

FIRE RESISTANCE TEST IN ACCORDANCE WITH BS EN 1634-1: 2014 + A1: 2018

On a Double-acting, Unequal Double-leaf Glazed Doorset with Side and Transom Panels

Test Report No.: R20L41-2A

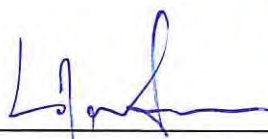
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Test Sponsor

HK Pro-Tech Fire Prevention Building Materials Ltd.
Unit B, 22nd Floor, Johnson Centre, 13 Hau Fook Street,
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APPROVED SIGNATORY:


Dr. SZE Lip-kit



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1 SUMMARY

Fire resistance test conducted in accordance with BS EN 1634-1: 2014 + A1: 2018 on a double-acting, unequal double-leaf glazed doorset with side and transom panels.

A specimen of double-acting, unequal double-leaf glazed doorset with side and transom panels had been subjected to a test in accordance with BS EN 1634-1: 2014 + A1: 2018 in order to determine its fire resistance performance. As requested by the test sponsor, the specimen was mounted within concrete lined specimen holder by test sponsor such that the door leaves were swinging towards or away from the heating conditions. The doorset was asymmetrical and only one side of the specimen was tested, in which the fire side was determined by the test sponsor.

The specimen had overall dimensions of 3,400 mm wide by 3,200 mm high. It was comprised of a double-acting, unequal double-leaf glazed doorset with three (3) nos. of transom panel and two (2) nos. of side panels. It was comprised of totally 7 nos. of glass panes, namely panes 'A' to 'G' (refer to photo 1). The left door leaf was with sizes of 1,160 mm wide by 2,605 mm high and the right door leaf was with sizes of 560 mm wide by 2,605 mm high. Both door leaves were hung to the door frame by 'Dorma' floor springs. The frame of transom and side panels was constructed by 30 mm by 50 mm by 2 mm thick and 25 mm by 50 mm by 2 mm thick G.M.S. hollow sections and the frame of door leaves was constructed by 50 mm by 30 mm by 2 mm thick G.M.S. hollow sections. All hollow sections were sandwiched by 1 layer of nominal 3 mm thick ceramic tape, 1 layer of nominal 12 mm thick fire rated board and 1 layer of nominal 1 mm thick stainless steel cladding at both sides (refer to test sponsor's drawings).

All panes were of nominal 25 mm thick 'Protech' insulated glass. Pane 'A' was with vision sizes 1,000 mm wide by 2,400 mm high. Pane 'B' was with vision sizes of 400 mm wide by 2,400 mm high. Pane 'C' was with vision sizes of 1,020 mm wide by 2,560 mm high. Pane 'D' was with vision sizes of 1,020 mm wide by 450 mm high. Pane 'E' was with vision sizes of 1,710 mm wide by 450 mm high. Pane 'F' was with vision sizes of 400 mm wide by 450 mm high. Pane 'G' was with vision sizes of 400 mm wide by 2,560 mm high. One (1) no. of intumescent fire seal with sizes of 20 mm wide by 4 mm thick was installed each jamb and head of door frame and four edges of both door leaves. A lockset was installed at bottom corner of left door leaf, top corner of right door leaf and meeting edge of left door leaf. A flush bolt was installed at top and bottom of right door leaf. An electric lockset was installed at the head of door frame, above left door leaf. A surface mounted hand was installed at both sides of both door leaves. A free edge was applied to the left vertical edge and infilled with mineral wool. The doorset was unbolted, unlocked and unlatched during the test.

The specimen satisfied the performance requirements specified in BS EN 1634-1: 2014 + A1: 2018 for the following periods:

Integrity:	Cotton Pad	114 Minutes
	Gap Gauge	119 Minutes (No failure)
	Sustained Flaming	119 Minutes (No failure)
Insulation (I₁ doorset excluding transom and side panels):		106 Minutes
Insulation (I₁ transom and side panels):		108 Minutes

The test was discontinued after a heating period of 119 minutes.

2 INTRODUCTION

The objective of the test is to determine the fire resistance performance of a specimen of double-acting, unequal double-leaf glazed doorset with transom and side panels when tested in accordance with BS EN 1634-1: 2014 + A1: 2018, 'Fire resistance tests for door and shutter assemblies – Part 1: Fire doors and shutters'.

This test report should be read in conjunction with BS EN 1363-1: 2012, 'Fire resistance tests – Part 1: General requirements'.

3 TEST INFORMATION

3.1 Test Sponsor

HK Pro-Tech Fire Prevention Building Materials Ltd.

Unit B, 22nd Floor, Johnson Centre, 13 Hau Fook Street, Tsim Sha Tsui, Kowloon, Hong Kong

3.2 Testing Location

Research Engineering Development Façade Consultants Limited Laboratory, Route YE60, Shan Pi Village, Lilin Town, Zhong Kai Gao Xin District, Huizhou City, Guang Dong Province, China.

3.3 Date of Test

22nd January 2021

3.4 Witness of the test

The test was led by Mr. Ben Li of Research Engineering Development Façade Consultants Limited (RED) and was witnessed by Mr. K.W. Cheung, the representative of the test sponsors.

4 EQUIPMENT

Twelve (12) 'type K' thermocouples to monitor the temperature of the furnace, which were kept at 100 mm from the exposed face of the specimen (see Figure 1).

Fifty-four (54) 'type K' thermocouples to monitor the temperature of the unexposed face of the specimen (see Figure 2).

A 'type K' roving thermocouple to measure temperature on hot spots of unexposed surface of specimen.

A micro-manometer provided to monitor the furnace pressure.

Cotton pads, 6 mm and 25 mm gap gauges.

Laser distance metres to monitor the lateral deflection of the specimen.

A radiometer placed at 1,000 mm away from the unexposed surface to measure the radiation of unexposed surface of the specimen.

5 CONDITIONING

The specimen's storage, construction, and test preparation took place in the test laboratory over a total, combined time of 2 days. Throughout this period of time, both of the temperature and humidity of the laboratory were measured and recorded as being within a range of 18 °C to 27 °C and 53 % to 80 % respectively.

6 TEST SPECIMEN CONSTRUCTION

A comprehensive description of the test specimen construction is presented in the appendix, which is based on a survey of the specimen and information supplied by the test sponsor.

7 VERIFICATION OF TEST SPECIMEN

In order to ensure the description of the test specimen, and in particular its construction, is on conformity with the test specimen, the laboratory shall either oversee the fabrication of the test specimen or request an additional test specimen.

In this case, RED's representative had visited the factory of the test sponsor to verify the fabrication of glass panes. Other construction details of the specimen were verified on site by RED as shown in 'Appendix D - Information from Test Sponsor'.

8 PRE-TEST MEASUREMENTS

8.1 Pre-cycling

The specimen was conditioned to equilibrium as specified in BS EN 1363-1.

Mechanical conditioning as required in Clause 8.2 of BS EN 1634-1 in terms of operational ability with the test method referenced to Annex A of BS EN 16034 had been conducted prior to test. The specimens 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° for 25 cycles.

8.2 Door Perimeter Gaps

The manufacturer did not declare a working range so the doorset was installed to open and close freely, maintaining gaps, where possible, to a range of 4.0 mm - 9.5 mm. The gaps between the edge of the door leaf/leaves and frame(s) were measured prior to test. The measurements (in mm) are given in Figure 3.

8.3 Retention Forces

The retention force was measured in accordance with BS EN 1634-1: 2014 + A1: 2018, Section 10.1.3.

Door Leaves	Swing Direction	Device	Opening Force (Nm)
Left door leaf	Swing towards the furnace	Floor Spring	133
Left door leaf	Swing away from the furnace	Floor Spring	125
Right door leaf	Swing towards the furnace	Floor Spring	71
Right door leaf	Swing away from the furnace	Floor Spring	52

8.4 Self-closing

The doorset was declared to be self-closing. The door leaves were subjected to open to $10^\circ \pm 2^\circ$, held for $20 \text{ s} \pm 2 \text{ s}$ and then released without shock and allowed to close at the speed. The closing speed was measured in accordance with BS EN 1634-1: 2014 + A1: 2018, Section 8.2.

Position	Swing Direction	Closing speed (mm/s)	Allowed maximum closing speed (mm/s)
Leading edge of left door leaf	Swing towards the furnace	N/A	300
Leading edge of left door leaf	Swing away from the furnace	88	300
Leading edge of right door leaf	Swing towards the furnace	N/A	300
Leading edge of right door leaf	Swing away from the furnace	N/A	300

8.5 Method of Installation

The doorset was installed into a concrete specimen holder with pre-prepared opening to form the test construction. The details of the fixings are outlined in Appendix D.

9 TEST PROCEDURES

The test was conducted in accordance with the procedures specified in BS EN 1634-1: 2014 + A1: 2018. The ambient temperature of the test area during the test was measured. After the first 5 minutes of the test, the furnace pressure was maintained at 17 ± 3 Pa relative to atmosphere, at top of the doorset.

The furnace was monitored by twelve (12) thermocouples so that the mean furnace temperature complied with the requirements of Clause 4.5.1.1 of BS EN 1363-1: 2012.

The temperature of the unexposed face was monitored by means of fifty-four (54) thermocouples fixed to the unexposed surface (see Figure 2 for the locations and reference numbers of the thermocouples).

Thermocouples S1 – S5 were fixed on the door leaves for mean and maximum temperatures of the unexposed surface of doorset excluding transom and side panels. Thermocouples S6 – S21 and S22 – S26 were fixed on the door leaves and door frame respectively for maximum temperature of the unexposed surface of doorset excluding transom and side panels only. Thermocouples S27 – S34 were fixed on the transom and side panels for mean and maximum temperatures of the unexposed surface of transom and side panels. Thermocouples S35 – S54 were fixed on the transom and side panels and frame for maximum temperature of the unexposed surface of transom and side panels only. The mean and maximum temperatures were recorded.

The cotton pads and gap gauges were used, if considered appropriate, to determine compliance with the integrity criterion of the standard. The occurrence of sustained flaming on the unexposed surface was monitored to determine compliance with this criterion. The lateral deflection of the specimen was measured by laser distance metres and recorded. The radiation of the specimen was measured and recorded.

10 TEST DATA AND INFORMATION

The ambient temperature of the test area during the test was 21 °C.

The furnace was controlled so that the mean furnace temperature complied with the requirements of Clause 4.5.1.1 of BS EN 1363-1: 2012. The temperature recorded is shown graphically in Figure 5.

The mean and maximum temperatures of the unexposed surface of the doorset (I_1) excluding transom and side panels are shown graphically in Figure 6.

The mean and maximum temperatures of the unexposed surface of the transom and side panels (I_1) are shown graphically in Figure 7.

The furnace pressure is shown graphically in Figure 8.

The radiation is shown graphically in Figure 9.

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

The deflection obtained is summarized in Table 1.

The mean furnace temperature obtained is summarized in Table 2.

The temperature rises of specimen obtained are summarized in Table 3 and 4.

The test was discontinued after a heating period of 119 minutes.

11 RESULTS

When tested in accordance with BS EN 1634-1: 2014 + A1: 2018, the requirements of the standard were satisfied for the following periods:

Integrity:	Cotton Pad	115 Minutes
	Gap Gauge	119 Minutes (No failure)
	Sustained Flaming	119 Minutes (No failure)
Insulation (I₁ doorset excluding transom and side panels):		106 Minutes
Insulation (I₁ transom and side panels):		108 Minutes

*Insulation (I₁) - It is required that the mean temperature rise of the unexposed surface shall not be greater than 140 °C and that maximum temperature rise shall not be greater than 180 °C.
Insulation failure also occurs simultaneously with integrity failure.*

Doorset excluding transom and side panels (I₁):

The 140 °C rise of the mean temperature of the unexposed surface of specimen reached after a heating period of 115 minutes. The 180 °C rise of the maximum temperature of the unexposed surface of specimen reached and measured by roving thermocouple after a heating period of 106 minutes at top of left door leaf (see photos for location). The maximum temperature rise was 595 °C measured by thermocouple S2 after a heating period of 119 minutes.

Transom and side panels (I₁):

The 140 °C rise of the mean temperature of the unexposed surface of specimen reached after a heating period of 113 minutes. The 180 °C rise of the maximum temperature of the unexposed surface of specimen reached and measured by unexposed thermocouple S41 after a heating period of 108 minutes. The maximum temperature rise was 906 °C measured by thermocouple S27 after a heating period of 119 minutes.

Integrity - It is required that there is no collapse for the specimen, no sustained flaming on the unexposed surface and no loss of impermeability.

Cotton pad applied at top portion of left door leaf and ignited after a heating period of 115 minutes.

No failure was observed regarding to the criteria of gap gauge during the test.

No failure was observed regarding to the criteria of sustained flaming during the test.

The specimen did not meet the integrity requirements after a heating period of 115 minutes.

12 LIMITATIONS

This report details the method of construction, the test conditions and the results obtained when the specific element of construction described herein was tested following the procedure outlined in BS EN 1363-1, and where appropriate BS EN 1363-2. Any significant deviation with respect to size, constructional details, loads, stresses, edges or end conditions other than those allowed under the field of application in the relevant test method is not covered by this report.

The test results are valid only for the conditions under which the test was conducted.

Because of the nature of fire resistance testing and the consequent difficulty in quantifying the uncertainty of measurement of fire resistance, it is not possible to provide a stated degree of accuracy of the result. Therefore, the results 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.

APPENDIX A – Photos and Test Record



Photo 1: The unexposed face of the specimen before the test.



Photo 2: The unexposed face of the specimen after a heating period of 60 minutes.



Photo 3: The unexposed face of the specimen a heating period of 90 minutes.



Photo 4: The unexposed face of the specimen after the test.



Photo 5: The exposed face of the specimen after the test.

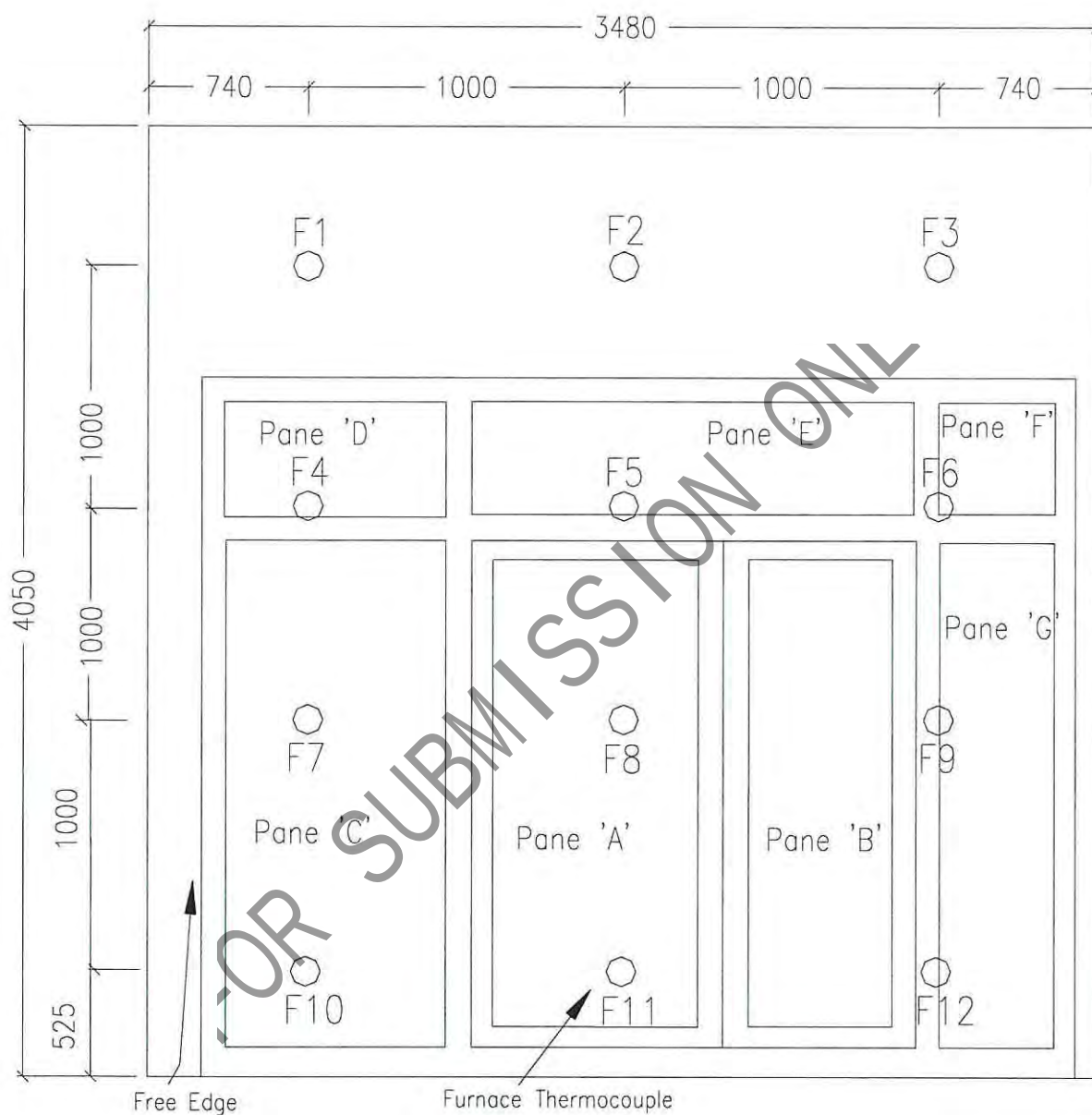


Figure 1 – Locations and reference numbers of furnace thermocouples.
(This figure is not to scale and all dimensions are in millimetres.)

