive leaf**

Manufacturer	:	Baimi
Brand	:	BM-A04
Model	:	Aluminum alloy
Material	:	34 mm x 15 mm *
Fixing method	:	By screw
Application location	:	1 no. of seal at the bottom edge of the inactive leaf. *

4 **Door Frame**

Manufacturer	:	Dongguan City Teliang Fire Doors and Windows Co., Ltd
Material	:	25 mm x 50 mm x 2.0 mm thick mild steel hollows 50 mm x 50 mm x 2.0 mm thick mild steel hollows 6 mm + 8 mm thick MgO board 15 mm thick MgO board 1.2 mm thick G.M.S cladding
Thickness	:	103 mm *
Overall size	:	2500 mm x 3002 mm *
Sectional dimension	:	103 mm x 55 mm * - perimeter door frame 103 mm x 102 mm * - transom
Rebate	:	20 mm *
Jambs to head jointing method	:	By welded
Fixing methods to concrete support frame	:	Fixed to supporting construction with screw at maximum 1050 mm centre to centre. *
Fixing material	:	HILTI HRD-C 10 x 80 mm screw *

5 **Door Leaf and Transom Panel Stile & Rail**

Manufacturer	:	Dongguan City Teliang Fire Doors and Windows Co., Ltd
Material	:	2.0 mm thick G.M.S C channel 6 layers 15 mm thick MgO board infilling
Density	:	7.93 g/cm^3

* Verified by the laboratory.

Schedule of Components (cont'd)

	Size	:	1 x (45 mm x 50 mm) - head and bottom edges of each leaf, each transom panel, glazed panel and each louver * 1 x (45 mm x 50 mm) - left and right edges of each leaf, each transom panel, glazed panel and each louver *
	Fixing method	:	By welding
6a	**Door Leaf Core**		
	Supplier	:	Dongguan City Teliang Fire Doors and Windows Co., Ltd
	Material	:	Rock wool
	Density	:	100 kg/m^3
	Thickness	:	21 mm *
6b	**Door Leaf Core**		
	Supplier	:	Dongguan City Teliang Fire Doors and Windows Co., Ltd
	Material	:	Acoustic panel
	Density	:	800 kg/m^3
	Thickness	:	3 mm *
	Fixing method	:	By adhesive
7	**Fire Board**		
	Supplier	:	Dongguan City Teliang Fire Doors and Windows Co., Ltd
	Brand	:	GemTree
	Material	:	Magnesium oxide (MgO)
	Density	:	800 -1000 kg/m^3
	Thickness	:	6mm, 8 mm, 15 mm *
	Fixing method	:	By adhesive
8	**Door Leaf Facing**		
	Supplier	:	Dongguan City Teliang Fire Doors and Windows Co., Ltd
	Material	:	G.M.S
	Thickness	:	1 mm *
	Fixing method	:	By adhesive
9a	**Butt Hinges for Active leaf**		
	Brand	:	Protech
	Model	:	P114/2
	Material	:	Stainless steel

* Verified by the laboratory.

Schedule of Components (cont'd)

Size		
i. Body	:	120 mm long by 16 mm diameter *
ii. Blade	:	114 mm x 114 mm x 3.0 mm thick *
Fixing method	:	By screw

9b **Concealed Hinges for Inactive leaf**

Brand	:	Dorma
Model	:	BA-C80
Material	:	Stainless steel
Size	:	160 mm (H) x 30 mm (W) x 28 mm (D) *
Fixing method	:	By screw

10 **Door Lock (Latch)**

Brand	:	Protech
Model	:	P9001
Material	:	Stainless steel
Size	:	240 mm long x 87 mm wide x 30 mm thick *
Fixing method	:	By screw

11a **Door Closer for Active leaf**

Brand	:	OUDE *
Model	:	OD-5044AW
Material	:	Aluminum alloy
Size	:	248 mm long x 72 mm wide x 44.5 mm thick *
Fixing method	:	By screw

11b **Concealed Door Closer for Inactive leaf**

Brand	:	OUDE *
Model	:	OD2000 Series 2024AWH
Material	:	Aluminum alloy
Size	:	230 mm long x 57 mm wide x 32 mm thick *
Fixing method	:	By screw

12a **Flush Bolt for Head Position**

Brand	:	Protech
Model	:	FB-300-S
Material	:	Stainless steel
Size	:	300 mm long x 22 mm wide x 35 mm depth *
Fixing method	:	By screw

* Verified by the laboratory.

Schedule of Components (cont'd)

12b **Flush Bolt for Bottom Position**

Brand	:	Protech
Model	:	FB-300-S
Material	:	Stainless steel
Size	:	250 mm long x 22 mm wide x 35 mm depth *
Fixing method	:	By screw

13 **Louver**

Manufacturer	:	Dongguan City Teliang Fire Doors and Windows Co., Ltd
Model	:	TL-L-001
Thickness	:	1 mm thick stainless steel *
Size	:	650 mm x 730 mm x 60 mm thick *
Fixing method	:	By screw
Application location	:	2 nos. of louver at the active leaf of the double-leaf door.

14 **Smoke Shutter**

Manufacturer	:	Dongguan City Teliang Fire Doors and Windows Co., Ltd
Model	:	TL-S-001
Thickness	:	2 mm G.M.S
Size	:	610 mm x 690 mm x 100 mm thick *
Fixing method	:	By screw
Application location	:	2 nos. of louver at the active leaf of the double-leaf door.

15 **Glass Panel**

Brand	:	PRO TECH
Model	:	PT-45-120
Thickness	:	45 mm thick *
Aperture size	:	270 mm x 1870 mm
Sight size	:	200 mm x 1800 mm *

16 **Glazing Bead**

Material	:	G.M.S
Size	:	35 mm x 4 mm thick *
Fixing method	:	By welding
Fixing frequency	:	At max. 100 mm c/c. *

* Verified by the laboratory.

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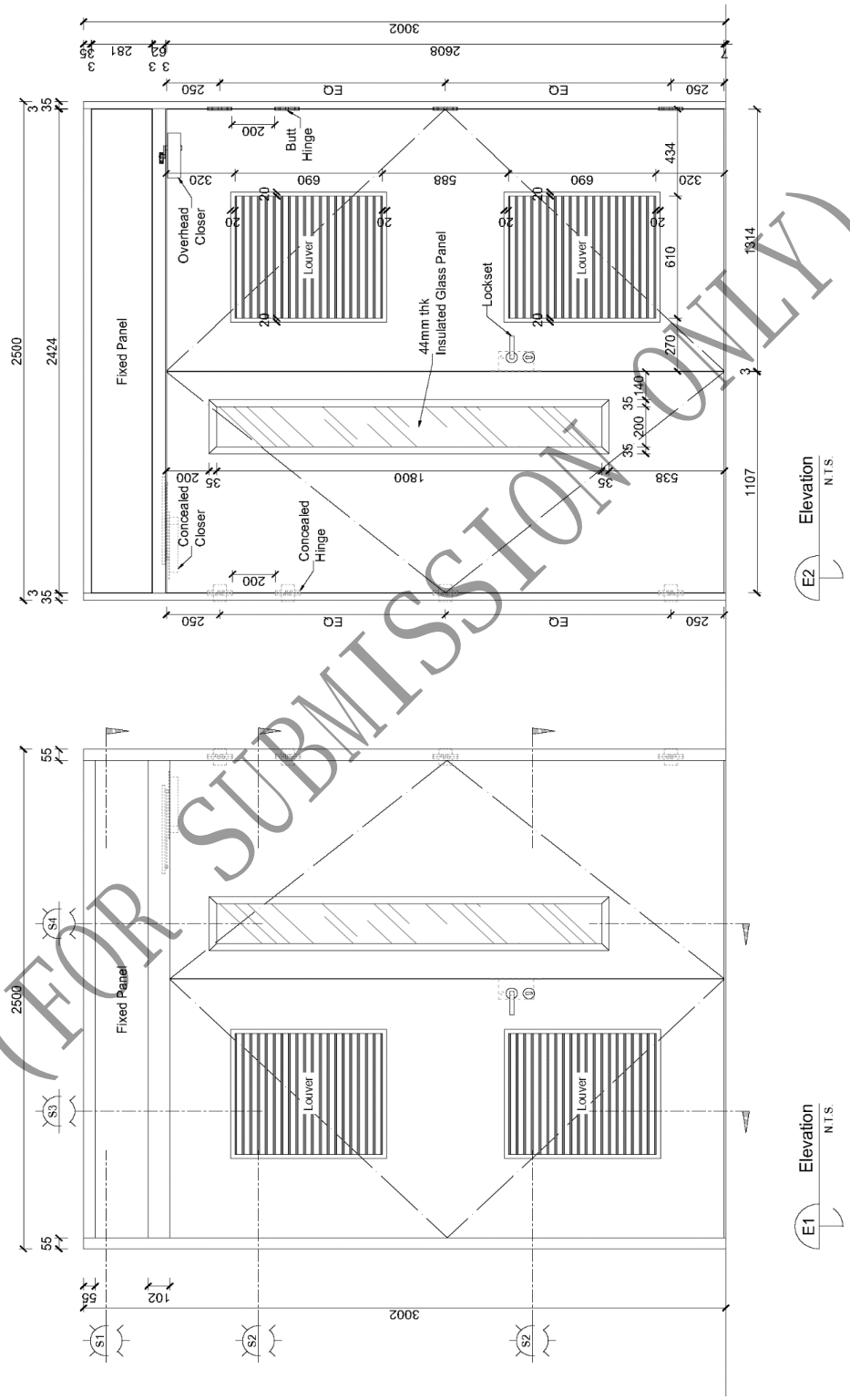
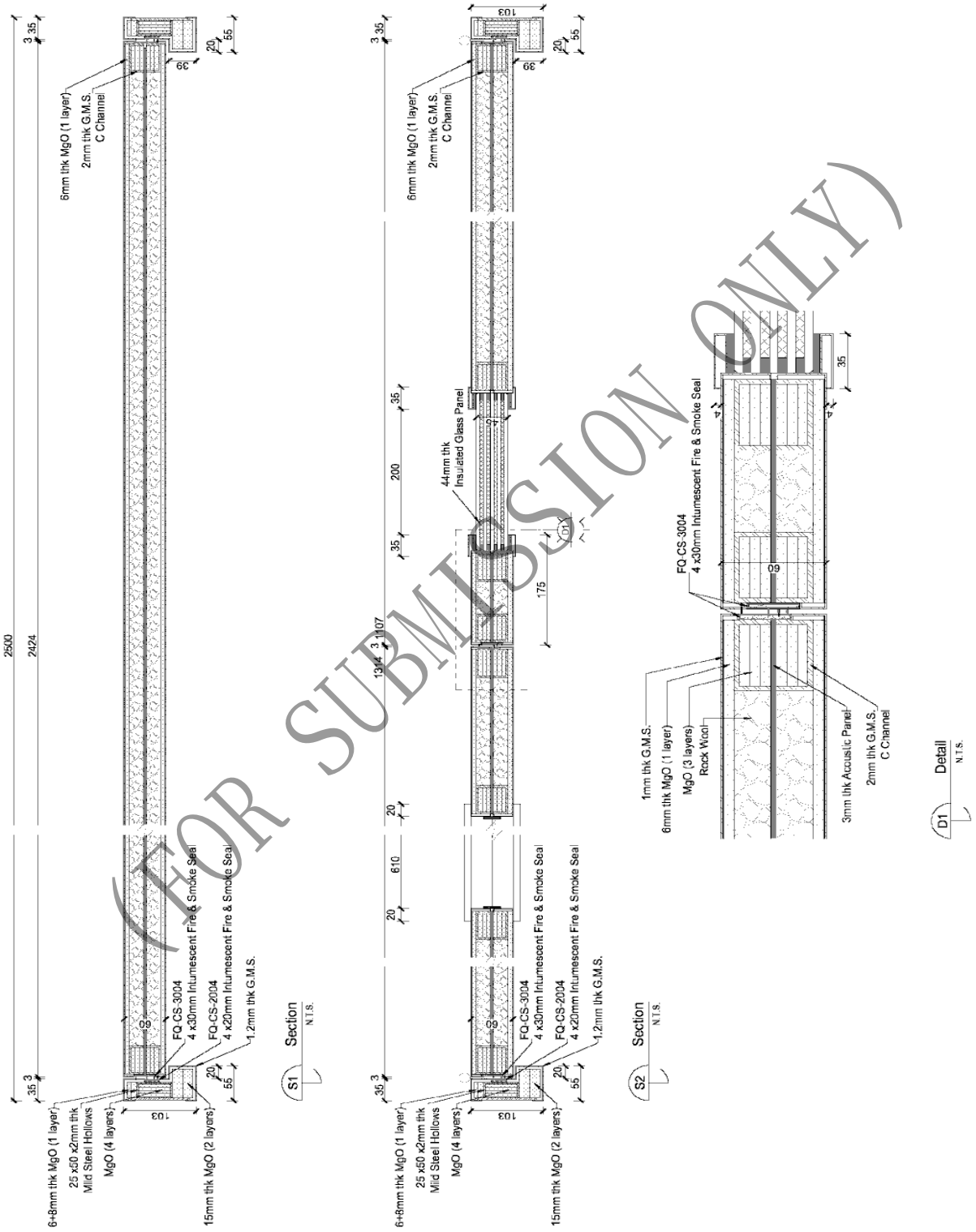