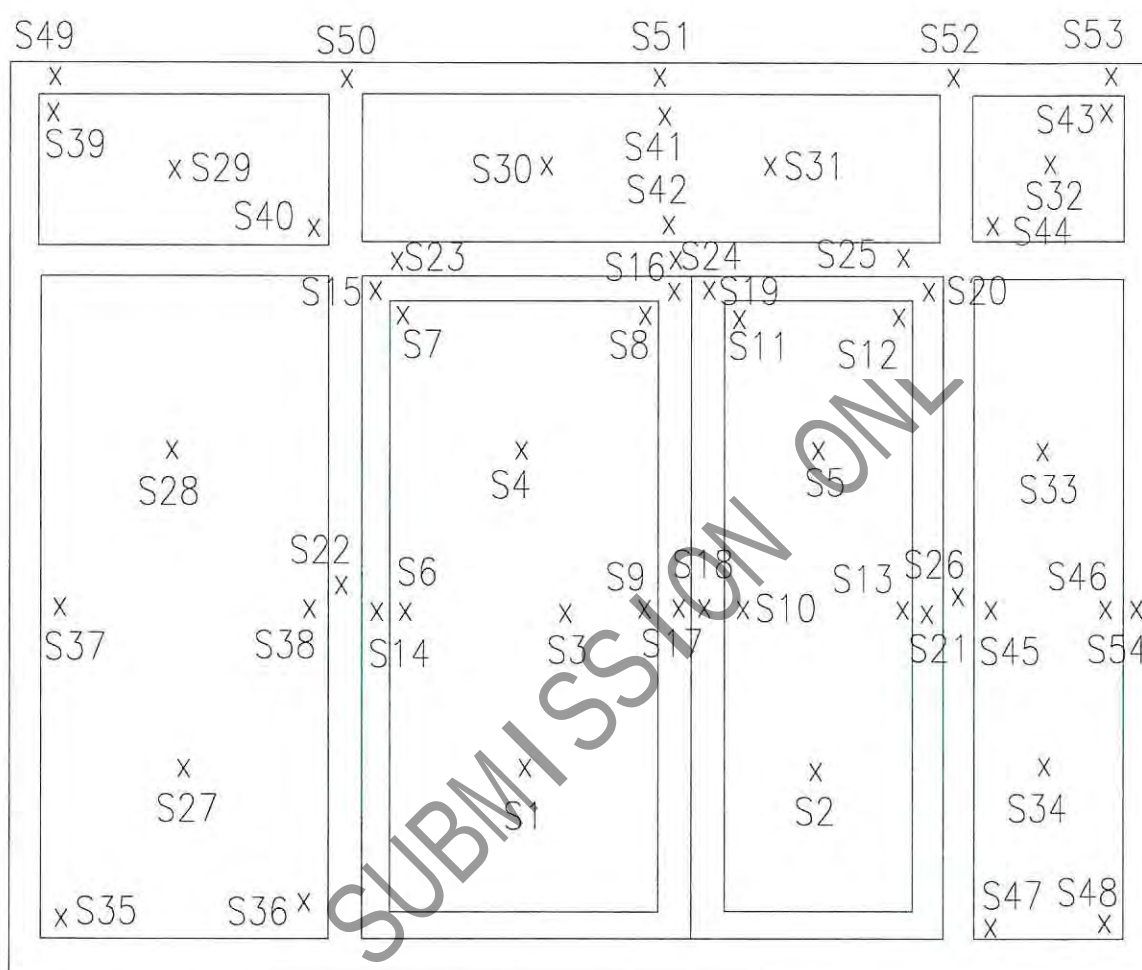


Figure 2 – Locations and reference number of thermocouples to monitor the temperature of unexposed surface of the specimen.

(This figure is not to scale.)

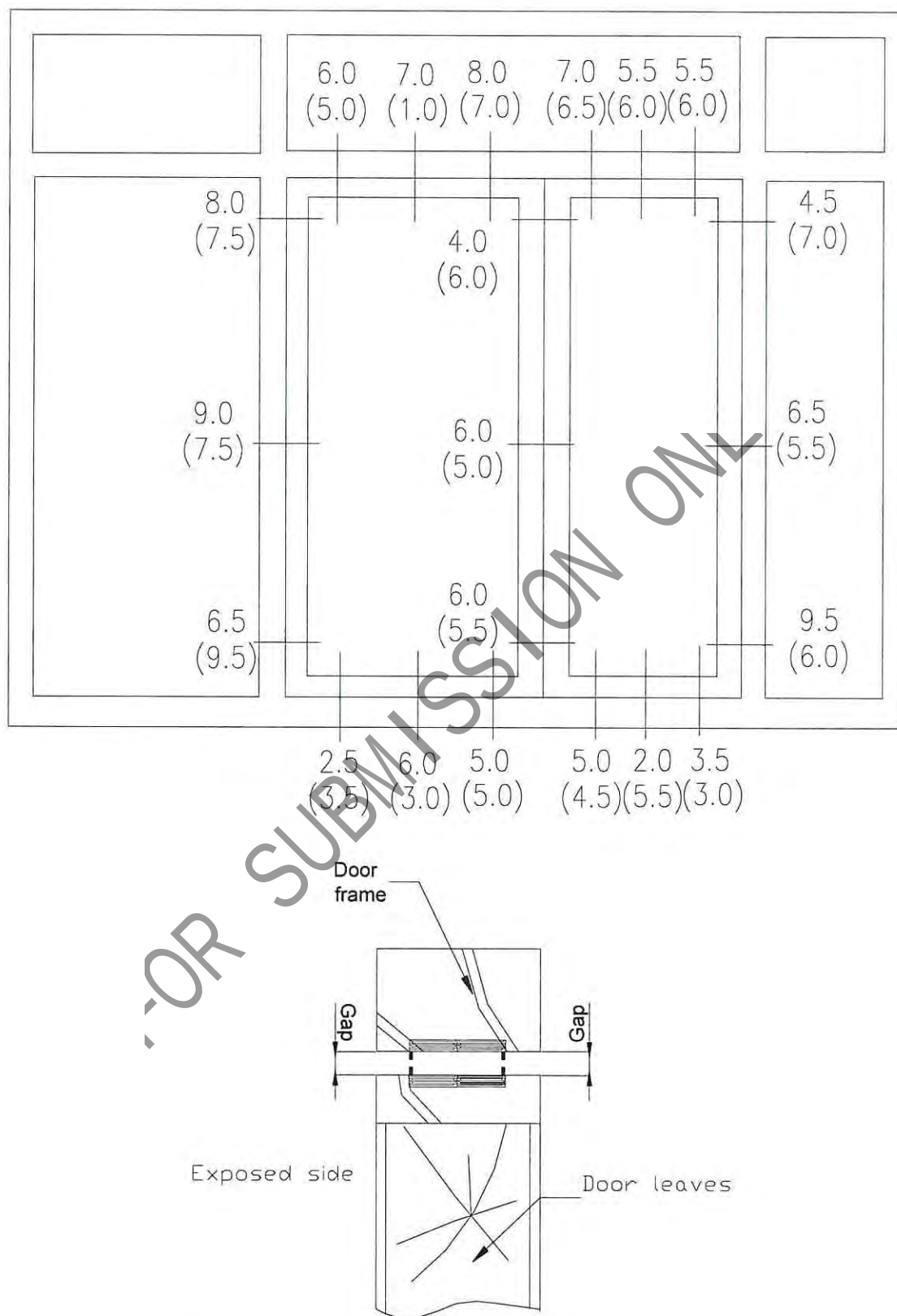


Figure 3 – Door gaps in mm, measured from unexposed face.
(Measurements from exposed face are in brackets)
(This figure is not to scale.)

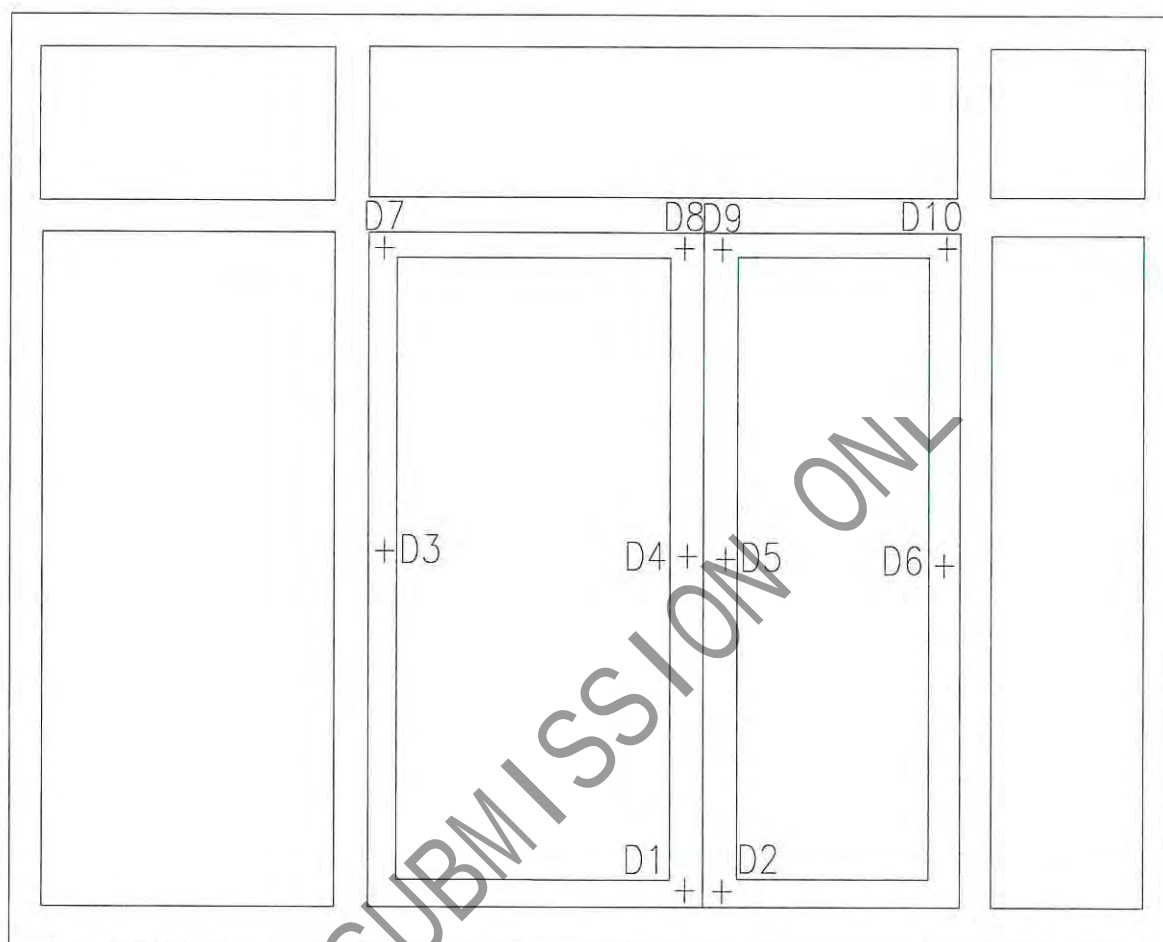


Figure 4 – Locations and reference numbers of displacement measurement.
(This figure is not to scale.)

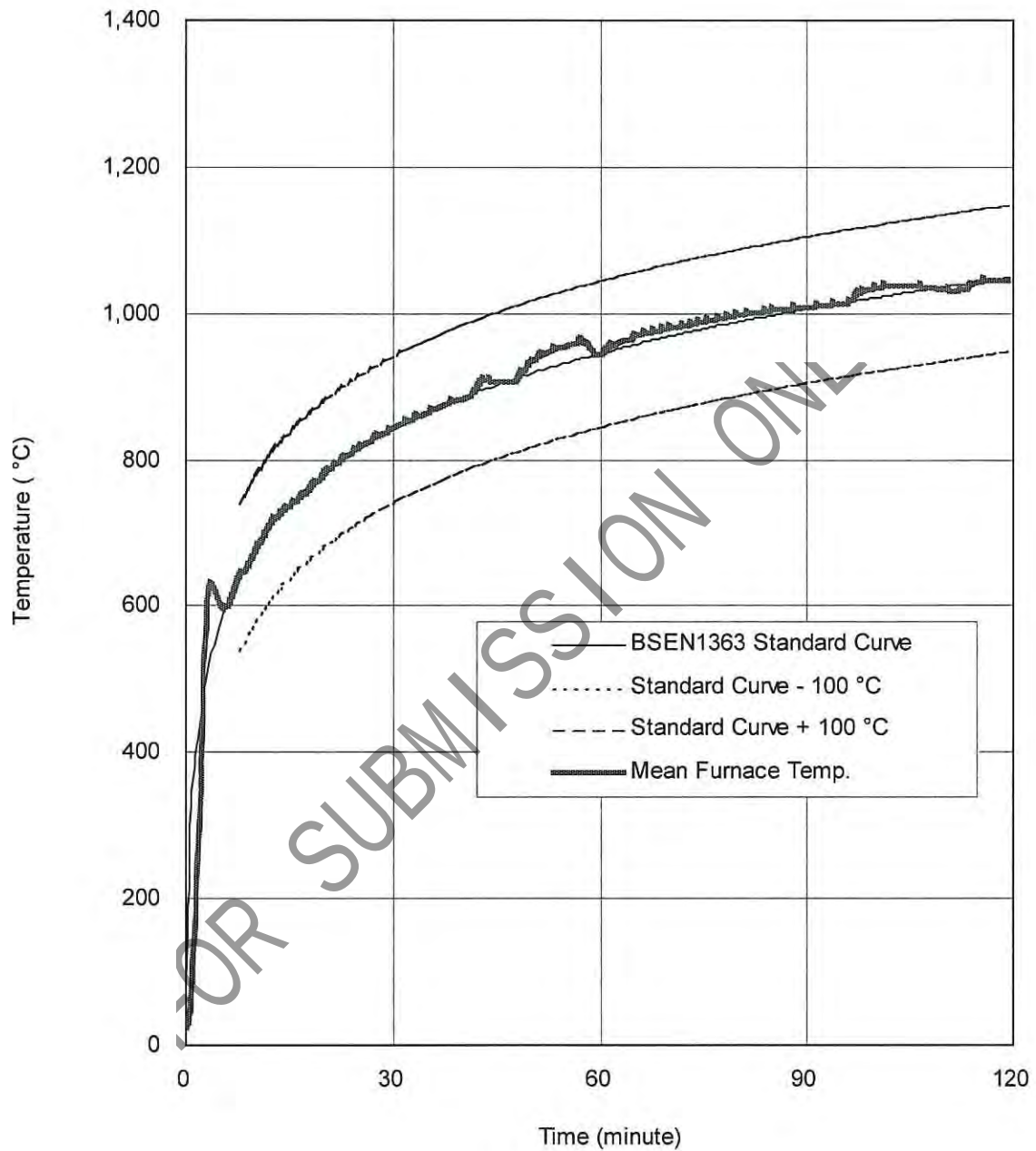


Figure 5 – Mean furnace temperature.

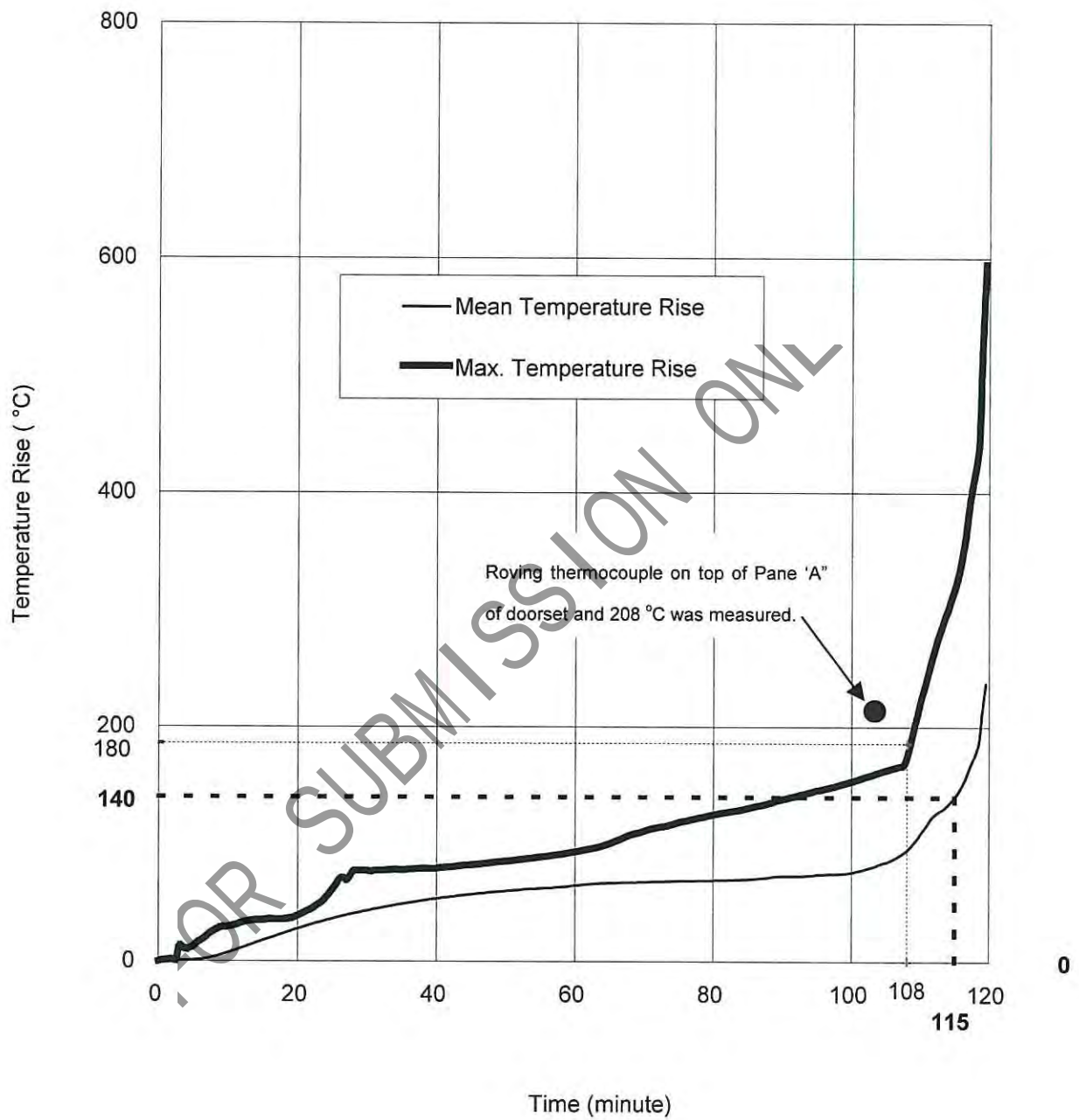


Figure 6 – Temperature rises of unexposed surface of doorset (I₁) excluding transom and side panels.

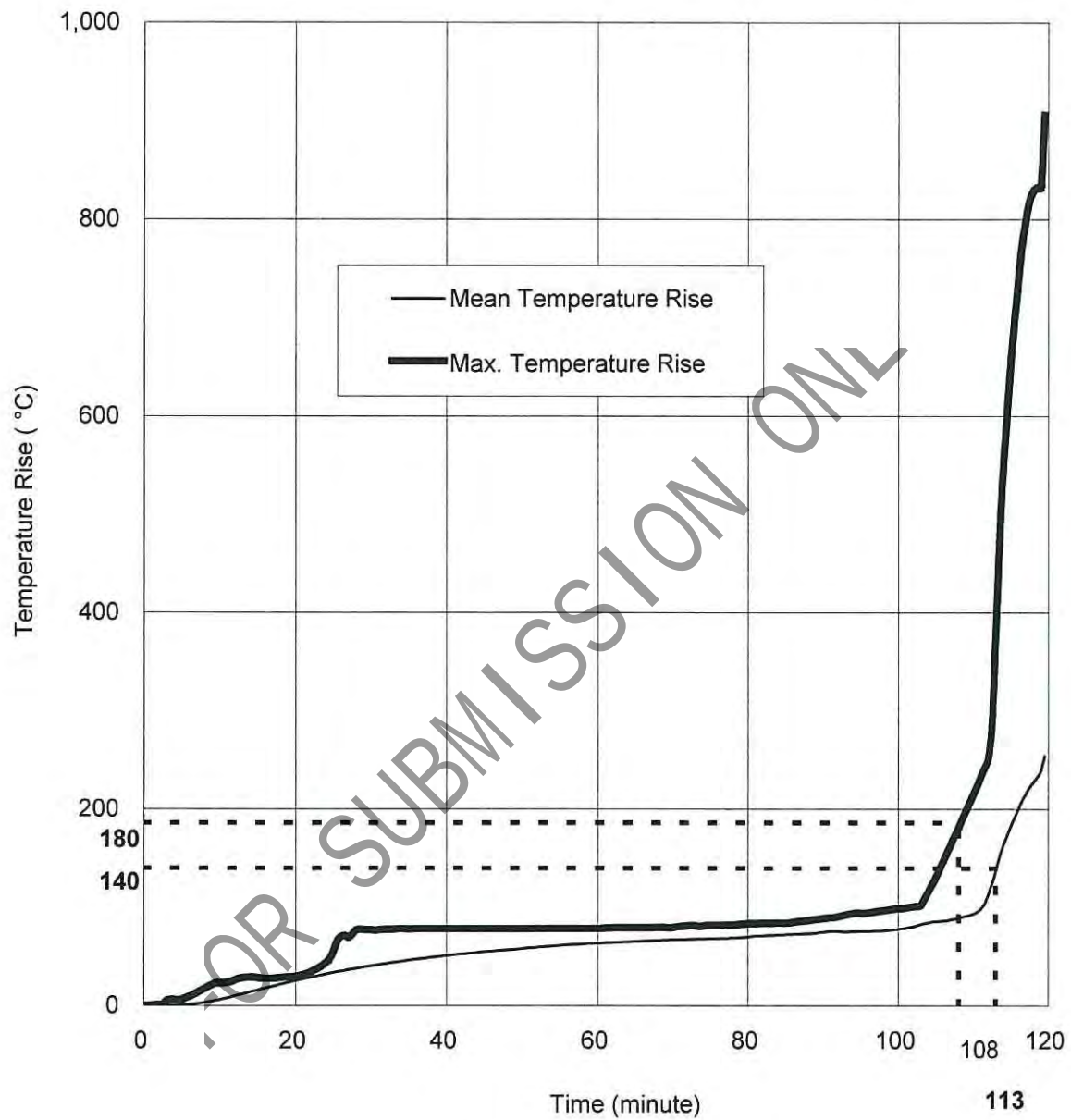


Figure 7 – Temperature rises of unexposed surface of transom and side panels (I₁).

After the first 5 minutes of the test, the furnace pressure was maintained at 17 ± 3 Pa relative to atmosphere, at top of the doorset.

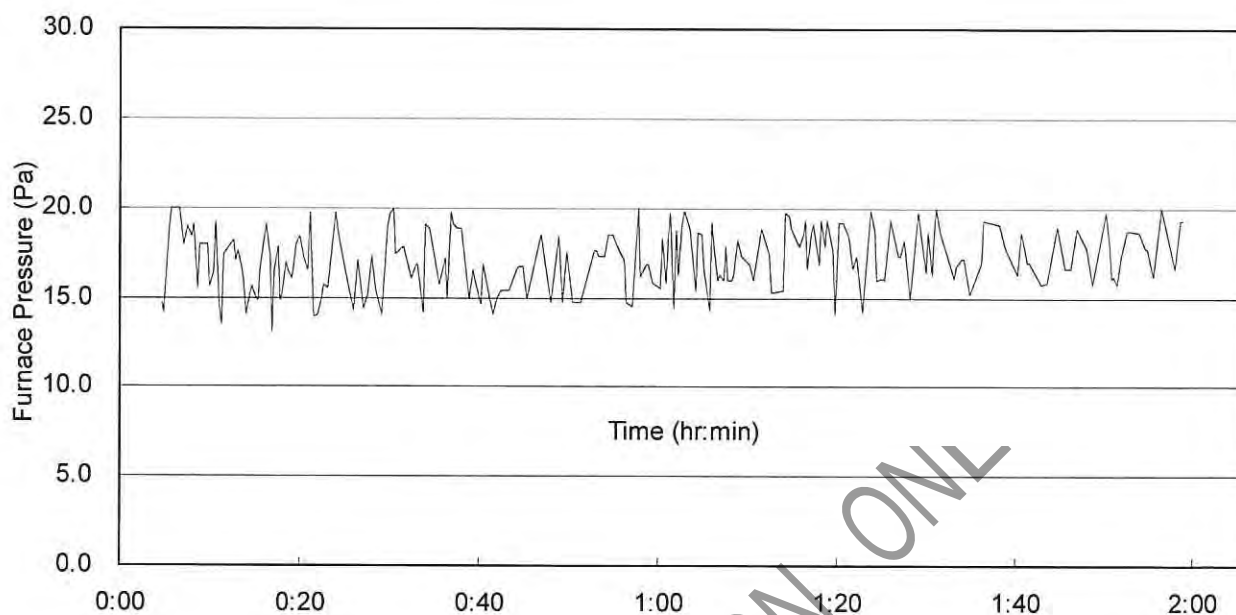


Figure 8 – Furnace pressure.

A radiometer placed at 1,000 mm away from the unexposed surface to measure the radiation of unexposed surface of the specimen.

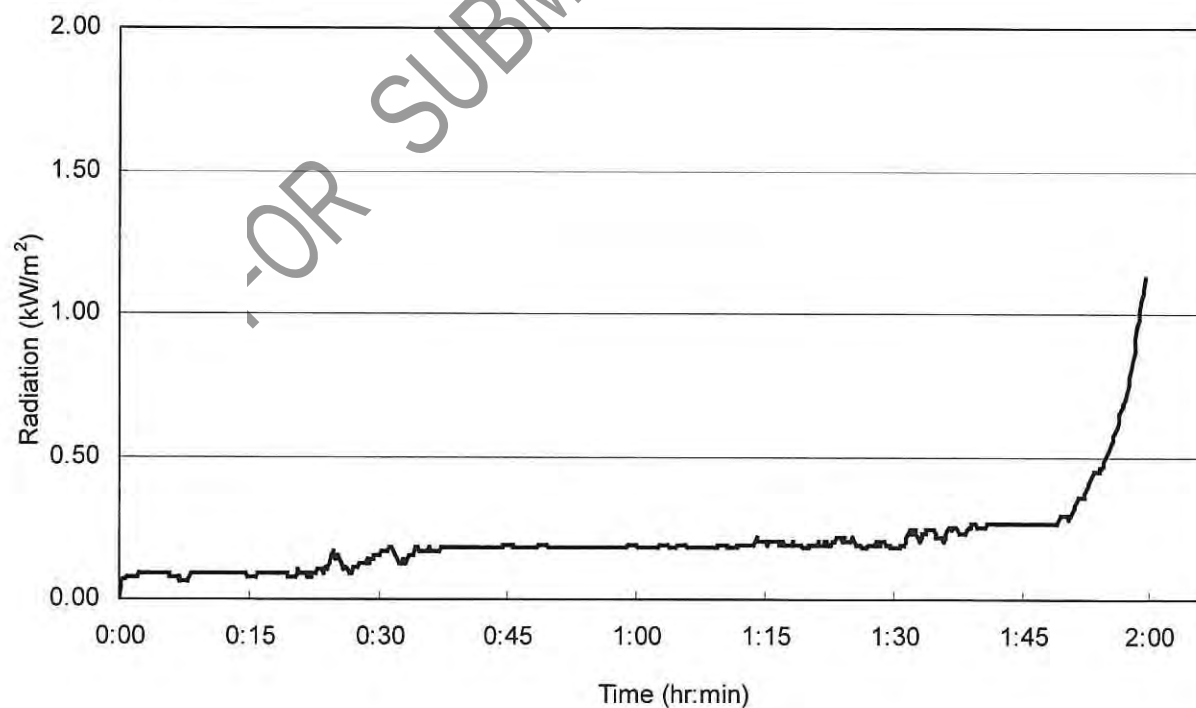


Figure 9 – Radiation.

APPENDIX B – Observation

Time (min.sec)	Exposed (E) or Unexposed (U)	Observation
00.00	-	Test started.
00.13	U	Smoke started releasing from top edges of door leaves.
01.34	U	Glass panels (Pane A, B, C, D & E) cracked from the exposed side.
01.45	U	Side panels (Pane F & G) cracked from the exposed side.
02.21	U	Glass panels of Pane A, B & G dropped from the exposed side.
02.45	U	Glass panels of Pane C, D, E, & F dropped from the exposed side.
03.13	U	Interlayer of glass panes started reacting and turned dull.
07.33	U	Interlayer turned yellowish colour.
08.58	U	Interlayer of Pane A, C & E turned dark.
19.16	U	Interlayer of Pane A near top edge glowed.
25.40	E	Surface of interlayer and door frame turned dark.
30.00	U	The specimen satisfied the integrity requirement performance.
34.55	U	Interlayer turned yellowish colour.
41.20	U	Smoke release from the sill of doorset and bottom left corner of Pane C was observed.
57.46	U	Cotton pad test applied on the top edge of left door leave near left corner. No failure was observed.
60.00	U	The specimen satisfied the integrity requirement performance.
72.50	U	Interlayer of Pane A near top edge turned white.
79.15	U	Smoke release from the top edge of Pane C was observed and interlayer of Pane E near top right corner turned white.
83.36	U	Cracks developed on the surface near top edge were observed.
85.24	U	Interlayer near top and bottom edges of Pane C and top of Pane E turned white.
90.00	U	The specimen satisfied the integrity requirement performance.
102.19	U	Pop sound was heard from the specimen.
106.40	U	Roving thermocouple was applied to the area near top edge of left door leaf. 208 °C was observed. Insulation criteria deemed to be failed.
107.54	U	The area near top edge of left door leaf charred.
115.05	U	Cotton pad test applied on the area near top edge of left door leaf and the cotton pad glowed. Integrity criteria deemed to be failed.
118.50	U	The area near top edge of left door leaf cracked.
119.37	-	Test was terminated as requested by test sponsor.

APPENDIX C – Data Recorded During the Test

Table 1 - Lateral deflection (mm) of the specimen during the test, as viewed from the unexposed face.

Time (minutes) Location	0	10	20	30	45	60	75	90	105	120
D1	0	-10	-8	-7	-7	-7	-7	-7	-8	-12
D2	0	-7	-5	-5	-6	-4	-4	-6	-6	-7
D3	0	14	14	14	16	22	23	26	31	32
D4	0	5	5	4	9	15	16	18	21	22
D5	0	2	1	1	5	14	16	19	24	24
D6	0	11	11	10	14	23	24	29	35	38
D7	0	10	11	12	15	20	21	21	26	29
D8	0	-2	1	2	6	11	13	13	15	15
D9	0	-2	-1	1	3	5	6	6	9	10
D10	0	4	5	6	11	16	16	20	22	24

Positive deflection indicates movement towards the furnace (see also Figure 4 for the locations).

The maximum deflection occurred at location D6 was 38 mm moving towards the furnace after a heating period of 120 minutes.

Table 2 - Mean furnace temperature.

Time (minute)	BS EN 1363-1 Standard Temp. Curve (°C)	Actual Mean Furnace Temp. (°C)
0	20	25
5	576	597
10	678	677
15	739	741
20	781	783
25	815	820
30	842	846
35	865	867
40	885	886
45	902	907
50	918	938
55	932	958
60	945	944
65	957	971
70	968	981
75	979	989
80	988	999
85	997	1006
90	1006	1010
95	1014	1014
100	1022	1036
105	1029	1038
110	1036	1034
115	1043	1045
119	1048	1047

Notes: Locations of furnace thermocouples are shown in Figure 1.

The test was terminated as requested by the test sponsor after a heating period of 119 minutes.

Table 3 - Time and related temperature rises measured by thermocouples S1 – S14.

Time (min)	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13	S14
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	1	1	1	1	1	1	1	1	1	1	1	1	1	2
10	5	7	11	6	7	8	6	6	9	7	7	6	7	2
15	15	18	24	15	18	19	15	16	20	17	17	15	18	5
20	24	28	35	25	27	29	22	26	31	27	26	24	28	11
25	32	37	44	33	35	37	29	36	39	37	35	33	36	18
30	40	44	51	40	42	44	40	45	46	44	45	42	43	26
35	46	50	56	45	47	50	47	54	52	51	55	50	50	34
40	51	55	61	50	51	55	53	61	57	56	61	58	55	45
45	55	59	64	53	55	59	59	67	61	61	67	63	59	57
50	58	62	66	56	58	62	58	70	64	65	71	68	63	73
55	61	64	68	58	61	66	61	73	67	69	74	72	66	77
60	64	67	70	60	63	68	65	74	69	75	77	74	69	78
65	65	71	73	61	65	70	76	75	72	78	81	77	74	78
70	67	71	72	62	66	73	82	79	75	79	82	81	77	79
75	69	73	72	64	67	76	87	81	77	79	82	82	78	79
80	69	72	73	65	67	77	70	81	77	78	82	80	78	81
85	71	74	74	65	68	77	64	81	77	78	82	80	78	82
90	72	79	79	65	70	77	66	79	78	78	85	83	78	85
95	76	78	78	66	72	78	72	80	77	79	91	90	78	89
100	77	85	77	69	73	79	78	83	78	79	105	105	79	94
105	77	127	78	70	73	78	88	101	78	80	126	122	80	99
110	82	222	92	71	79	79	106	129	78	81	148	141	79	105
115	81	318	147	76	79	80	137	154	79	84	169	161	84	112
119	104	527	265	90	82	81	168	178	81	87	187	177	92	118

Notes: Locations of thermocouples S1 – S14 are shown in Figure 2.

The test was terminated as requested by the test sponsor after a heating period of 119 minutes.

Table 4 - Time and related temperature rises measured by thermocouples S15 – S28.

Time (min)	S15	S16	S17	S18	S19	S20	S21	S22	S23	S24	S25	S26	S27	S28
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	13	3	0	1	3	3	0	1	6	1	2	0	1	0
10	29	14	2	3	14	10	2	1	23	5	7	1	6	3
15	35	25	7	8	24	21	5	3	29	11	13	3	16	10
20	38	39	15	16	39	34	10	7	30	17	24	7	26	18
25	49	57	26	27	61	45	16	12	53	30	57	13	34	25
30	69	73	42	38	71	54	24	19	77	68	62	42	41	32
35	71	78	51	46	73	64	34	34	78	72	77	78	47	38
40	75	79	66	54	76	72	47	60	78	72	77	78	53	43
45	78	82	77	63	79	78	55	69	78	74	77	78	57	48
50	81	85	77	78	82	79	61	76	78	74	77	78	60	52
55	85	89	77	79	85	81	68	76	79	75	77	78	62	55
60	90	93	78	80	88	89	77	77	79	75	77	78	65	58
65	95	101	78	82	93	96	80	77	80	76	78	78	67	60
70	101	111	77	85	98	103	83	77	80	76	78	77	70	61
75	108	119	75	90	104	110	85	77	82	76	78	78	71	63
80	114	125	74	96	110	118	89	77	83	76	79	78	73	65
85	118	131	74	103	115	126	93	77	84	76	84	79	76	67
90	123	138	78	111	122	133	98	77	85	84	89	82	82	69
95	129	146	81	118	131	141	104	78	87	94	93	87	78	70
100	137	154	85	127	138	150	110	78	95	87	99	95	79	72
105	146	163	90	136	148	161	117	78	104	88	104	102	83	73
110	156	172	95	142	157	173	125	84	111	90	111	105	108	77
115	167	182	102	151	165	184	134	89	117	93	116	108	647	77
119	175	189	108	159	174	194	141	92	122	100	121	111	906	84

Notes: Locations of thermocouples S15 – S28 are shown in Figure 2.

The test was terminated as requested by the test sponsor after a heating period of 119 minutes.

Table 5 - Time and related temperature rises measured by thermocouples S29 – S42.

Time (min)	S29	S30	S31	S32	S33	S34	S35	S36	S37	S38	S39	S40	S41	S42
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	1	1	1	1	1	1	1	1	1	1	1	1	1	1
10	8	6	6	8	6	7	6	6	7	6	8	8	7	7
15	18	16	16	19	16	18	16	15	18	16	19	19	16	16
20	28	26	25	29	26	27	26	25	28	26	29	28	26	25
25	35	34	34	38	34	36	34	33	36	34	38	36	34	33
30	42	40	41	45	40	43	41	40	43	41	45	42	41	39
35	47	46	47	50	46	49	47	45	48	47	50	47	47	45
40	51	50	51	55	51	53	51	50	53	52	54	51	51	50
45	54	54	56	58	55	58	54	54	56	55	57	54	55	54
50	56	58	59	61	58	62	56	56	58	58	60	56	59	57
55	59	63	62	64	60	65	58	58	60	61	62	58	62	58
60	61	65	65	66	62	68	59	60	62	63	63	60	64	60
65	63	66	67	67	65	70	60	61	63	64	64	62	67	61
70	65	67	68	68	66	71	62	62	64	65	65	63	69	62
75	66	69	69	70	67	71	63	63	65	66	67	64	74	63
80	67	71	73	71	68	72	64	65	67	68	69	64	76	65
85	68	77	77	72	69	74	65	67	68	70	73	65	77	74
90	73	76	76	74	70	79	67	67	68	73	76	67	77	75
95	75	76	77	77	72	80	69	69	69	76	76	68	89	75
100	75	78	86	78	75	82	71	71	71	76	77	70	83	74
105	77	97	98	78	75	103	73	74	74	76	77	72	131	74
110	95	90	87	79	76	141	72	73	75	77	77	73	216	75
115	113	113	109	80	82	230	71	72	76	87	77	74	301	76
119	168	172	195	82	93	330	71	73	77	81	80	76	367	80

Notes: Locations of thermocouples S29 – S42 are shown in Figure 2.

The test was terminated as requested by the test sponsor after a heating period of 119 minutes.

Table 6 - Time and related temperature rises measured by thermocouples S43 – S54.