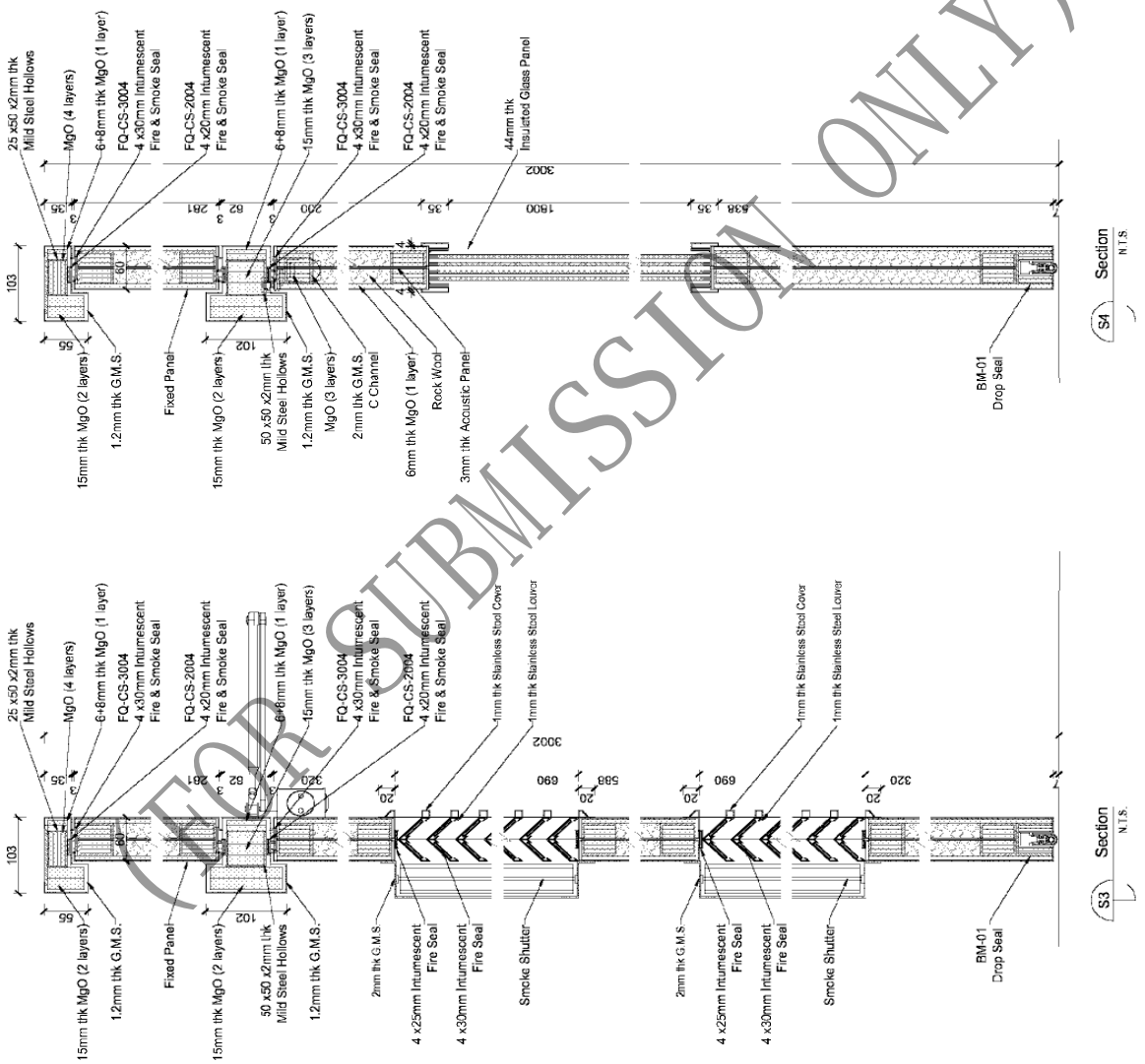
All dimensions are in mm.

Figure 1



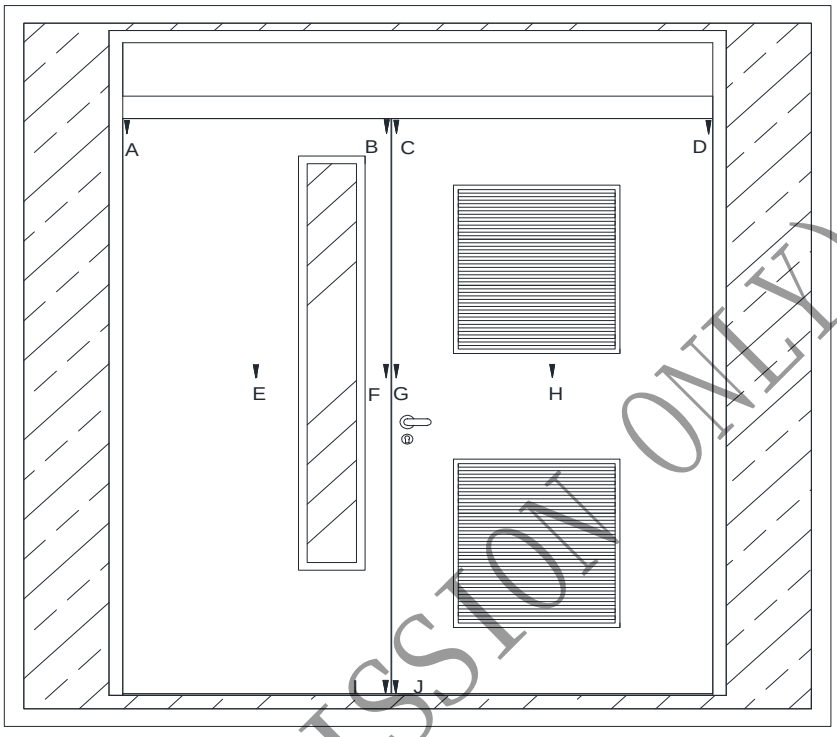
All dimensions are in mm.

Figure 2



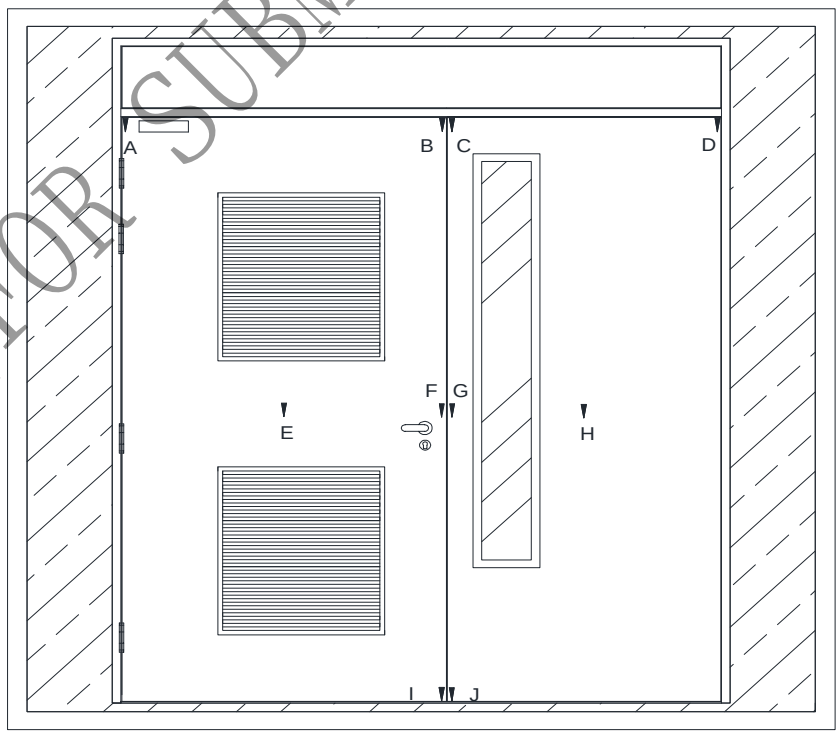
All dimensions are in mm.