Time (min)	S43	S44	S45	S46	S47	S48	S49	S50	S51	S52	S53	S54
0	0	0	0	0	0	0	0	0	0	0	0	0
5	1	1	1	1	1	1	0	1	0	0	0	0
10	7	7	7	7	6	6	1	3	1	1	1	0
15	17	16	18	18	15	15	3	4	2	4	4	1
20	26	24	28	28	25	25	9	8	6	11	11	3
25	33	31	37	36	33	33	18	13	12	21	20	7
30	40	37	44	43	39	40	28	25	19	34	29	12
35	45	42	50	48	45	45	40	38	27	51	36	18
40	49	45	54	52	49	49	55	48	35	72	42	25
45	52	48	58	56	53	53	67	55	40	73	47	30
50	55	50	61	59	55	56	71	59	41	74	50	35
55	57	52	63	61	57	58	72	61	41	74	52	40
60	58	53	65	63	58	60	73	61	43	74	53	44
65	60	54	67	65	60	61	74	62	44	74	54	47
70	61	55	69	66	61	62	74	65	44	75	55	50
75	64	56	70	67	63	62	74	67	44	75	55	52
80	67	57	70	69	63	63	74	68	45	75	57	55
85	69	59	72	72	65	63	74	70	48	75	58	60
90	72	60	74	73	66	64	74	71	48	76	61	65
95	72	61	75	74	68	65	74	72	49	76	65	69
100	72	63	77	74	69	66	75	72	51	77	68	70
105	72	65	77	75	71	66	75	73	56	79	71	71
110	73	67	78	76	72	67	76	74	60	81	73	72
115	74	68	90	76	74	69	77	75	69	83	73	71
119	77	69	96	76	74	70	78	77	78	84	75	72

Notes: Locations of thermocouples S43 – S54 are shown in Figure 2.

The test was terminated as requested by the test sponsor after a heating period of 119 minutes.

APPENDIX D – Information from Test Sponsor

(The information provided by the test sponsor, which was not verified by RED or unless specified.)

Item	Description
1 Frame Section	Manufacturer : HK Pro-Tech Fire Prevention Building Materials Limited. Overall size : 3,400 mm wide x 3,200 mm high.* Section sizes : 55 mm wide by 80 mm wide by 80 mm thick.* Construction : The frame was constructed by a 30 mm by 50 mm by 2 mm thick G.M.S. hollow sections and the frame of door leaves was constructed by a 50 mm by 30 mm by 2 mm thick G.M.S. hollow sections. All hollow sections were sandwiched by 1 layer of nominal 12 mm thick fire rated board, 1 layer of nominal 1 mm thick stainless steel cladding at both sides.* Cladding : 1 mm thick stainless steel.* Fixing method to concrete frame : M10 by 80 mm long anchor bolt with 120 mm by 100 mm by 8 mm thick steel plate.*
2 Hollow Section	Sizes : 30 mm x 50 mm x 2 mm thick & 50 mm x 30 mm x 2 mm thick.* Material : Mild steel.* Joint method : Screws and welding. Fixing method : M10 by 80 mm long anchor bolt with 120 mm by 100 mm by 8 mm thick steel plate.*
3 Fire Rated Boards	Brand : GemTree. Material : Calcium silicate board.# Thickness : 1 layer of 12 mm thick at the frame.* Density : 1,000 kg/m³. Applied location : Sandwiched the hollow sections on both sides and fixed by M5 mm x 90 mm long self-tapping screws at 500 mm c/c on both sides.*

Notes: * Verified on site by RED.

As shown on the test construction.

APPENDIX D - Information from Test Sponsor (Con't)

(The information provided by test sponsor, which is not verified by RED or unless specified.)

Item	Description
4 Glazing Panels	
Manufacturer	: HK Pro-Tech Fire Prevention Building Materials Limited.
Brand & Model	Protech.
Nominal thickness	: 25 mm.*
Glass composition	: 4.5 mm thick tempered glass + 16 mm interlayer + 4.5 mm thick tempered glass.*
Aperture sizes	: Pane 'A': 1,060 mm wide by 2,460 mm high.* Pane 'B': 460 mm wide by 2,460 mm high.* Pane 'C': 1,080 mm wide by 2,620 mm high.* Pane 'D': 1,080 mm wide by 510 mm high.* Pane 'E': 1,770 mm wide by 510 mm high.* Pane 'F': 460 mm wide by 510 mm high.* Pane 'G': 460 mm wide by 2,620 mm high.*
Vision sizes	: Pane 'A': 1,000 mm wide by 2,400 mm high.* Pane 'B': 400 mm wide by 2,400 mm high.* Pane 'C': 1,020 mm wide by 2,560 mm high.* Pane 'D': 1,020 mm wide by 450 mm high.* Pane 'E': 1,710 mm wide by 450 mm high.* Pane 'F': 400 mm wide by 450 mm high.* Pane 'G': 400 mm wide by 2,560 mm high.*
Fixing method	: Sandwiched by 3 mm thick ceramic tape and 12 mm fire rated boards.#
5 Ceramic Tape	
Brand	: FAN QIU.
Materials	: 3 mm thick ceramic tape.
Density	: 160 kg/m ³ .
Applied location	: 1 layer of nominal 3 mm thick ceramic tape sandwiched at perimeter of both sides of all glazed panes.#
6a Locksets (Meeting edge)	
Brand	: Gamma.
Model	: DC8200-A01 (lockcase), LH8302S (handle) & ECT40440 (E Keyhold).
Applied location	: Left door leaf.
Status	: Unlocked and unlatched.#

APPENDIX D - Information from Test Sponsor (Con't)

(The information provided by test sponsor, which is not verified by RED or unless specified.)

Item	Description
6b Locksets (Corners)	
Brand	: Gamma.
Model	: ML-532a.
Applied location	: Bottom corner of left door leaf & top corner of right door leaf.
Status	: Unlocked and unlatched.#
7 Floor Spring	
Brand	: Left door leaf: DORMA; Right door leaf: DORMA.
Model	: Left door leaf: 84; Right door leaf: 75V.
8 Magnetic Lockset	
Brand	: HIKVISION.
Model	: DS-K4T108
Size	: 205 mm wide by 35 mm thick.
Applied location	: Top of left door leaf.
Status	: Unlocked.#
9 Flush Bolts	
Brand & Model	: Protech, FB-A01.
Size:	: 170 mm x 25 mm by 15 mm.
Applied location	: Top and bottom of right door leaf.
10 Pull Handles	
Material	: Stainless steel.
Size:	: 25 mm x 1.5 mm thick hollow section.
Applied location	: Both side of door leaves.
11 Fire and Smoke Seal	
Brand	: FAN QIU..
Model	: FQ-CS-2004.
Size:	: 20 mm x 4 mm thick.*
Applied location	: Head and jambs of door frame and four edges of both door leaves.

* and # refer to page 28

(The drawings provided by test sponsor, which was not verified by RED, except those specified and described in 'information from test sponsor'.)



- 1) G. M. S. hollow sections
50mm x 25mm x 2mm
- 2) Handle (Stainless steel)
32mm Diameter and 2, 220mm Long
- 3) Fire and Smoke Seal
20mm x 4mm thick
- 4) G. M. S. hollow sections
50mm x 30mm x 2mm thick
- 5) Glazing Panels
25mm thick insulated glass
- 6) Cladding
1mm thick mild steel
- 7) Fire rated board
12mm thick
- 8) Ceramic tape
3mm thick
- 9) Floor Spring
Dorma BTS- 84
- 10) Floor Spring
Dorma BTS- 75V
- 11) Lockset
Gamma ML-532a
- 12) Lockset
Gamma DC8200-A01 (Lockcase)
Gamma LH8302S (Handle)
Gamma EC74040 (E. Keyhole)
- 13) Electric Lockset
HILVISION DS-K4T108
- 14) Flush Bolt (Concealed bolt)
170mm x 25mm x 15mm

- End of report -

SMOKE CONTROL TEST IN ACCORDANCE WITH BS EN 1634-3: 2004

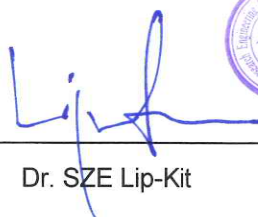
On Double-acting, Double-leaf, Glazed Doorset

Test Report No.: R21H02-1A
Sample Identification: Q21G58-A
Issue Date: 3 November, 2021

Test Sponsor

HK Pro-Tech Fire Prevention Building Materials Limited
Unit B, 22nd Floor, Johnson Centre, 13 Hau Fook Street,
Tsim Sha Tsui, Kowloon, Hong Kong

APPROVED SIGNATORY:


Dr. SZE Lip-Kit



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1 SUMMARY

Smoke control test conducted in accordance with BS EN 1634-3: 2004 on double-acting, double-leaf, glazed doorset

A specimen of double-acting, double-leaf, glazed doorset had been subjected to the tests in accordance with BS EN 1634-3: 2004, in order to determine the smoke leakage (S_a and S_m) from one side to the other under the ambient and medium temperature at pressure differences of 10 Pa, 25 Pa and 50 Pa. As requested by the test sponsor, the specimens were mounted within concrete lined specimen holders and the fixing details were as shown in the test sponsor's drawings (see the appendix). Since the specimen was symmetrical in design, therefore only the leakage rate from the closing face of the doorset was measured.

One doorset had been submitted by the test sponsor had the overall dimensions of 1,845 mm wide by 2,850 mm high by 80 mm frame thickness. The doorset incorporated of two unequal-width door leaf with sizes of 1,160 mm wide by 2,605 mm high and 560 mm wide by 2,605 mm high, respectively. The thickness of the door leave was 60 mm thick. The doorset consisted of a top transom panel with overall sizes of 245 mm high by 1,845 mm wide. The door leaves and the glazed transom panel were fitted with 25 mm thick "Protech" fire rated glass. The framework of the door leaf was composed of 30 mm by 50 mm by 2 mm thick RHS and sandwiched by one layer of 12 mm thick fire rated boards on each side. The door frame was composed of 50 mm by 50 mm by 2 mm thick SHS sandwiched by one layer of 12 mm thick fire rated boards.

The door leaves were hung by a top pivot and "Dorma BTS-65 & BTS-80" floor spring. The doorset was fitted with surface mounted pull handles. A "Gamma ML 532" lockset was fitted at the bottom corner of the larger door leave, and a "HIKVISION" electric lockset was incorporated at the top corner of the smaller door leave.

The doorsets were fitted with smoke control seals as follows:

Door Frame

- i) "Fan Qiu FQ-CZ-2004", 20 mm by 4 mm thick intumescent body with 4 mm high double-fins at the centre. One no. of seal was fitted full height and full width at the reveal of the door frame. The seal was full interrupted at the electric lockset, and the pivot hinge location. (See photos 4 and 5).

Door Leaves

- ii) "Fan Qiu FQ-CZ-2004", 20 mm wide by 4 mm thick intumescent body with 4 mm high double-fins at the centre. One no. of seal was fitted full height at the meeting edge of the door leaf without interruption. (See photos 6 and 7).
- i) "Fan Qiu FQ-CS-2004", 20 mm wide by 4 mm thick intumescent body with 4 mm high single fin at each side of the seal. One no. of seal was fitted full height and full width at the top and vertical edges

(except one of the meeting edge) of the door leaf. The seal was slightly modified at the flush bolt, striking plate position without interruption to the fins (See photos 6 and 7).

- ii) "Fan Qiu FQ-CD-2004" 20 mm wide by 4 mm thick with intumescent body with 8 mm high single fin at each side of the seal. The seal was fitted at the bottom sill of the door leaf full width without interruption to the fins (See photo 8).

The smoke leakage rates of the doorsets were summarized as below:

Test	Temp	Leakage rate Q_{spec} (m ³ /h) at pressure difference of			S_m Criterion (m ³ /h)	Linear leakage rate Q_l (m ³ /h/m) at pressure difference of		S_a Criterion (m ³ /h/m)
		10 Pa	25 Pa	50 Pa		10 Pa	25 Pa	
1	Ambient	4.17	7.60	11.60	< 30	0.44	0.79	< 3.0
2	Medium	2.57	5.60	9.77	< 30	N/A	N/A	N/A

The performance criteria of the smoke leakage rate (S_a) and (S_m) as mentioned in the BS EN 1634-3: 2004 shall be referenced to BS EN 13501-2: 2007 + A1: 2009 where

Smoke leakage (S_m) – when the maximum leakage rate measured at both ambient temperature and 200°C and up to a pressure of 50 Pa does not exceed 30 m³/h for a double-leaf doorset;

Smoke leakage (S_a) – when the maximum leakage rate measured at ambient temperature, and at a pressure of up to 25 Pa only, does not exceed 3 m³/h per meter length of gap between the fixed and movable components of the doorset, excluding leakage at the threshold.

According to the performance criteria as given in BS EN 13501-2: 2007 + A1: 2009, it can be concluded that the tested double-leaf doorset **satisfied both the S_a and S_m** requirements.

2 INTRODUCTION

The specimens were tested 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 – Smoke control test for door and shutter assemblies'. Both ambient and medium temperature leakage rates were considered in the tests.

The specimens were submitted by the test sponsor, and was mounted and constructed by the test sponsor. The test was led by Ms. Ivy Zou of Research Engineering Development Façade Consultants Limited (RED).

3 INFORMATION

3.1. Testing laboratory

Research Engineering Development Façade Consultants Limited (RED)
No. 111, Jiaoxin Road, Lanhe Town, Nansha District, Guangzhou, China

3.2. Test date

28th September, 2021

3.3. Equipment

A test chamber with an open front of size 3 m by 3 m to mount the test construction and provide a sealed enclosure to generate the necessary heating and pressure condition.

Nine (9) thermocouples to monitor the temperature of the test chamber, which were kept at 100 mm from the face of the specimen (see Figure 1).

A flowmeter to measure the volume flow rate supplied to the apparatus to compensate for the total leakage.

A micro-manometer provided to monitor the furnace pressure.

Displacement transducers provided to measure the deflection of the doorset.

3.4. Test environment

The temperature around the test area during the test was in the range of 32 °C – 34 °C.

The chamber was controlled so that the mean test chamber temperature at medium temperature test complied with the requirement of Clause 10.2.2.2 of BS EN 1634-3: 2004. The temperatures recorded are shown graphically in Figure 4.

Summaries of the observations made on the general behaviour of the specimens are given in the appendix of this report.

4 CONDITIONING

The specimen's storage, construction, and test preparation took place in the test laboratory over a total, combined time of 11 days. Throughout this period of time, both of the temperature and humidity of the laboratory were measured and recorded as being within a range of 28 °C to 34 °C and 65 % to 98 % respectively.

Mechanical conditioning as required in clause 8.2 of BS EN 1634-3 in terms of operational ability with the test method referenced to clause 5.1.1.1 of BS EN 14600: 2005 had been conducted prior to test. The specimens 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° for 25 cycles.

5 TEST SPECIMEN

5.1. Selection of specimen

The specimens were submitted to the test location by the test sponsor. RED did not involve in the selection of the specimens.

5.2. Verification of specimen

The specifications of the door assembly provided by the test sponsor were as shown in Appendix D of this report. Items that had been verified by RED were clearly identified.

5.3. Supporting construction

The supporting constructions were concrete lined system of 300 mm thick with a structural opening of 2,000 mm wide by 2,900 mm high.

5.4. Specimen construction

One doorset had been submitted by the test sponsor had the overall dimensions of 1,845 mm wide by 2,850 mm high by 80 mm frame thickness. The doorset incorporated of two unequal-width door leaf with sizes of 1,160 mm wide by 2,605 mm high and 560 mm wide by 2,605 mm high, respectively. The thickness of the door leave was 60 mm thick. The doorset consisted of a top transom panel with overall sizes of 245 mm high by 1,845 mm wide. The door leaves and the glazed transom panel were fitted with 25 mm thick "Protech" fire rated glass. The framework of the door leaf was composed of 30 mm by 50 mm by 2 mm thick RHS and sandwiched by one layer of 12 mm thick fire rated boards on each side. The door frame was composed of 50 mm by 50 mm by 2 mm thick SHS sandwiched by one layer of 12 mm thick fire rated boards.

The door leaves were hung by a top pivot and "Dorma BTS-60V & BTS 80V" floor spring. The doorset was fitted with surface mounted pull handles. A "Gamma ML 532" lockset was fitted at the bottom corner of the larger door leave, and a "HIKVISION" electric lockset was incorporated at the top corner of the smaller door leave.

The doorsets were fitted with smoke control seals as follows:

Door Frame

- i) "Fan Qiu FQ-CZ-2004", 20 mm by 4 mm thick intumescent body with 4 mm high double-fins at the centre. One no. of seal was fitted full height and full width at the reveal of the door frame. The seal was full interrupted at the electric lockset, and the pivot hinge location. (See photos 4 and 5).

Door Leaves

- ii) "Fan Qiu FQ-CZ-2004", 20 mm wide by 4 mm thick intumescent body with 4 mm high double-fins at the centre. One no. of seal was fitted full height at the meeting edge of the door leaf without interruption. (See photos 6 and 7).
- iii) "Fan Qiu FQ-CS-2004", 20 mm wide by 4 mm thick intumescent body with 4 mm high single fin at each side of the seal. One no. of seal was fitted full height and full width at the top and vertical edges (except one of the meeting edge) of the door leaf. The seal was slightly modified at the flush bolt, striking plate position without interruption to the fins (See photos 6 and 7).
- iv) "Fan Qiu FQ-CD-2004" 20 mm wide by 4 mm thick with intumescent body with 8 mm high single fin at each side of the seal. The seal was fitted at the bottom sill of the door leaf full width without interruption to the fins (See photo 8).

6 TEST PROCEDURE

The tests were conducted in accordance with the procedures specified in Section 10 of BS EN 1634-3: 2004.

6.1. Pre-test procedure

The doorsets were opened to an angle of at least 30° and closed 10 times to ensure the assembly operates normally prior to the test.

The retention forces of the doorsets were measured in accordance with Clause 10.1.2 of BS EN 1634-3: 2004 as shown in the table below.

Doorset	Left Door Leaf (Floor Spring)		Right Door Leaf (Floor Spring)	
	Arm distance	Retention force	Arm distance	Retention force
1	1,000 mm	300 N	500 mm	370 N

The lengths of gap and the clearance between the fixed and moving components of the doorset were measured as shown in appendix A, Figures 3 of this report.

The leakage rate through the apparatus together with the associated/supporting construction at 50 Pa and ambient temperature was measured to be lower than 10 m³/hr.

6.2. Air Leakage test

The ambient temperature of the test area during the test was measured. The furnace was monitored by nine (9) thermocouples so that the mean test chamber temperature complied with the requirements of Clause 10.2.2.2 of BS EN 1634-3: 2004.

Sequence of test

The tests were carried out in the following sequence:

- i) Doorset was mounted with one of the face towards the test chamber;
- ii) Determine the leakage rate through the test chamber and any support or associated construction at ambient temperature;
- iii) Determine the total leakage rate at ambient temperature;
- iv) Determine the total leakage rate at medium temperature; and
- v) Determine the leakage rate through the apparatus and any supporting or associated construction at medium temperature;

6.3. Test conditions

The temperature in the test chamber was controlled to be lower than 30 °C before the start of the test. The leakage rates through the test chamber and any supporting or associated construction and the total leakage rate at ambient temperature at pressure differences of 10 Pa, 25 Pa and 50 Pa were measured. The leakage rates were measured while the pressure difference was maintained for 2 minutes.

The temperature of the test chamber was raised to medium temperature (200 °C) in 30 ± 5 minutes at neutral pressure as stated in Clause 10.2.2.2 of BS EN 1634-3: 2004.

The leakage rates through the test chamber and any supporting or associated construction and the total leakage rate at medium temperature at pressures differences of 10 Pa, 25 Pa and 50 Pa were measured. The leakage rates were measured while the pressure difference was maintained for 2 minutes.

7 RESULTS

When tested in accordance with BS EN 1634-3: 2004, the measured leakage rates and the calculated linear leakage rates were summarized below. There was no failure of any components observed during the test. The observations during and after the test were summarized in Appendix B. The deflections of the doorsets were summarized in Table 2 of Appendix C.

Door type: Double-acting, Double-leaf, Glazed doorset

Door opening size: 1,720 mm (wide) by 2,605 mm (high)

Test	Temp	Leakage rate Q_{spec} (m ³ /h) at pressure difference of			S_m Criterion (m ³ /h)	Linear leakage rate Q_l (m ³ /h/m) at pressure difference of		S_a Criterion (m ³ /h/m)
		10 Pa	25 Pa	50 Pa		10 Pa	25 Pa	
1	Ambient	4.17	7.60	11.60	< 30	0.44	0.79	< 3.0
2	Medium	2.57	5.60	9.77	< 30	N/A	N/A	N/A

The performance criteria of the smoke leakage rate (S_a) and (S_m) as mentioned in the BS EN 1634-3: 2004 shall be referenced to BS EN 13501-2: 2007 + A1: 2009 where

- (a) Smoke leakage (S_m) – when the maximum leakage rate measured at both ambient temperature and 200°C and up to a pressure of 50 Pa does not exceed 30 m³/h for a double-leaf doorset;
- (b) Smoke leakage (S_a) – when the maximum leakage rate measured at ambient temperature, and at a pressure of up to 25 Pa only, does not exceed 3 m³/h per meter length of gap between the fixed and movable components of the doorset, excluding leakage at the threshold.

According to the performance criteria as given in BS EN 13501-2: 2007 + A1: 2009, it can be concluded that the tested double-leaf doorset **satisfied both the S_a and S_m** requirements.

8 POST-TEST OBSERVATION

The doorset was able to open manually after the test. All the smoke seals remained intact in position without deterioration.

9 LIMITATIONS

This report details the method of construction, the test conditions and the results obtained when the specific element of construction described herein was tested following the procedure outlined in BS EN 1634-3: 2004. Any significant deviations with respect to size, construction details, loads, stresses, edges or end conditions other than those allowed under the field of application in the relevant test method is not covered by this report.

FOR SUBMISSION ONLY

APPENDIX A – PHOTOS AND TEST RECORD



Photo 1: Exposed face of Doorset before the test.



Photo 2: Exposed Face of Doorset after the test.



Photo 3: Unexposed face of Doorset during the test



Photo 4: Fire seal & smoke seal arrangements at the head of door frame



Photo 5: No smoke seal arrangements at the door frame vertical jamb

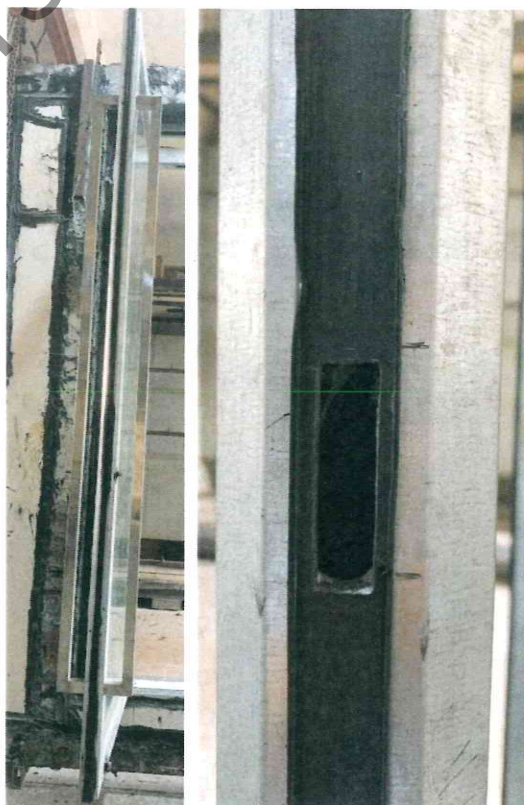


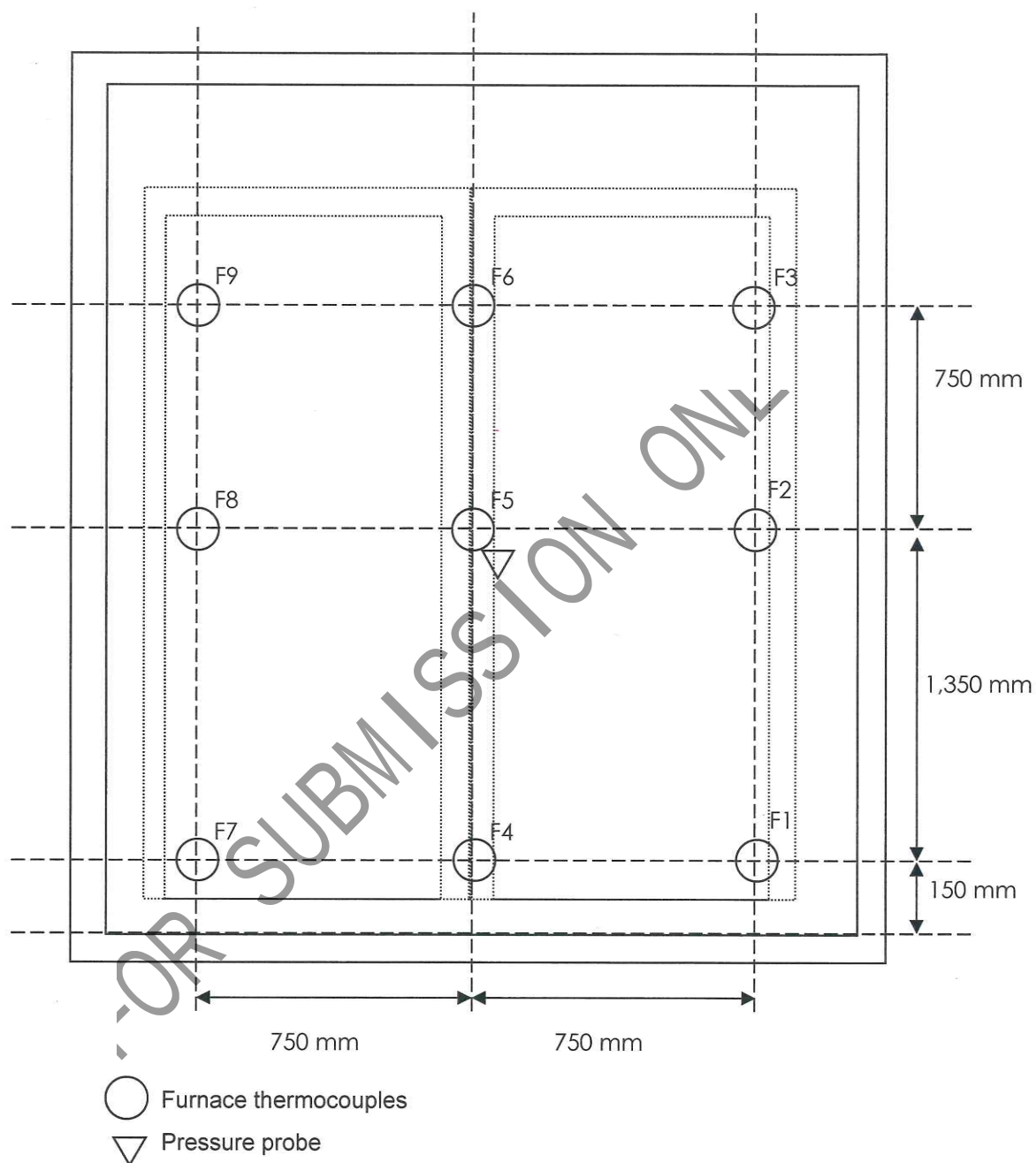
Photo 6: Fire and smoke seal at the meeting edges



Photo 7: Fire and smoke seals at the top edge of the door leaf

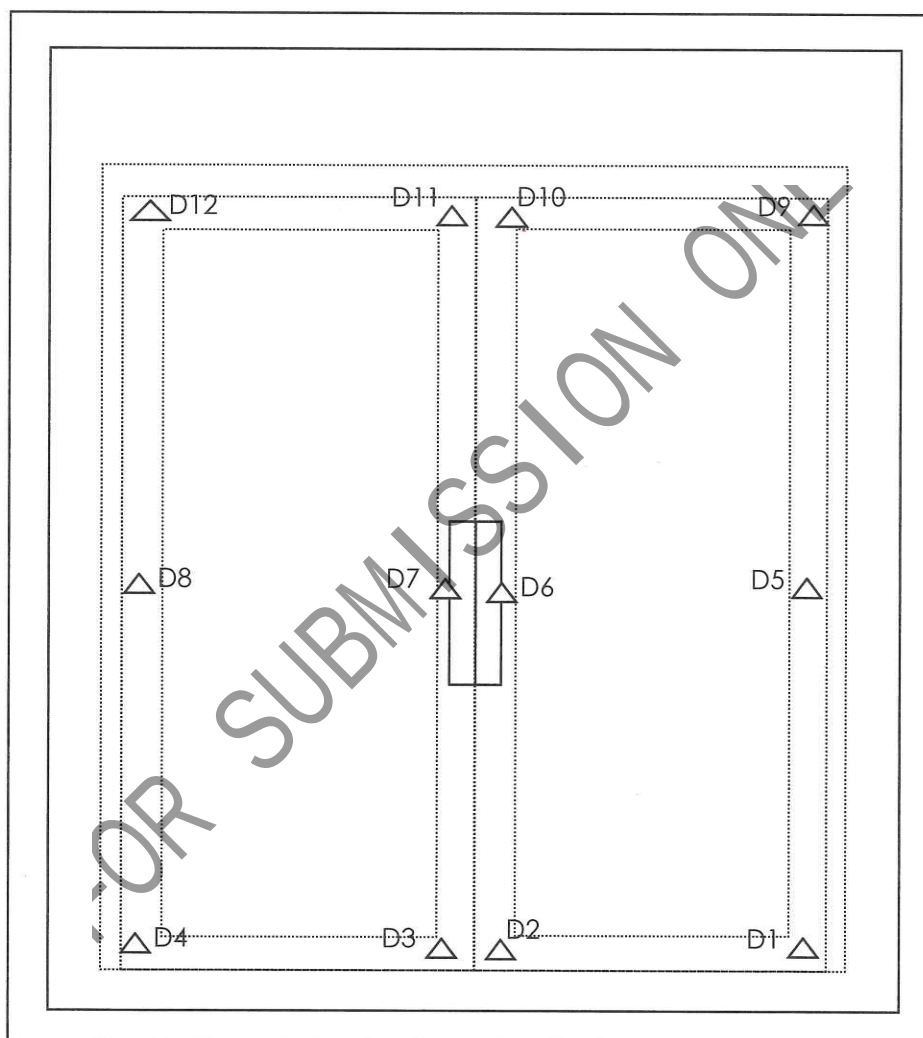


Photo 8: Fire and smoke seals arrangement at the bottom edge of both door leaves



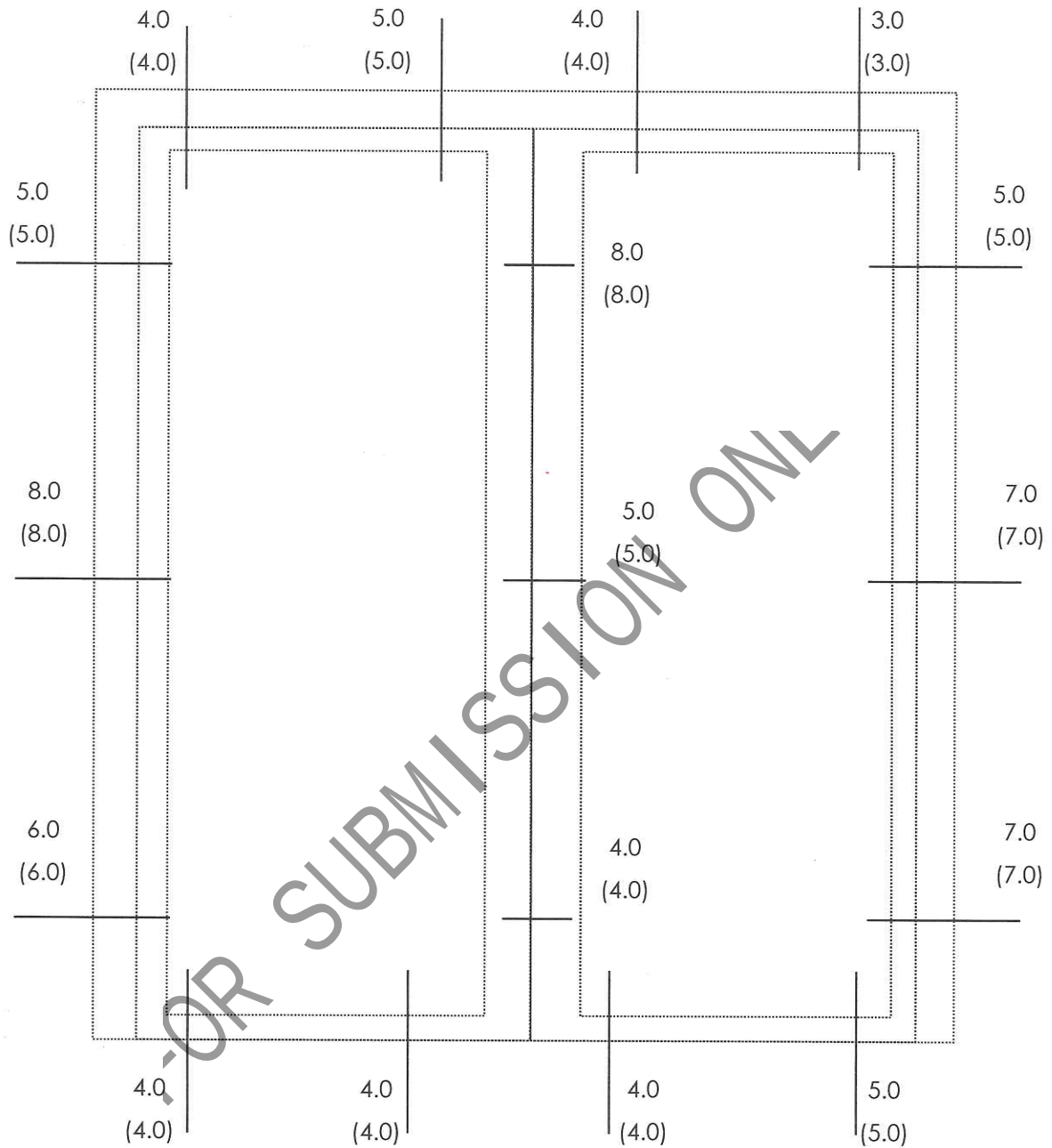
(The illustration not to scale)

Figure 1 – Locations and reference numbers of furnace thermocouples.



(The illustration not to scale)

Figure 2 – Locations and reference numbers of displacement measurement.



(The illustration not to scale)

Length of clearance		Jamb edges (mm)		Meeting edge (mm)	Top edge (mm)	Bottom edge (mm)	Total (excluding the bottom edge) (mm)
Doorset	Opening	2,610	2,610	2,610	1,735	1,735	9,565
	Closing	2,610	2,610	2,610	1,735	1,735	9,565

Figure 3 – Doorset clearance gap in mm, measured from opening face.