Figure 3



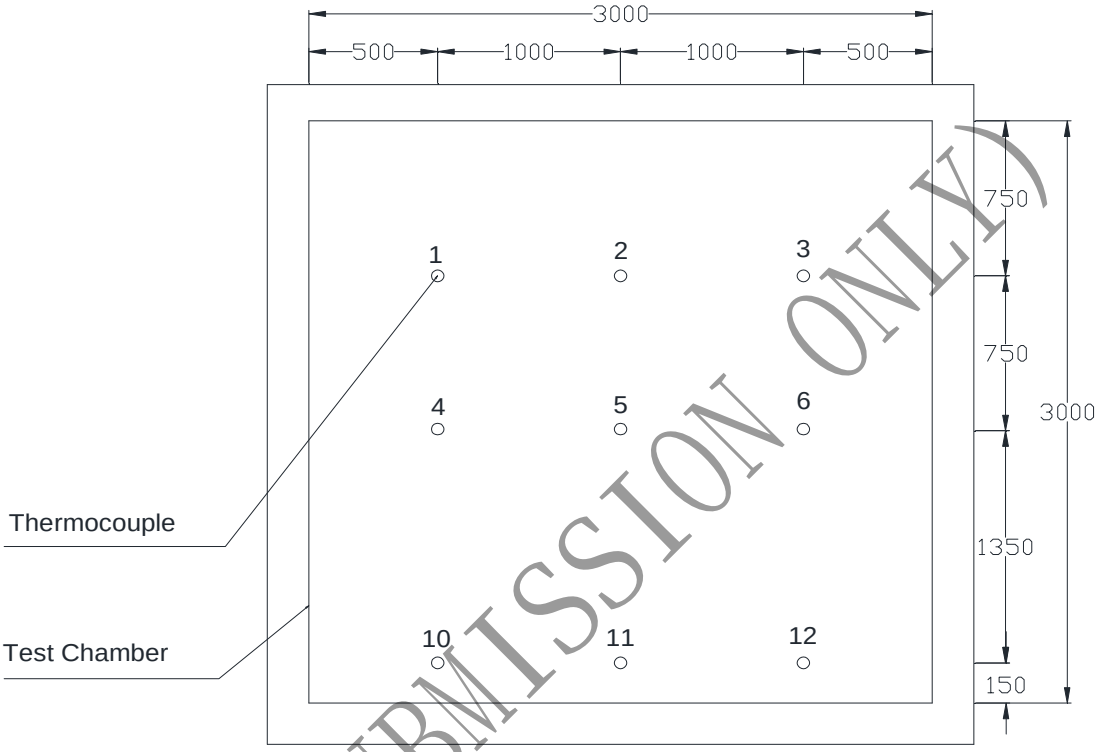
▼ positions for deflection measurements

Figure 4 - Elevation Diagram of Test Construction of Specimen FU236219



▼ positions for deflection measurements

Figure 5 - Elevation Diagram of Test Construction of Specimen FU236220



○ locations of thermocouples
All dimensions are in mm.

Figure 6 - Locations of Thermocouples

5. Equipment

Nine bare metal type thermocouples were positioned (100±50) mm away from the exposed face of the test construction to monitor the air temperature inside the test chamber. The locations of the thermocouples are shown in Figure 6.

A pressure measuring device head was mounted in the test chamber at the centre of the test specimen (100±50) mm away from the inside face of the test specimen to measure the static pressure of the test chamber.

An air flow instrumentation was installed to measure the volume, Q_t, and the temperature of air supplied to the apparatus to compensate for the total leakage.

A steel ruler was provided to measure the lateral deflections of the specimens relative to a laser line. The measurement positions are shown in Figure 4 and 5.

6. Test Procedure

6.1 Pre-test examination and preparation

Prior to the smoke control test, the doorset was opened to an angle of 30° and closed 10 times to ensure the assembly operates normally as specified in BS EN 1634-3:2004, Clause 10.1.1.

Gaps, retention forces were measured as specified in BS EN 1634-3: 2004, Clause 6.4 and 10.1.2.

6.2 Smoke leakage test

The test was conducted in accordance with the procedure specified in BS EN 1634-3: 2004, Clause 10.2.

For ambient temperature tests, the leakage rate through the specimen was measured at pressure differences of 10 Pa, 25 Pa, 50 Pa, or at the pressure difference specified by the sponsor. During measurement of the leakage rate, the pressure difference was maintained for 2 min and the value of Q_t established at the end of this period using:

$$Q_{spec} = Q_t^{(20)} - (Q_{app}^{(20)} + Q_{sup/assoc}^{(20)})$$

$$Q_l = Q_{spec}^{(20)} / \text{"length of gap"}$$

Where the symbols and designation are defined as follows:

Symbols	Unit	Designation
Q	m^3/h	leakage rate
Q_{app}	m^3/h	apparatus leakage rate
$Q_{sup/assoc}$	m^3/h	supporting / associated construction leakage rate
Q_{spec}	m^3/h	test specimen leakage rate
Q_t	m^3/h	total leakage rate
Q_l	$m^3/h/m$	linear leakage rate

For medium temperature tests, the average air temperature close to the face of the door was raised from ambient temperature to the temperature of (200±20) ℃ in (30±5) min. The temperature distribution over the face of the door was controlled to (200±40) ℃ as measured by each thermocouple. The leakage rate through the specimen was measured at pressure differences of 10 Pa, 25 Pa, 50 Pa, or at the pressure difference specified by the sponsor. During measurement of the leakage rate, the pressure difference was maintained for 2 min and the value of Q_t established at the end of this period using:

$$Q_{spec} = Q_t^{(200)} - (Q_{app}^{(200)} + Q_{sup/assoc}^{(200)})$$

A steel ruler was used to measure the lateral deflection of the specimen during the test.

7. Test Data and Information

The closing speed of the active leaf and the inactive leaf of specimen FU236219 was 103.9 mm/s and 112.6 mm/s respectively. The closing speed of the active leaf and the inactive leaf of specimen FU236220 was 115.5 mm/s and 118.3 mm/s respectively.

The gaps between the door leaf and the door frame are shown in Figure 7 and 8. The length of gap was 10.254 m.