(Measurements from closing face are in brackets)

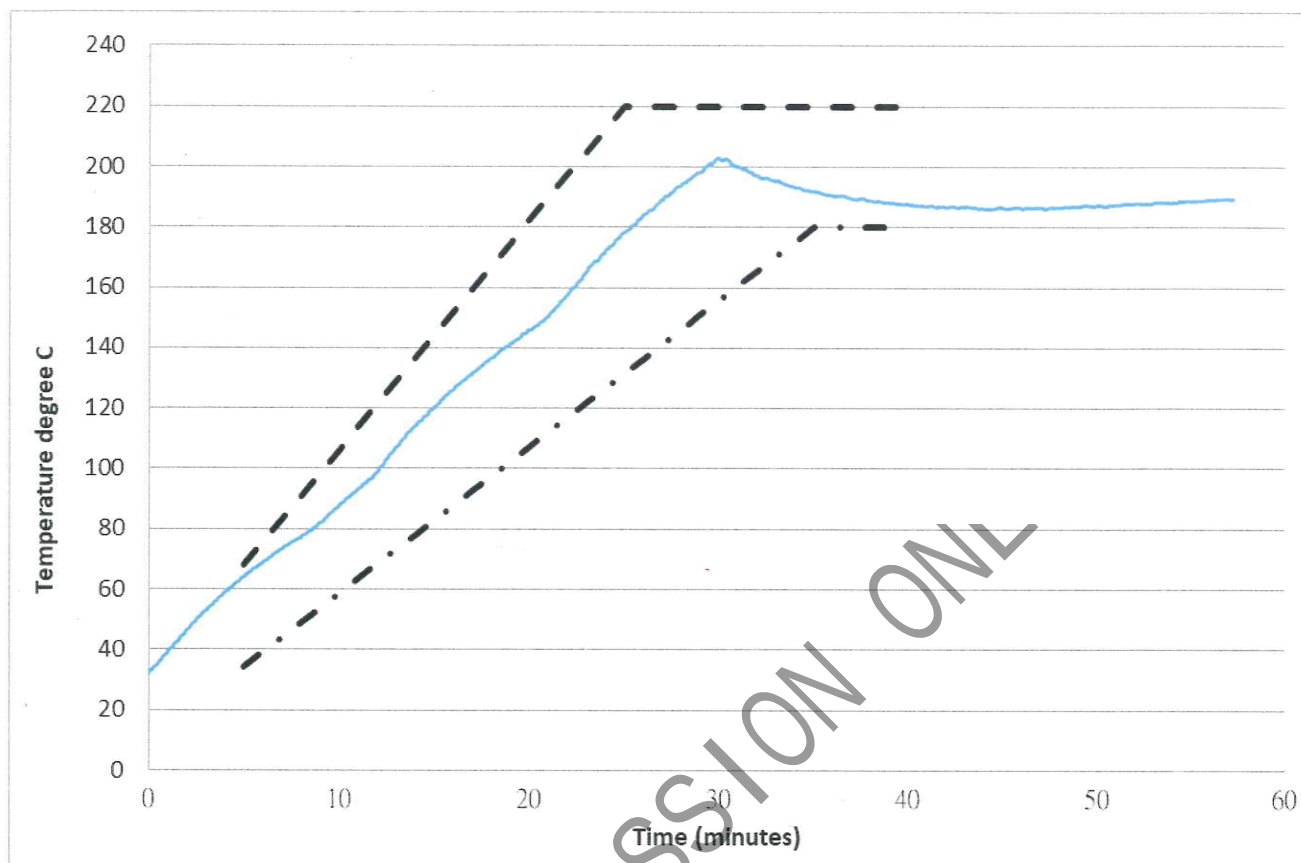


Figure 4 – Test chamber temperature of Doorset (Medium Test)

Medium Temperature Test of Doorset									
Time (mins)	Temperature (°C)								
	F1	F2	F3	F4	F5	F6	F7	F8	F9
0	30	30	30	29	30	30	30	30	30
5	64	64	68	61	64	64	64	65	64
10	87	88	92	83	87	88	86	89	88
15	119	120	127	113	121	120	117	122	121
20	143	146	154	140	148	146	141	149	147
25	175	181	191	167	177	175	173	183	182
30	197	206	217	191	202	200	194	210	208
35	185	193	200	184	194	193	186	196	197
40	183	189	194	181	190	189	181	192	192
45	181	188	193	180	189	188	180	190	190
50	182	189	194	180	189	190	180	190	191
55	183	190	196	182	191	191	181	192	192
57	184	191	196	181	192	192	183	193	193

Figure 5 – Temperature measured by individual thermocouples

APPENDIX B – OBSERVATION

Table 1 - Ambient and Medium Temperature Test

Time (min.sec)	Observation
Ambient Temperature Test	
00.00	All the door gaps were sealed with pressure sensitive tapes.
00.01	Measurement of leakage rates through apparatus and supporting construction started.
07.30	Measurement of leakage rates through apparatus and supporting construction ended and removed the pressure sensitive tapes.
09.20	Measurement of total leakage rates started.
16.10	Ambient temperature test ended
Medium Temperature Test	
00.00	Setup of displacement transducer completed and heat up of the test chamber cavity started.
30.00	The mean temperature of the test chamber reached 200 °C, no further significant change on the specimen was observed.
30.10	Measurement of total leakage rates started.
37.20	Measurement of total leakage rates ended
37.30	The door gaps were sealed with pressure sensitive tapes.
50.50	Measurement of leakages rate through apparatus and supporting construction started.
57.20	Test ended.
Post-test observation	
1. The doorset was able to open manually after the test. 2. All smoke seals remained in position with slight deterioration.	

APPENDIX C – DATA RECORDED DURING THE TEST

Table 2 - Deflections of the specimen after the measurement of Q_{total} during the medium temperature test, as viewed from the unexposed face.

Location	Deflection	
	Ambient	Medium
D1	0	-1
D2	0	0
D3	0	-1
D4	0	-2
D5	0	-4
D6	0	-6
D7	0	-5
D8	0	-7
D9	0	-2
D10	0	-3
D11	0	1
D12	0	-2

Positive deflections indicate movement away the test chamber (see also Figure 2 for the locations).

APPENDIX D – PRODUCT INFORMATION FROM TEST SPONSOR

(The information provided by the test sponsor, which was not verified by RED or unless specified.)

Item	Description
1	Door Frame Section
Overall dimensions	: 1,845 mm wide by 2,850 mm high.*
Section sizes	: 55 mm wide x 80 mm thick*
Construction	: The frame of transom panels was constructed by 25 mm wide by 50 mm deep by 2mm thick and 50 mm by 50 mm by 2 mm thick G.M.S. hollow sections and the door leaves was constructed by a 50 mm wide by 30 mm deep by 2 mm thick G.M.S. hollow sections. All hollow sections were sandwiched by 1 layer of nominal 12 mm thick fire rated board, 1 layer of nominal 1 mm thick mild steel cladding at both sides.*
Cladding	: 1.2 mm thick mild steel.#
Fixing method to surrounding frame	: By 2 nos. of M10 by 80 mm long anchor bolts at 500 mm spacing max.*
2	Door Leaves
Overall dimensions	: Active Leaf: 1,160 mm wide by 2,605mm high by 60 mm thick* Passive Leaf: 560 mm wide by 2,605 mm high by 60 mm thick*
Sizes of hollow	: 30 mm (D) x 50 mm (H) x 2 mm thick GMS hollow.*
Construction	: Hollow sections framework sandwiched by 1 layer of nominal 12 mm thick fire rated board, 1 layer of nominal 1 mm thick mild steel cladding at both sides. Glazed with 25 mm thick "Protech" insulated glass*
3	Fire Rated Boards
Brand	: Gemtree
Material	: Calcium silicate board.
Thickness	: 12 mm*
Density	: 1,000 kg/m ³ .
Fixing method	: Sandwiched the hollow sections on both sides and fixed by M5 mm x 90 mm long self-tapping screws at 500 mm c/c on both sides.*

Notes: * Verified on site by RED. # As shown on the test construction.

Item	Description
4	Glazing Panel Brand & Model : Protech# Nominal thickness : 25 mm Glass composition : 4.5 mm thick clear glass + 16 mm interlayer + 4.5 mm thick clear glass Aperture sizes : Active door leaf: 1,060 mm wide by 2,505 mm high* Passive door leaf: 460 mm wide by 2,505 mm high* Transom Panel: 1,775 mm wide by 145 mm high* Vision sizes : Active door leaf: 1,000 mm wide by 2,445 mm high* Passive door leaf: 400 mm wide by 2,445 mm high* Transom Panel: 1,735 mm wide by 95 mm high* Fixing method : Sandwiched by 12 mm thick fire rated board and 3 mm thick ceramic tape.# Reference : 6 mm thick calcium silicate board was for setting board.*
5	Glazed Panel Sealant Brand : Jiaojiaoze Type : JJZ-995 Applied location : In between the beadings and the glazed panel
6a	Intumescent Fire and Smoke Seal Brand : Fan Qiu Model : FQ-CZ-2004 Type : Double flippers at the centre of the seal Sizes : 20 mm wide by 4 mm thick intumescent body with 4 mm high flippers at the side* Applied location : (i) 1 no. of seal at the reveal of the door frame# (ii) 1 no. of seal at the meeting edge of active leaf#
6b	Intumescent Fire and Smoke Seal Brand : Fan Qiu Model : FQ-CS-2004 Type : Flippers at the side of the seal Sizes : 20 mm wide by 4 mm thick intumescent body with 4 mm high flippers at the side* Applied location : 1 no. of seal at the top and vertical edges of door leaf (except the meeting edge)#

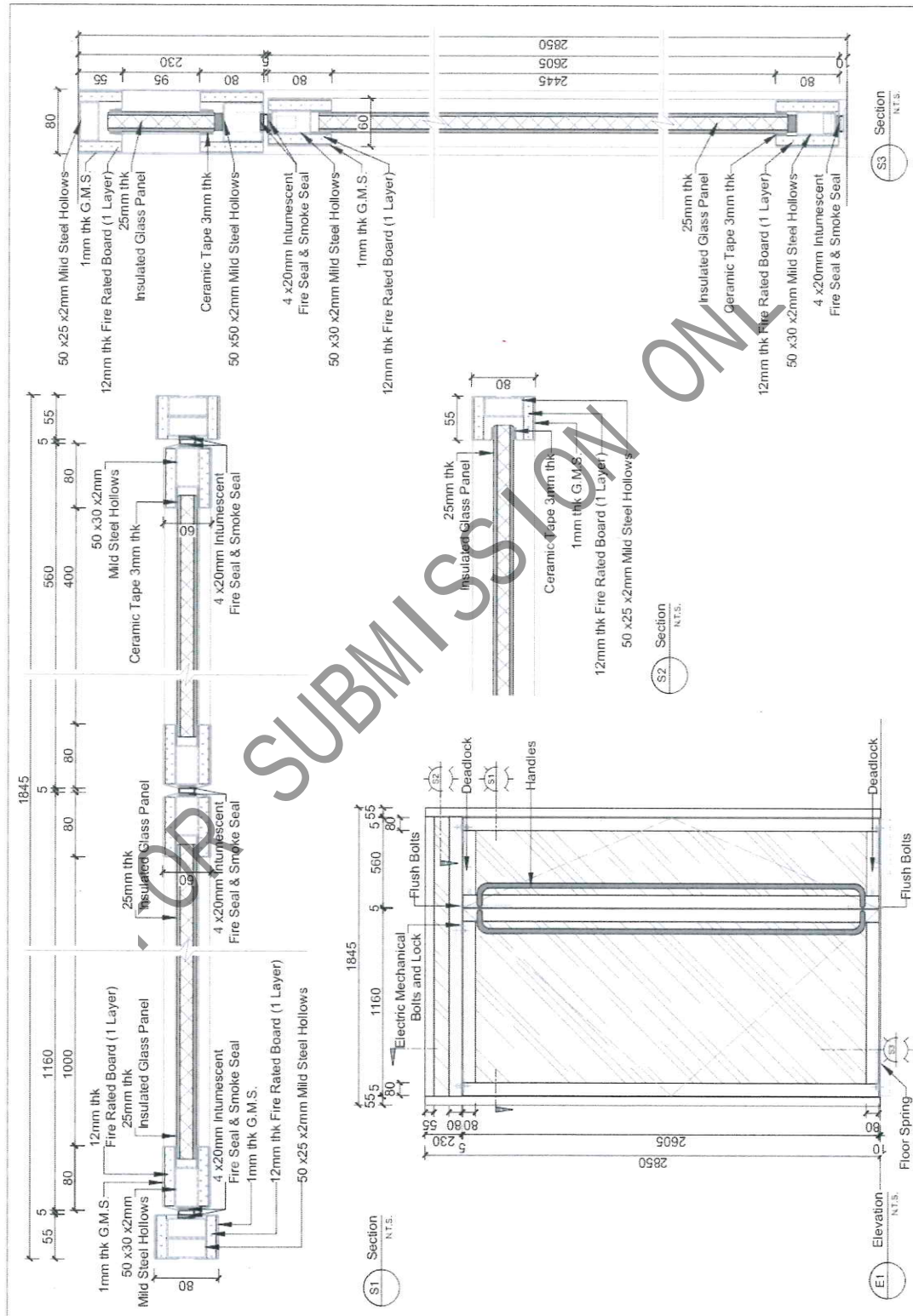
* and # refer to page 21

Item	Description
6c	Bottom Smoke Seal
	Brand : Fan Qiu
	Model : FQ-CD-2004
	Type : Flippers at the side of the seal
	Overall sizes : 20 mm wide by 4 mm thick intumescent body with 8 mm high flippers at the side*
	Applied location : 1 no. of seal at the sill of the door leaf#
7	Floor Spring
	Brand : Dorma#
	Model : BTS-65 for passive door leaf BTS-80 for active leaf
	Overall sizes : BTS-65: 276 mm by 108 mm by 40 mm depth BTS-80: 359 mm by 105 mm by 60 mm depth
8a	Lockset
	Brand : Gamma.
	Model : ML-532
	Overall sizes : 124 mm by 19 mm by 50 mm
	Applied location : Bottom corner of left door leaf.
	Status : Unlocked and unlatched.#
8b	Lockset
	Brand : Gamma.
	Model : DC8200-A01.
	Applied location : Middle of both door leaves
	Status : Unlocked and unlatched.#
9	Electronic Lockset
	Brand : HIKVISION.#
	Model : KAT108
	Overall sizes : 205 mm by 35 mm by 42 mm
	Applied location : Head of door frame, above left door leaf.#
	Status : Unlocked.#
10	Surface Mounted Handle
	Sizes : 50 mm by 50 mm by 2,200 mm
	Applied location : Both sides of both door leaves.#

* and # refer to page 21

DRAWING FROM TEST SPONSOR

(The drawings provided by test sponsor, which was not verified by RED, except those specified and described in 'Product information from test sponsor'.)



- End of report -



ASSESSMENT REPORT ON THE FIRE RESISTANCE PERFORMANCE OF FIRE RESISTANT GLASS DOORSET

FOR SUBMISSION ONLY

Client : HK Pro-Tech Fire Prevention Building Materials Ltd.

Project : Performance Appraisal on a Fire Resistant
Glass Doorset

Client Ref. : --

Report No. : G22094FU226119



Date of Issue : 17 October 2022

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- 2.0 Requirement
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- 4.0 Proposal
- 5.0 Discussion
- 6.0 Overall Performance
- 7.0 Conclusion
- 8.0 Declaration by the Client
- 9.0 Validity



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ASSESSMENT REPORT ON THE FIRE RESISTANCE PERFORMANCE OF A FIRE RESISTANT GLASS DOORSET

1.0 Introduction

This assessment report represents an appraisal of the expected performance of a fire resistant glass doorset, when incorporating variations in design and materials. The reference doorsets were tested according to BS EN 1634-1: 2014 + A1: 2018 stated in the following sections and met the required fire integrity and insulation for door leaf / door frame and glazed panel.

1.1 A double-acting, Unequal double-leaf, glazed doorset with transom and side panels achieved a fire integrity of 119 minutes and insulation of 106 minutes. The test results are stated in test report R20L41-2A.

Reference has been made to BS EN 15269-5 : 2014 for the extended application of fire test results for hinged and pivoted metal framed glazed doorset and BS EN 15254-4 : 2008 + A1 : 2011 for the extended application of fire test results for glazed constructions in the preparation of this report.

2.0 Requirement

2.1 The assessment made in this report is based on the following provisions;

2.1.1 The structural opening into which the glass doorset is fixed is capable of supporting the doorset without detriment, for the 106 minutes duration of a fire test.

2.1.2 The proposed doorset shall be of similar construction to the doorset subject to the full fire test, except in those various design options or modifications stated in this assessment report.

2.1.3 The clearance gaps between the leaf and frame shall not exceed the specified tolerance in the reference test reports.

2.1.4 The doorset shall be in the closed position.

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ASSESSMENT REPORT ON THE FIRE RESISTANCE PERFORMANCE OF A FIRE RESISTANT GLASS DOORSET

3.0 Supporting Data

The following report summaries are provided for information only, and reference shall be made to complete copies of the reports for full specifications.

3.1 R20L41-2A

Fire resistance test conducted in accordance with BS EN 1634-1: 2014 + A1: 2018 on a double-acting, unequal double-leaf glazed doorset with side and transom panels.

A specimen of double-acting, unequal double-leaf glazed doorset with side and transom panels had been subjected to a test in accordance with BS EN 1634-1: 2014 + A1: 2018 in order to determine its fire resistance performance. As requested by the test sponsor, the specimen was mounted within concrete lined specimen holder by test sponsor such that the door leaves were swinging towards or away from the heating conditions. The doorset was asymmetrical and only one side of the specimen was tested, in which the fire side was determined by the test sponsor.

The specimen had overall dimensions of 3,400mm wide by 3,200mm high. It was comprised of a double-acting, unequal double-leaf glazed doorset with three (3) nos. of transom panel and two (2) nos. of side panels. It was comprised of totally 7 nos. of glass panes, namely panes 'A' to 'G' (refer to photo 1). The left door leaf was with sizes of 1,160mm wide by 2,605mm high and the right door leaf was with sizes of 560mm wide by 2,605mm high. Both door leaves were hung to the door frame by 'Dorma' floor springs. The frame of transom and side panels was constructed by 30mm by 50mm by 2mm thick and 25mm by 50mm by 2mm thick G.M.S. hollow sections and the frame of door leaves was constructed by 50mm by 30mm by 2mm thick G.M.S. hollow sections. All hollow sections were sandwiched by 1 layer of nominal 3mm thick ceramic tape, 1 layer of nominal 12mm thick fire rated board and 1 layer of nominal 1mm thick stainless steel cladding at both sides.

All panes were of nominal 25mm thick 'Protech' insulated glass. Pane 'A' was with vision sizes 1,000mm wide by 2,400mm high. Pane 'B' was with vision sizes of 400mm wide by 2,400mm high. Pane 'C' was with vision sizes of 1,020mm wide by 2,560mm high. Pane 'D' was with vision sizes of 1,020mm wide by 450mm high. Pane 'E' was with vision sizes of 1,710mm wide by 450mm high. Pane 'F' was with vision sizes of 400mm wide by 450mm high. Pane 'G' was with vision sizes of 400mm wide by 2,560mm high. One (1) no. of intumescent fire seal with sizes of 20mm wide by 4mm thick was installed each jamb and head of door frame and four edges of both door leaves. A lockset was installed at bottom corner of left door leaf, top corner of right door leaf and meeting edge of left door leaf. A flush bolt was installed at top and bottom of right door leaf. An electric lockset was installed at the head of door frame, above left door leaf. A surface mounted hand was installed at both sides of both door leaves. A free edge was applied to the left vertical edge and infilled with mineral wool. The doorset was unbolted, unlocked and unlatched during the test.



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3.1 R20L41-2A

The specimen satisfied the performance requirements specified in BS EN 1634-1: 2014 + A1: 2018 for the following periods:

Integrity :

Cotton Pan	114 Minutes
Gap Gauge	119 Minutes (No failure)
Sustained Flaming	119 Minutes (No failure)

Insulation (I1 doorset excluding transom and side panels) : 106 Minutes

Insulation (I1 transom and side panels) : 108 Minutes

The test was discontinued after a heating period of 119 minutes.

Test Date : 22nd January, 2021

Test Sponsor : HK Pro-Tech Fire Prevention Building Materials Ltd.



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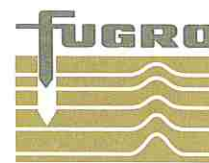
ASSESSMENT REPORT ON THE FIRE RESISTANCE PERFORMANCE OF A FIRE RESISTANT GLASS DOORSET

4.0 Proposal

It is proposed to evaluate the fire resistance performance of fire resistance glass doorset of the same general construction as the sample tested in test reports R20L41-2A. And it's proposed all the glazed panel on door leaves, transom and side panel which achieved fire integrity and insulation of 30 and 60 minutes. The assessment is based on the actual data obtained from the sample subjected to the full test shown in that report.

The construction shall remain essentially unchanged with the following exception.