The retention forces of the door leaf were shown as follows:

Specimen		Push	Pull
FU236219	Active leaf	136.7 N	145.3 N
	Inactive leaf	65.1 N	90.6 N
FU236220	Active leaf	127.8 N	125.9 N
	Inactive leaf	78.3 N	85.5 N

The following data were recorded during the smoke leakage test:

a) The actual average air temperature/ time curve as well as the standard air temperature/ time curve, are shown in Figure 9 and 10.

b) The lateral deflections of the specimen are shown in Table 1 and 2.

A summary of the observations made on the general behaviour of the specimen is given in Table 3 and 4.

The ambient air temperature in the vicinity of the test construction was 20.9℃ and 23.2℃ at the start of the test of specimens FU236219 and FU236220 respectively.

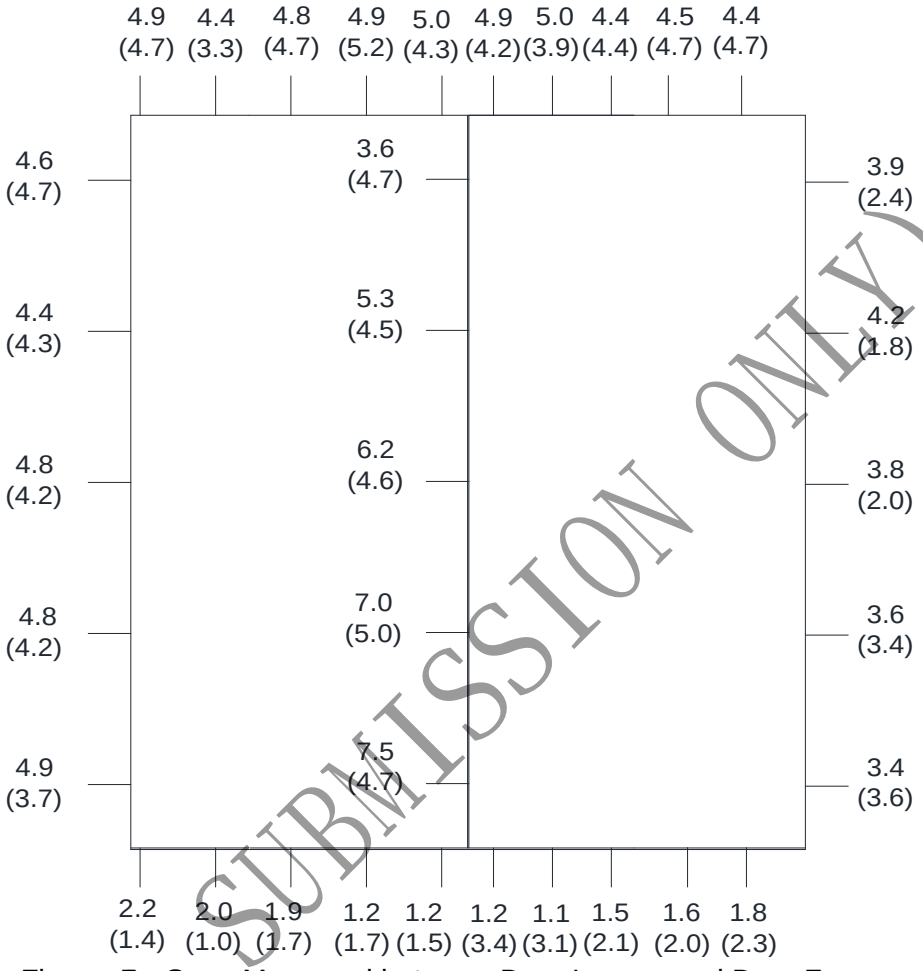


Figure 7 - Gaps Measured between Door Leaves and Door Frame as Viewed from the Unexposed Face of Specimen FU23219

All dimensions are in mm.

Dimensions shown in brackets were measured from the exposed face.

Gap dimension (mm)	Surface	Measured value		
		Maximum	Minimum	Average
Hinge edge	Exposed	4.7	1.8	3.4
	Unexposed	4.9	3.4	4.2
Meeting edge	Exposed	5.0	4.5	4.7
	Unexposed	7.5	3.6	5.9
Head edge	Exposed	5.2	3.3	4.4
	Unexposed	5.0	4.4	4.7
Bottom edge	Exposed	3.4	1.0	2.0
	Unexposed	2.2	1.1	1.6

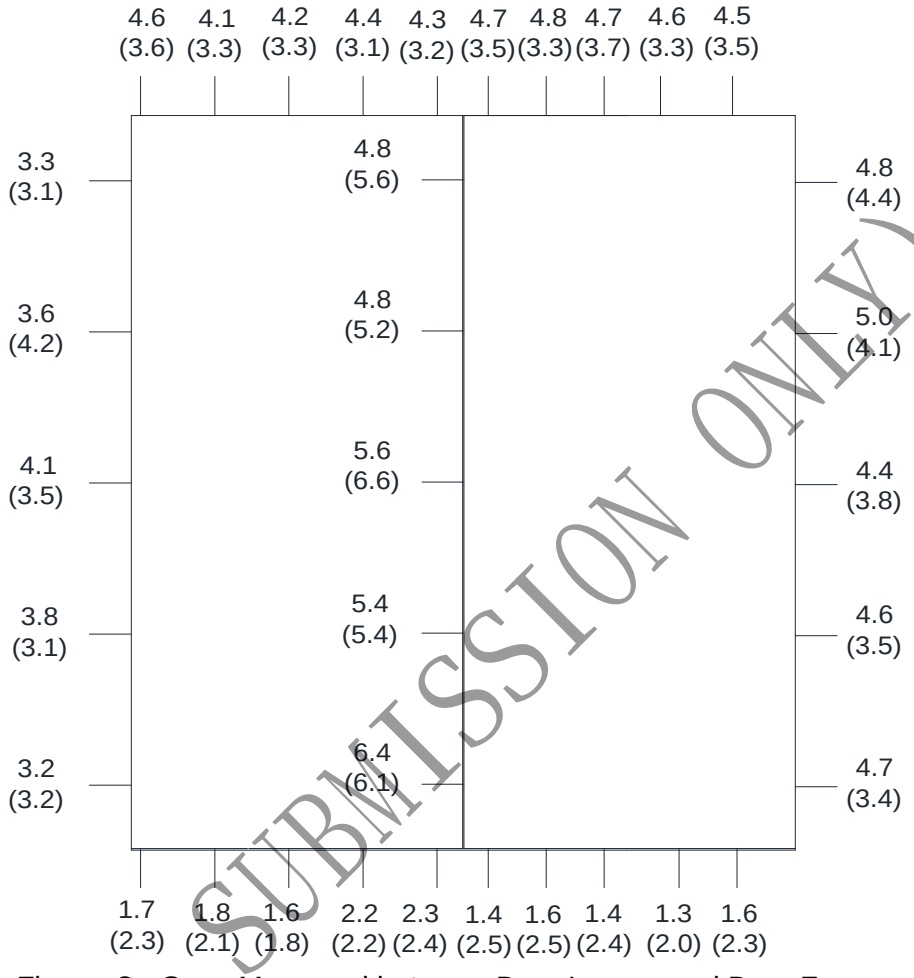


Figure 8 - Gaps Measured between Door Leaves and Door Frame as Viewed from the Unexposed Face of Specimen FU236220

All dimensions are in mm.

Dimensions shown in brackets were measured from the exposed face.

Gap dimension (mm)	Surface	Measured value		
		Maximum	Minimum	Average
Hinge edge	Exposed	4.4	3.1	3.6
	Unexposed	5.0	3.2	4.2
Meeting edge	Exposed	6.6	5.2	5.8
	Unexposed	6.4	4.8	5.4
Head edge	Exposed	3.7	3.1	3.4
	Unexposed	4.8	4.1	4.5
Bottom edge	Exposed	2.5	1.8	2.3
	Unexposed	2.3	1.3	1.7

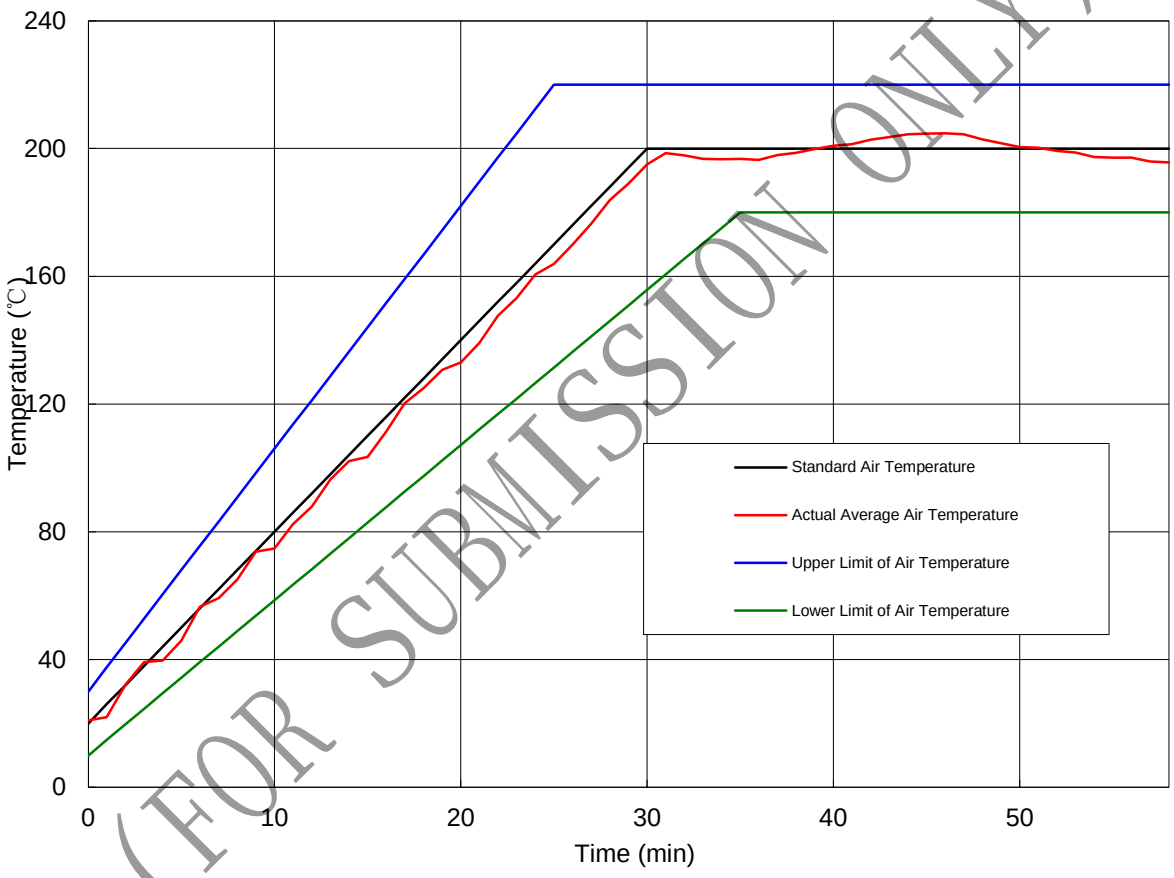


Figure 9 - Actual Average Air Temperature/Time Curve and Standard Air Temperature/Time Curve of Specimen FU236219

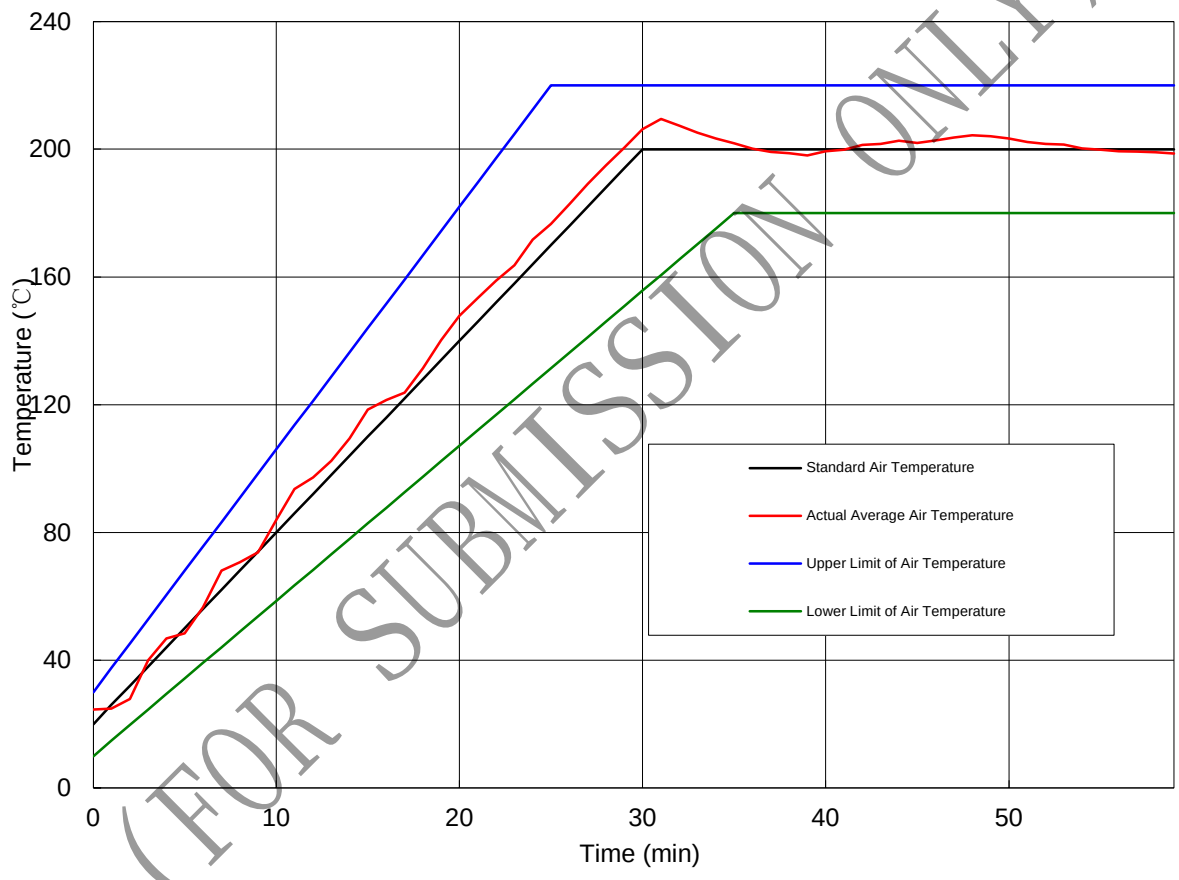


Figure 10 - Actual Average Air Temperature/Time Curve and Standard Air Temperature/Time Curve of Specimen FU236220