- 4.1 The Unequal double leaf doorsets may be altered to different construction of side transom & panel arrangements.
- 4.2 Dimension of the door leaf may be increased.
- 4.3 Size of transom panel and glazed pane.
- 4.4 The doorset that assessed on Clause 5.1, left, right side or both side may be connected to side panel.
- 4.5 The proposed doorset may be with or without lockset on door leaves
- 4.6 After the doorset altered to particular doorset arrangements stated in Clause 5.4 a transom may be add on those doorset as shown in Figure 2.
- 4.7 Material of the cladding may be altered, and on top of the cladding decorative facing may be added.
- 4.8 Alternative of building hardware manufacturer. The brand of the building hardware mentioned on test report R20L41-2A may be altered with same size and same material.
- 4.9 Shape of the door frame and meeting edge may be altered.



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4.0 Proposal

4.10 Alternative of the hinge.

4.11 Threshold / Sill / Frame member to the bottom of the frame. (Figure 6)

4.12 Appraisal to BS 476 -22 : 1987.

4.13 With the glazed structure tested in our reports R20L41-2A. The proposed construction may be repeated when installed in a rigid construction.

4.14 Glazed panel with different arrangement may be produced independently and fulfill the requirement of BS EN 1364-1 : 2015

4.15 Fire and smoke seal with fins may be replaced by flat type of fire and smoke intumescent seals and support to BS 476 -22 : 1987.

4.16 All of above assessed items on BS EN 1634-1 : 2014 may be applied to BS 476 -22 : 1987.

4.17 Both side of the doorset may be exposed to fire sources.

4.18 The proposed fire resistance doorset may be used as smoke control performance doorset as the reference doorset construction as same as the construction stated in smoke performance reports R21H02-1A and R21H02-2A.

The purpose of the assessment is to provide a stated opinion on the probable effect on the fire insulation and integrity of the proposed change to doorset if subjected to the fire test stated in BS EN 1634-1: 2014 + A1: 2018.

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5.0 Discussion

As shown in test report R20L41-2A, the glass doorset, incorporated a side panels, transom, over panel, was tested according to BS EN 1634-1 : 2008, met the required fire integrity and insulation requirements (Classification I1).

When the materials and design of the tested timber doorset maybe altered with the following variations, it is expected that the proposed doorset will also meet the above mentioned fire integrity and insulation or the low fire integrity and insulation requirements (Classification I1).

5.1 The Unequal double leaf doorsets may be altered to different construction of side transom & panel arrangements.

When the doorset was tested, the double door leaf construction may be altered to different construction arrangements. with accordance of EN 15269-5:2014 (E) - Annex B with particular doorset arrangements of side panels and transoms, in this case of test report R20L41-2A, the proposed glazed door configuration may be altered to single door leaf and unequal double door leaves doorset, with or without transom panel. Figure 1 shows the arrangement made for Double leaf doorsets altered to different construction arrangements.

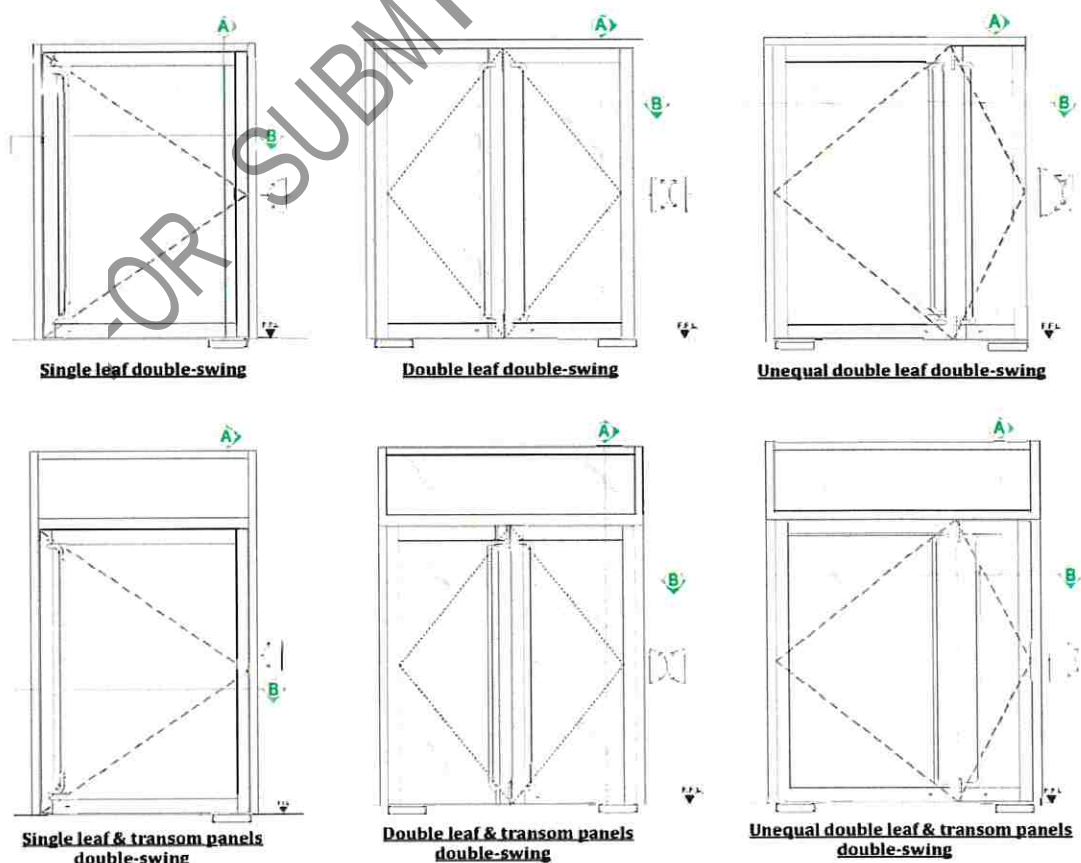


Figure 1

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5.2 Dimension of the door leaf may be increased.

The dimensions of door leaf is permitted to be changed with certain limitations but the variations are dependent on product type and the length of time that the performance criteria are fulfilled. An extended time to the test period shall be fulfilled to BS EN 15254-4:2008+A1:2011. The samples tested in test R20L41-2A fulfilled the performance criteria of overrun requirement stated in BS EN 15254-4:2008+A1:2011. The following table 1 shows the information relating to the test periods and performance criteria.

Test Report	Dimension of Door Leaf	Test Period (mm)		Performance Criteria Fulfilled for at Least (minutes)
		Classification Time	Extended Time	
R20L41-2A	2460mm x 1060mm x 25mm	60	106	66
	2460mm x 460mm x 25mm			

Table 1 Information relating to the test periods and performance criteria for door leaf

It is expected that the size of above mentioned tested door leafs are permitted up to : --

- 20% height
- 20% width
- 21% area

The maximum permissible dimensions are shown on the table 2

Test Report	Dimension of Door Leaf	Maximum Permissible Dimension			Maximum Allowance Area (mm ²)
		Height (mm)	Width (mm)	Extended Area (mm ²)	
R20L41-2A	2460mm x 1060mm	2952	1068	3152736	3155196
		2480	1272	3154560	
	2460mm x 460mm	2952	463	1366776	1369236
		2480	552	1368960	

Table 2 Maximum permissible dimension of door leaf


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5.3 Size of transom panel and glazed panel

The dimensions of transom panel and glazed panel are permitted to be increased with certain limitation with BS EN 15254-4 : 2008 + A1 : 2011 but the increase is only allowed provided the length of overrun time in the following table 3. The distance between the edge of glazing and the perimeter of the door leaf is not decreased. The table 3 shows the information relating to the test periods and performance criteria.

Test Report	Dimension of Panel	Test Period (mm)		Criteria for Overrun Time (minutes)
		Classification Time	Extended Time	
R20L41-2A	Pane C Side Panel 2620mm x 1080mm x25mm	60	106	66
	Pane D Transom 510mm x 1080mm x25mm			
	Pane E Transom 510mm x 1770mm x25mm			
	Pane F Transom 510mm x 460mm x25mm			
	Pane G Side Panel 2620mm x 460mm x25mm			

Table 3 Information relating to the test periods and performance criteria for transom panel

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The samples tested in test report R20L41-2A fulfilled the performance criteria in overrun requirement stated in BS EN 15269-5 : 2014.

It is expected that the size of above mentioned tested door leafs are permitted up to : --

- 20% height
- 20% width
- 21% area (maximum extended are when both height and width are increased)

The maximum permissible dimension are shown on the table 4

Test Report	Dimension of Panel	Maximum Permissible Vision Size			Maximum Allowable Area (mm ²)
		Height (mm)	Width (mm)	Extended Area (mm ²)	
R20L41-2A	Pane C Side Panel	3144	1089	3423816	3423816
	2620mm x 1080mm x 25mm	2641	1296	3422736	
	Pane D Transom	612	1089	666468	666468
	510mm x 1080mm x 25mm	514	1296	666144	
	Pane E Transom	612	1784	1091808	1092267
	510mm x 1770mm x 25mm	514	2124	1091736	
	Pane F Transom	612	463	283356	283866
	510mm x 460mm x 25mm	514	552	283728	
	Pane G Side Panel	3144	463	1455672	1458292
	2620mm x 460mm x 25mm	2641	552	1457832	

Table 4 Maximum permissible dimension of transom panel

5.4 The doorset that assessed on Clause 5.1, left, right side or both side may be connected to side panel.

It's possible for the unequal double door leaves, equal double door leaves and single door leaf doorsets to be connected to side panel, since the reference doorset stated in the test report of R20L41-2A had been tested with both side with glazed panel and met the requirement of the resistance glass doorset, plus with accordance of EN 15269-5:2014 (E) - Annex B with particular doorset arrangements of side panels and transoms, Therefore the doorset without side panels of the proposed door shall be as good as the original reference doorset stated in our test report R20L41-2A provided the design, fixing method, supporting construction and construction of the doorset shall be maintained.

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ASSESSMENT REPORT ON THE FIRE RESISTANCE PERFORMANCE OF A FIRE RESISTANT GLASS DOORSET

5.5 The proposed doorset may be with or without lockset on door leaves

With evidence of fire resistance performance report R20L41-2A , both kind of the lockset (normal one and magnetic unlocked and unlatched. Therefore it's possible to remove the lockset on door leaves providing the door leaves shall be operable and any remaining holes adequately covered.

5.6 After the doorset altered to particular doorset arrangements stated in Clause 5.4 a transom may be add on those doorset as shown in Figure 2.

After the doorset altered to particular doorset arrangements stated in Clause 5.1. with accordance of EN 15269-5:2014 (E) - Annex B with particular doorset arrangements of side panels and transoms, a transom may be added on top of the proposed unequal double door leaves, equal double door leaves and single door leaf doorsets to be connected with side panel at the same time provided the design, fixing method, supporting construction and construction of the doorset shall be maintained.

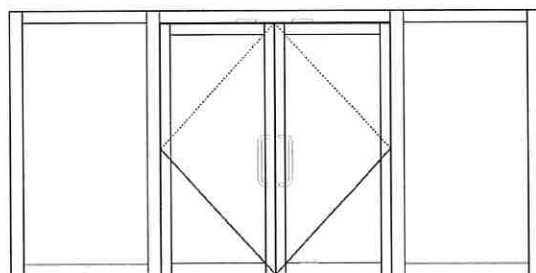


Figure 2

Double leaf with corner and side panels double-swing

Figure 2

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5.7 Material of the cladding may be altered, and on top of the cladding decorative facing may be added.

With accordance of BS EN 15269-5 : 2014 for the extended application of fire test results for hinged and pivoted metal framed glazed doorset test report R20L41-2A of the glazed doorsets satisfied the requirements of the fire resistance performance. Therefore, it's possible to add G.S.M. cladding, also decorative facing material like wall paper, paint, fire board, MDF board, plywood may be added on leaf up to 1.5mm; marble, ceramic, tile, glass and mirror may be added on leaf as well but that the alternative thickness does not add more than 25% to the weight of the door leaf providing the design, fixing method, supporting construction and construction of the doorset shall be maintained.

Decorative laminated sheets and timber veneers less than or up to 1.5mm thickness may be added on the face of the leaf and / or frame. The materials of decorative laminated sheets may be altered to stainless steel, aluminum, mild steel, timber or mild steel with paint coating.

Decorative surface coverings of the glazed beads may be added. The covering material shall achieve at least Class A2 when tested according to EN 13501-1 or tested with reference test data that it does not negatively affect the fire performance. The additional coverings shall not adversely affect the fire resistance performance of the fire resistant glazed element. The fixing method of coverings shall be same as tested.

5.8 Alternative of building hardware manufacturer. The brand of the building hardware mentioned on test report R20L41-2A may be altered with same size and same material.

With accordance of extended application of BS EN 15269-5 : 2014 test report R20L41-2A of the glazed doorsets satisfied the requirements of fire resistance performance of fire resistance glass door. It's possible to alter the building hardware mentioned on test report R20L41-2A such as floor spring, lockset, magnetic lockset and surface mounted handle to another brand provided the size, material and the position of the hardware are the same, and providing that the alternative brand is of the same type complies with the relevant product standard, is suitable for use on the original doorset and has passed a full size fire test according to EN 1634-1 or a small scale fire test to EN 1634-2, and the alternative building hardware shall be representative of the proposed doorset construction and for the required classification period. Also providing the design, fixing method, supporting construction and construction of the doorset shall be maintained as tested in test report R20L41-2A.

5.9 Shape of the door frame and meeting edge may be altered.

It is possible alter the shape of the door frame to be extended in accordance with extended application of BS EN 15269-5 : 2014 providing the door frame does not project beyond the face of the supporting construction more than tested. Also the dimension may be increased as shown in (Figure 3 & 4).

The glazed metal frame section are permitted to be increased with certain limitations but the variations are dependent on metal frame performance criteria are fulfilled section 7.2.3 in BS EN15254-4 : 2008 +A1 : 2011. The samples tested in test report R20L41-2A fulfilled the performance criteria in requirement stated in BS EN15254-4:2008 +A1:2011.

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Section of metal frame may be changed provided that it can be demonstrated that :

- axial stress levels in the vertical elements and the bending stress in horizontal elements are not increased in the cold state;
- HP/A factor for the frame and bead is not increased, described in Figure 3.
- depth of the section is not reduced, described in Figure 4.
- wall thickness and number of chambers in the frame are not be reduced.

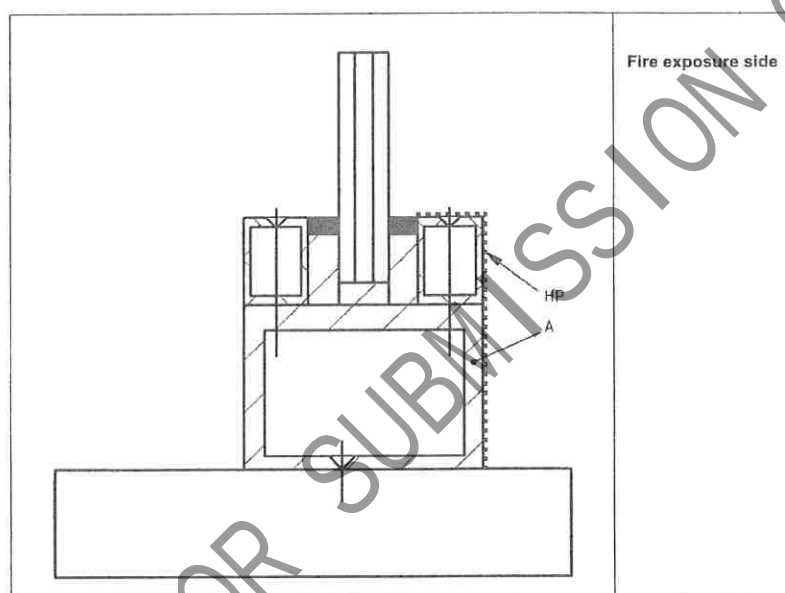


Figure 3

Key

HP = Heated perimeter [mm]
A = Heated cross section [mm²]

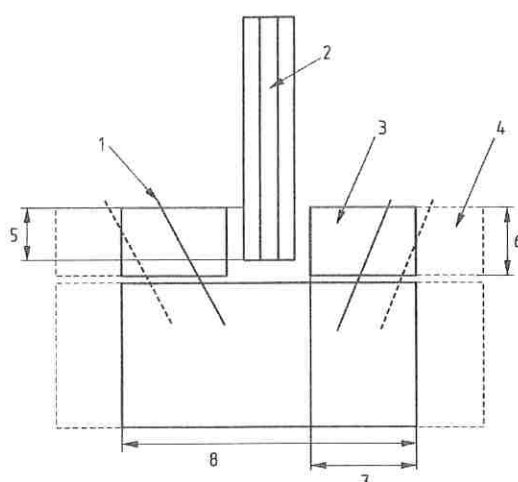


Figure 4

Key

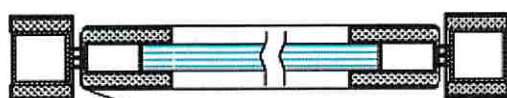
- 1 bead fixing e.g. screws, nails etc;
- 2 glass;
- 3 bead;
- 4 bead extended in depth;
- 5 edge cover;
- 6 bead height;
- 7 bead depth;
- 8 frame section depth.

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For the propose door drawing on Figure 5, the shape of the meeting edge is small fillet edge which is similar to the reference reports R20L41-2A, we expected the fire resistance performance would be satisfied the requirements of BS EN 1634-1 : 2008, therefore the shape of the meeting edge may be altered to a small fillet edge shown in Figure 5 provided the design, fixing method, supporting construction and construction of the doorset shall be maintained.



Single leaf door with small fillet edge



Double leaf door with small fillet edge

Figure 5

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5.10 Alternative of the hinge.

With accordance of extended application BS EN 15269-5 : 2014, it's possible to altered the hinge to different type and material, in this case it's possible to installed as surface mounted bullet hinge will be added on the glass doorset providing the component has been tested in a full scale or small scale test and providing any intumescent seal, the position and type of fixing shall remain as tested.

5.11 Threshold / Sill / Frame member to the bottom of the frame. (Figure 6)

With accordance of extended application BS EN 15269-5 : 2014, it's possible to add or threshold / sill made of metal or A1 materials or frame member of identical construction like the upper member of the door frame providing the door leaf is adapted in the same way, also providing fixing method, supporting construction and construction of the doorset shall be maintained as tested in test report R20L41-2A.