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Caotang, Hualong, Panyu
Guangzhou
China

Table 1 Lateral Deflections of Specimen FU236219 as Viewed from the Unexposed Face

Ambient temperature test										
Pressure	Deflections (mm)									
	A	B	C	D	E	F	G	H	I	J
0 Pa	0	0	0	0	0	0	0	0	0	0
10 Pa	0	0	0	0	0	0	0	0	0	0
25 Pa	0	0	0	0	0	0	0	0	-1	0
50 Pa	0	-2	0	0	-3	-1	-1	-1	-1	-1
Medium temperature test										
Medium temperature test										
Time or Pressure	Deflections (mm)									
	A	B	C	D	E	F	G	H	I	J
0 Pa	0	0	0	0	0	0	0	0	0	0
10 min	0	0	2	0	3	5	6	0	0	0
20 min	0	3	4	0	8	8	7	8	2	3
30 min	1	7	6	2	11	13	11	12	7	6
10 Pa	1	7	6	2	11	13	11	12	7	6
25 Pa	1	7	6	2	11	13	11	12	6	6
50 Pa	-1	4	4	0	11	13	11	12	5	4

Positive deflections indicate movement towards the heat source.

Table 2 Lateral Deflections of Specimen FU236220 as Viewed from the Unexposed Face

Ambient temperature test										
Pressure	Deflections (mm)									
	A	B	C	D	E	F	G	H	I	J
0 Pa	0	0	0	0	0	0	0	0	0	0
10 Pa	0	0	0	0	0	0	0	0	0	0
25 Pa	0	0	0	0	0	0	0	0	-1	-1
50 Pa	0	0	0	0	-1	-1	-1	-1	-2	-2
Medium temperature test										
Medium temperature test										
Time or Pressure	Deflections (mm)									
	A	B	C	D	E	F	G	H	I	J
0 Pa	0	0	0	0	0	0	0	0	0	0
10 min	0	2	1	1	5	7	5	4	1	2
20 min	0	4	5	1	8	12	11	9	5	3
30 min	1	8	7	1	11	14	13	11	6	5
10 Pa	1	8	7	1	11	14	13	11	6	5
25 Pa	1	8	7	2	11	13	12	10	4	4
50 Pa	2	7	8	2	10	12	11	9	3	2

Positive deflections indicate movement towards the heat source.

Table 3 Observations of Specimen FU236219 Made during and after the test

Ambient temperature test	
No significant change of the specimen was observed.	
Medium temperature test **a) Druing the test**	
Time (min:sec)	Observations
00:00	The test commences.
30:00	No significant change was visible to the specimen.
58:48	Test is terminated.
b) After the test	
Damages on the specimen	Blur discolouration was visible on the exposed surface of the glass panel.
	The intumescent fire seal with fins harden and damaged at the door frame and the door leaves.
	No significant change was visible to the bottom smoke seal.
Operability	The door leaves was able to be opened manually.

Table 4 Observations of Specimen FU236220 Made during and after the test

Ambient temperature test	
No significant change of the specimen was observed.	
Medium temperature test **a) Druing the test**	
Time (min:sec)	Observations
00:00	The test commences.
28:43	Smoke release is visible from the meeting edges of the doorset.
29:04	Smoke release is visible from the top left corner of the doorset.
32:41	Smoke release is visible from the bottom edges of the doorset.
34:52	Smoke release is visible from the top right corner of the doorset.
48:21	Blur discolouration was visible on the exposed surface of the glass panel.
59:28	Test is terminated.
b) After the test	
Damages on the specimen	Blur discolouration was visible on the exposed surface of the glass panel.
	The intumescent fire seal with fins harden and damaged at the door frame and the door leaves.
	No significant change was visible to the bottom smoke seal.
Operability	The door leaves was able to be opened manually.

8. Performance Criteria

The definitions of smoke leakage S_a and S_m are stated in BS EN 1634-3: 2004.

3.1.4 Smoke leakage S_a

Ambient temperature smoke leakage classification as defined in 7.5.6.3.1 of BS EN 13501-2:2003;

3.1.5 Smoke leakage S_m

Ambient plus medium temperature (200℃) smoke leakage classification as defined in 7.5.6.3.1 of BS EN 13501-2:2003.

BS EN 13501-2:2003, 'Fire classification of construction products and building elements – Part 2: Classification using data from fire resistance tests, excluding ventilation services'.

7.5.6.3.1 Smoke leakage

This is the ability of the element to reduce or eliminate the passage of smoke from one side of the door to the other. The following performance levels are defined:

a) smoke leakage S_m – when the maximum leakage rate measured at both ambient temperature and 200℃ and up to a pressure of 50 Pa does not exceed 20 m^3/h for a single leaf doorset, or 30 m^3/h for a double leaf doorset;
b) smoke leakage S_a – when the maximum leakage rate measured at ambient temperature, and up to a pressure of 25 Pa only, does not exceed 3 m^3/h per meter length of gap between the fixed and moveable components of the doorset (e.g. between the door leaf and door frame), excluding leakage at the threshold.

9. Conclusion

Two identical specimens of a single-acting, double-leaf, metal doorset has been subjected to smoke control test in accordance with BS EN 1634-3: 2004. The results of the specimens were obtained and summarized as follows:

FU236219:

No. of test	Face exposed to pressure	Temperature	Leakage rate Q_{spec} (m^3/h) at pressure difference of			Linear leakage rate Q_l ($m^3/h/m$) at pressure difference of	
			10 Pa	25 Pa	50Pa	10 Pa	25 Pa
1	Open inwards	Ambient (threshold sealed)	2.90	5.55	8.22	0.28	0.54
2	Open inwards	Ambient	6.92	13.22	20.54		
3	Open inwards	Medium	5.86	13.29	16.23		

FU236220:

No. of test	Face exposed to pressure	Temperature	Leakage rate Q_{spec} (m^3/h) at pressure difference of			Linear leakage rate Q_l ($m^3/h/m$) at pressure difference of	
			10 Pa	25 Pa	50Pa	10 Pa	25 Pa
1	Open outwards	Ambient (threshold sealed)	3.11	6.62	10.05	0.30	0.65
2	Open outwards	Ambient	7.67	15.75	24.56		
3	Open outwards	Medium	3.08	9.94	14.04		

The performance of the specimens were assessed against the criteria for S_a and S_m, and the specimens satisfied the performance requirement of S_a and S_m of BS EN 1634-3: 2004.
Remarks: Decision rule: Simple acceptance (guard band =0).

10. Field of Direct Application of Test Results

The field of direct application of test results is restricted to the allowable changes which a sponsor may make to the tested specimen following a successful smoke leakage test. These variations can be introduced automatically without the need for the sponsor to seek additional evaluation, calculation or approval.

The field of direct application of test results is conducted in accordance with the rules specified in 13 of BS EN 1634-3: 2004.

11. Limitation

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, constructional details, edge or end conditions other than those allowed under the field of direct application in the relevant test method is not cover by this report.

Because of the nature of fire resistance testing and 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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No.6, Nongye Gongsi Road
Caotang, Hualong, Panyu
Guangzhou
China

Appendix A - Test Photographs
FU236219:

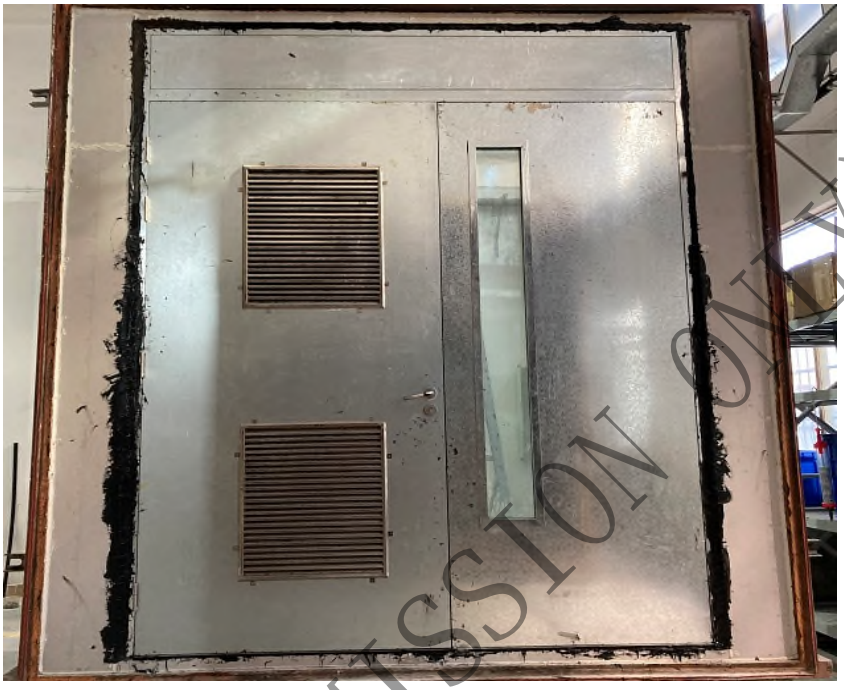

Photo 1 - The exposed face of the specimen before medium temperature test

Photo 2 - The exposed face of the specimen after medium temperature test

Photo 3 - The top left corner of doorset after medium temperature test

Photo 4 - The top right corner of doorset after medium temperature test

Photo 5 - The bottom left corner of doorset after medium temperature test

Photo 6 - The bottom right corner of doorset after medium temperature test

Photo 7 - The top edge of active leaf after medium temperature test

Photo 8 - The top edge of inactive leaf after medium temperature test

Photo 9 - The position of flush bolt after medium temperature test

Photo 10 - The position of flush bolt after medium temperature test

Photo 11 - The meeting edge of active leaf after medium temperature test

Photo 12 - The meeting edge of inactive leaf after medium temperature test

Photo 13 - The bottom edge of active leaf after medium temperature test

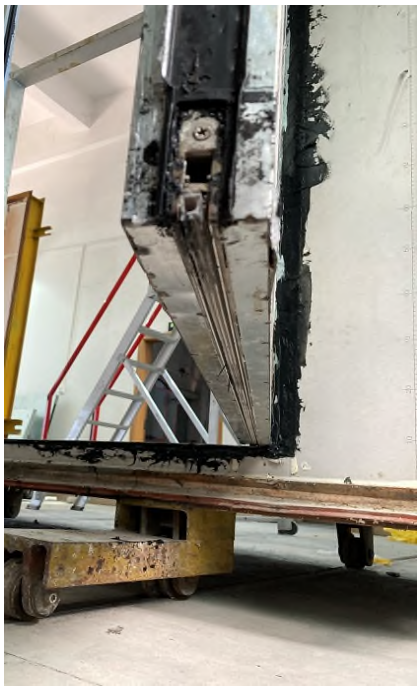

Photo 14 - The bottom edge of inactive leaf after medium temperature test

Photo 15 - The glass panel and louvers of the doorset after medium temperature test

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FU236220:

Photo 16 - The exposed face of the specimen before medium temperature test

Photo 17 - The exposed face of the specimen after medium temperature test

Photo 18 - The top left corner of doorset after medium temperature test

Photo 19 - The top right corner of doorset after medium temperature test

Photo 20 - The bottom left corner of doorset after medium temperature test

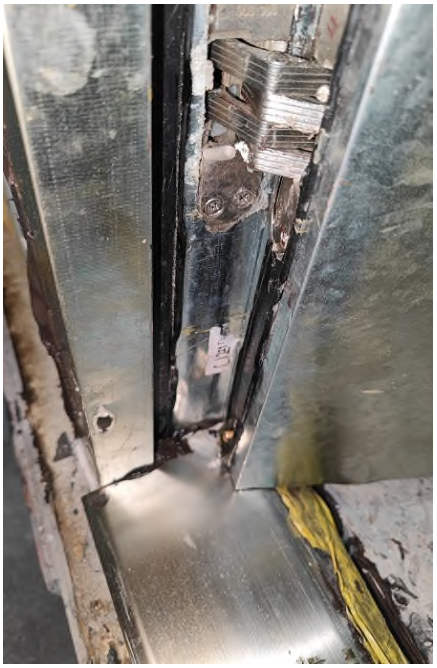

Photo 21 - The bottom right corner of doorset after medium temperature test

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Photo 22 - The top edge of active leaf after medium temperature test

Photo 23 - The top edge of inactive leaf after medium temperature test

Photo 24 - The position of flush bolt after medium temperature test

Photo 25 - The position of flush bolt after medium temperature test

Photo 26 - The meeting edge of active leaf after medium temperature test

Photo 27 - The meeting edge of inactive leaf after medium temperature test

Photo 28 - The bottom edge of active leaf after medium temperature test

Photo 29 - The bottom edge of inactive leaf after medium temperature test

Photo 30 - The glass panel and louvers of the doorset after medium temperature test

** End of Report **