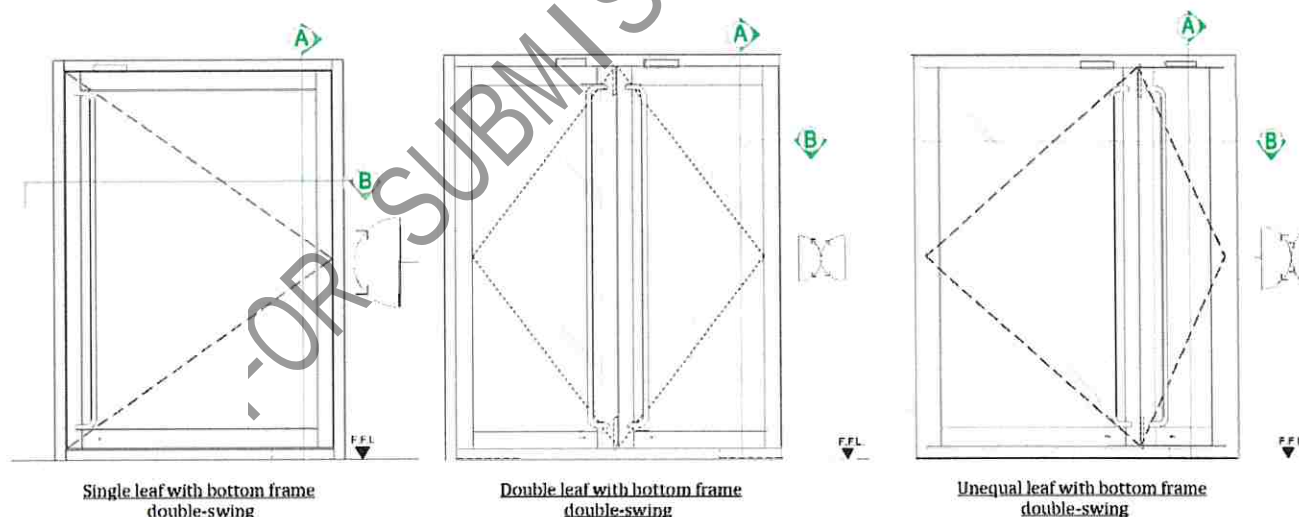


Figure 6

ASSESSMENT REPORT ON THE FIRE RESISTANCE PERFORMANCE OF A FIRE RESISTANT GLASS DOORSET

5.12 Appraisal to BS 476 -22 : 1987

The test methodology of the BS EN 1634-1 : 2014 and BS 476-22 : 1987 are essentially very similar.

The standard temperature / time of both tests, and the number and type of thermocouples used to control the furnace temperature are same. Plate thermometers are employed to measure the temperature of the furnace in BS EN test methodology, which may cause the temperature inside the furnace to be higher than the test temperature when using the BS test method.

The pressure gradient of both tests is same. The furnace pressure in the BS EN test was controlled by the neutral pressure plane at 500mm above notional floor level. This will cause a similar or higher pressure conditions than the test pressure required by BS 476-22 : 1987, which requires a neutral pressure plane established at 1000mm above the door threshold.

The failure criteria in terms of "integrity" and "insulation" in both test standards are same. The number of measurement locations for maximum temperature rise using the BS EN test is greater than the number required when using the BS test.

Since the test methods are very similar, it is proposed that the doorsets, tested under the reports R20L41-2A, would achieve similar or better results if they are to be subjected to a fire test to BS 476-22 : 1987. Therefore For both BS EN 1634-1 : 2014 and BS 476-22 : 1987 would support the reference report R20L41-2A to achieve fire rating of 30 minutes and 60 minutes of fire integrity and insulation.

5.13 With the glazed structure tested in our reports R20L41-2A. The proposed construction may be repeated when installed in a rigid construction.

It is possible to alter the glass door leaf construction to a glass panel construction the same as glass side panel stated in reports R20L41-2A. The construction of the glass doorset construction and the glass panel shall be the same as the tested panel, including the installation method, position and number of used intumescent seals.

It is possible to repeat the installation of each proposed glazed construction with or without transom when fixed to a masonry, concrete or adequately protected structured steel work supporting structure (The repeated installation may be allowed to be the patterns described in Figure 7 & 8). All supporting structures between each glazed shall be capable of providing the required 120 minutes integrity and insulation fire performance. It shall be able to effectively support the purposed glazed construction without detrimental effect. The installation method of the proposed glazed construction shall be the same as that tested.

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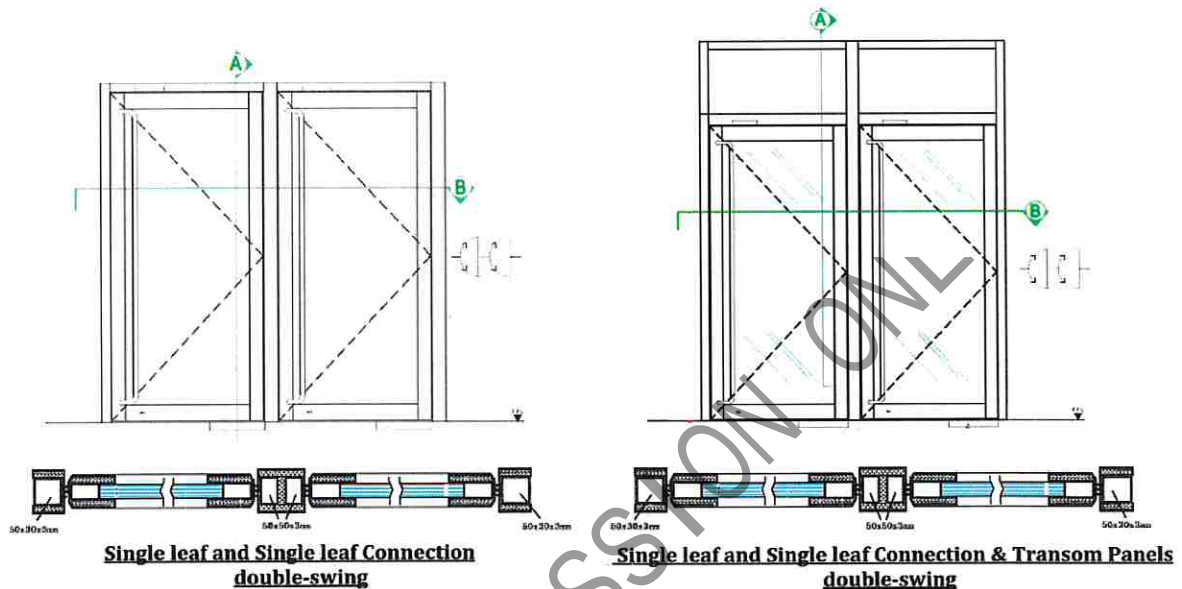


Figure 7

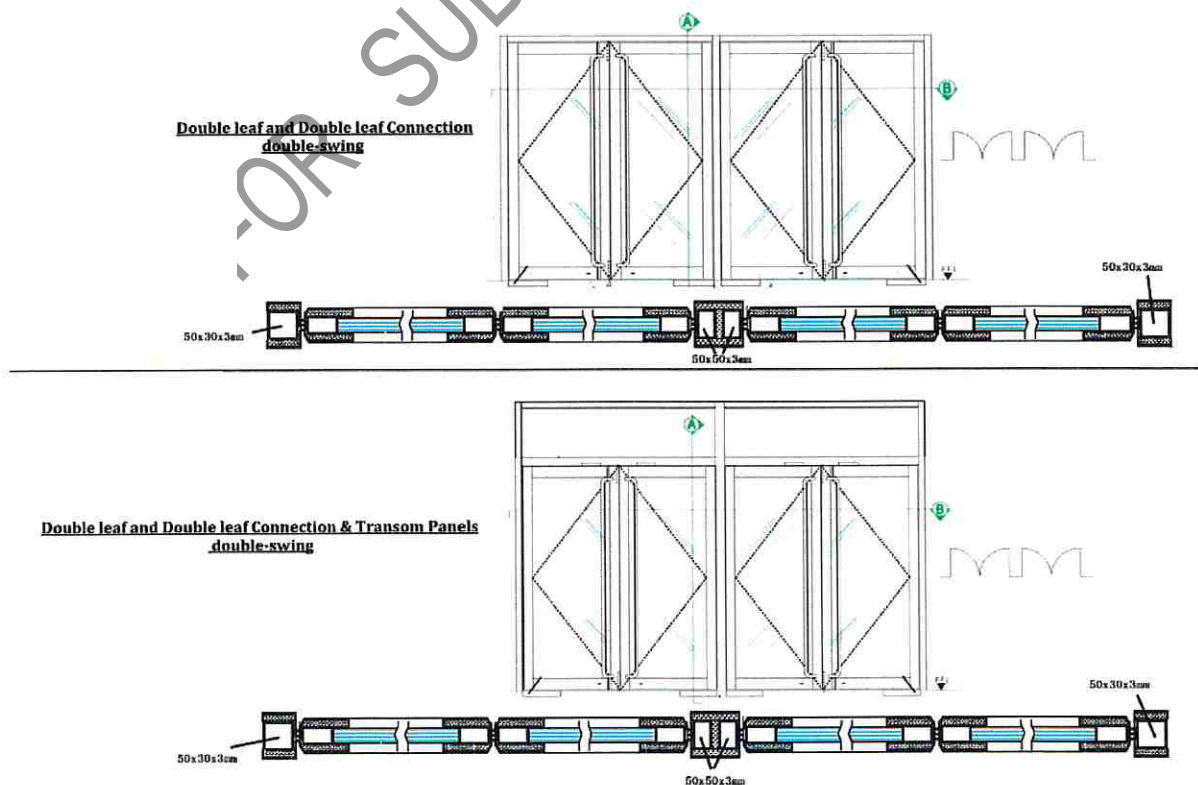


Figure 8

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5.14 Glazed panel with different arrangement may be produced independently and fulfill the requirement of BS EN 1364-1 : 2015

It's possible to altered the door leaves construction to form a glazed panel construction because the doorset incorporated door leaves is more onerous during the fire resistance test by comparing with the same doorset without door leaves replace by glazed panel, and the doorset door leaves replaced by glazed panel is considered to present a similar or reduced level of risk. Therefore the proposed doorset door leaves replace by glazed panel to form a glazed wall construction shall be as good as the original reference doorset stated in our test report R20L41-2A provided the design, fixing method and supporting construction shall be maintained. Therefore the reference doorset may be altered to glazed panel to form a glazed panel construction. (see Figure 9)

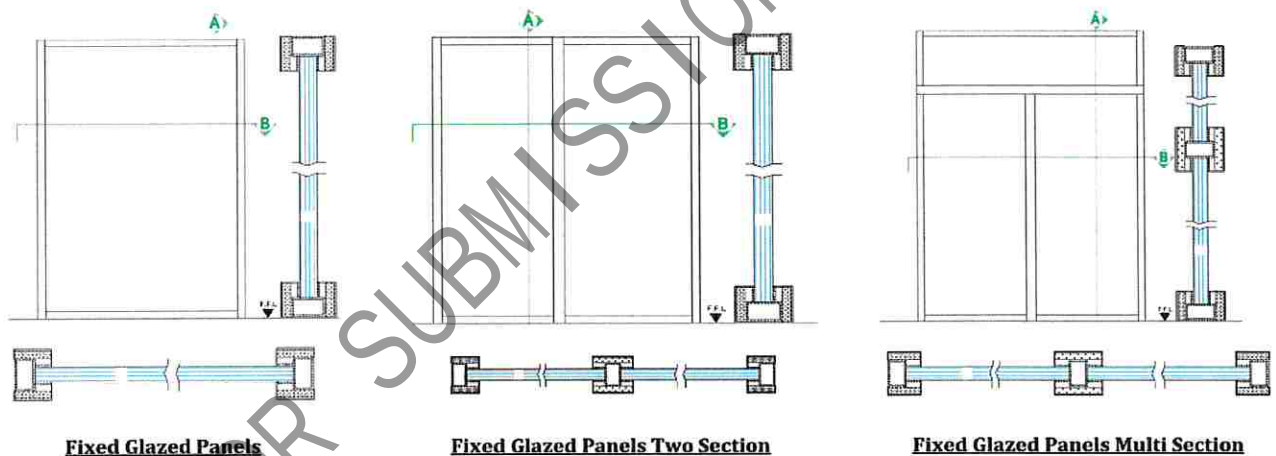


Figure 9

5.15 Fire and smoke seal with fins may be replaced by flat type of fire and smoke intumescent seals and support to BS 476 -22 : 1987.

It's possible to altered Fire and smoke seal with fins to flat type of fire and smoke intumescent seals without fins on reference door R20L41-2A since the function of the fins is prevent the smoke and fire and smoke intumescent seals without fins would do the same function. and since on clause 5.12 already assessed BS 478-22 1987, therefore Fire and smoke seal with fins may be replaced by flat type of fire and smoke intumescent seals provided the position of the seal and fixing method will be as same as the reference report R20L41-2A.



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5.16 All of above assessed items on BS EN 1634-1 : 2014 may be applied to BS 476 -22 : 1987.

Since we had already assessed on clause 5.12 the test methodology of the BS EN 1634-1 : 2014 and BS 476-22 : 1987 are essentially very similar but the test methodology of the BS EN 1634-1 : 2014 is onerous than BS 476 -22 : 1987, we would expect the proposed door fire test if they are to be subjected to BS 476 -22 : 1987 to have a similar results, therefore the assessed items in this report may be applied to BS 476 -22 : 1987.

5.17 Both side of the doorset may be exposed to fire sources.

Since the both sides of the doorset of reference test report of R20L41-2A are identical, we assumed the other side of the doorset would achieved same result a fire integrity of 119 minutes and insulation of 106 minutes, same as the original side of same test door.

5.18 The proposed fire resistance doorset may be used as smoke control performance doorset as the reference doorset construction as same as the construction stated in smoke performance reports R21H02-1A and R21H02-2A.

For the proposed doorset may be used as smoke control performance and fire resistance door. When the construction, material used, fixing method, smoke seal and fire seal are of reference smoke control performance doorset and reference Fire resistance performance doorset are identical with the proposed doorset, which both smoke control met the requirement of S_m and S_a smoke leakage value, and fire resistance had met the requirement of the fire integrity and insulation, we would expected the proposed doorset may be used as smoke control performance and fire resistance door when it is identical to the drawing provided by client.



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6.0 Overall performance

- 6.1** The proposed fire insulation glass doorset designs are based on the information from the fire test specimen results allowing for the variations in the design and construction and taking into account the requirements indicated in section 5 of this assessment report.
- 6.2** The glass doorset designs described in the test report R20L41-2A have been positively assessed for integrity and insulation performances of 30 minutes and 60 minutes.

7.0 Conclusion

If the fire resistance glass doorset, as described in report R20L41-2A had been varied as described in section 6.1 then the resulting glass doorset would be expected to attain 30 minutes and 60 minutes of integrity and insulation of the original item when tested in a similar manner.

8.0 Declaration by the client

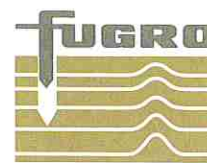
Client : HK Pro-Tech Fire Prevention Building Materials Ltd.

- 8.1** We confirm that the component or element of structure, which is the subject of this assessment, has not to our knowledge been subjected to a fire test to the standard against which this assessment is being made.
- 8.2** We agree to withdraw this assessment from circulation should the component or element of structure be the subject of a fire test to the standard against which this assessment is being made.
- 8.3** We are not aware of any information that could adversely affect the conclusions of this assessment.
- 8.4** We agree that should we become aware at any future date of any of the above information we will request Fugro Technical Services (Guangzhou) Limited to withdraw this assessment report.

Name : HK Pro-Tech Fire Prevention Building Materials Limited

Signed : *Eric Cheung*

For and on behalf of : Eric Cheung (General Manager)



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9.0 Validity

- 9.1** This assessment is issued on the basis of test data and information at the time of preparation. It is recommended that this assessment is valid for a period of five years.
- 9.2** This assessment related to those aspects of design, materials and structure on the fire resistance performance. It is not a complete specification for a purpose and long-term serviceability.
- 9.3** This assessment report is invalidated if assessment of variations other than those started in this report are included.

Reviewed by : Chan Chun Wai, Ivan
Manager (Product Testing Laboratory)

Issue Date : 17 October 2022

****End of Report****



**ASSESSMENT REPORT
ON SMOKE CONTROL
PERFORMANCE OF FIRE
RESISTANT GLASS DOORSET**

FOR SUBMISSION ONLY

Client : HK Pro-Tech Fire Prevention Building Materials Ltd.

Project : Performance Appraisal on a Smoke Control
Glass Doorset

Client Ref. : --

Report No. : G22094FU226118



Date of Issue : 10 October 2022



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- 2.0 Requirement
- 3.0 Supporting Data
- 4.0 Proposal
- 5.0 Discussion
- 6.0 Overall Performance
- 7.0 Conclusion
- 8.0 Declaration by the Client
- 9.0 Validity



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ASSESSMENT REPORT ON THE SMOKE CONTROL PERFORMANCE OF A FIRE RESISTANT GLASS DOORSET

1.0 Introduction

This assessment report represents an appraisal of the expected performance of a smoke control resistant timber doorset, when incorporating variations in design and materials. The reference doorsets were tested according to BS EN 1634-3: 2004, stated in the following sections and met the required fire integrity and insulation for door leaf / door frame and glazed panel.

1.1 A double-acting, double-leaf, glazed doorset with a glazed panel and overhead glazed panel achieved a maximum leakage rate of 11.60 m³/h at 50 Pa pressure to open outward and inward face at ambient temperature. The test results are stated in the test report R21H02-1A.

1.2 A double-acting, single-leaf, glazed doorset achieved a maximum leakage rate of 8.08 m³/h at 50 Pa pressure to open outward face at ambient temperature. The test results are stated in the test report R21H02-2A.

1.3 A double-acting, Unequal double-leaf, glazed doorset with transom and side panels achieved a fire integrity of 119 minutes and insulation of 106 minutes. The test results are stated in test report R20L41-2A.

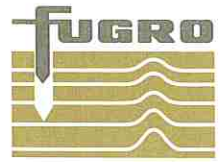
Reference has been made to BS EN 15269-20 : 2009 for the extended application of fire test results for timber doorset in the preparation of this report.

2.0 Requirement

2.1 The assessment made in this report is based on the following provisions;

2.1.1 The proposed doorset shall be of similar construction to the doorset subject to the full smoke control test, except in those various design options or modifications stated in this assessment report.

2.1.2 The clearance gaps between the leaf and frame shall not exceed the specified tolerance in the reference test reports.



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3.0 Supporting Data

The following report summaries are provided for information only, and reference shall be made to complete copies of the reports for full specifications.

3.1 R21H02-1A

Smoke control test conducted in accordance with BS EN 1634-3: 2004 on double-acting, double-leaf, glazed doorset.

A specimen of double-acting, double-leaf, glazed doorset had been subjected to the tests in accordance with BS EN 1634-3: 2004, in order to determine the smoke leakage (S_a and S_m) from one side to the other under the ambient and medium temperature at pressure differences of 10 Pa, 25 Pa and 50 Pa. As requested by the test sponsor, the specimens were mounted within concrete lined specimen holders and the fixing details were as shown in the test sponsor's drawings (see the appendix). Since the specimen was symmetrical in design, therefore only the leakage rate from the closing face to the doorset was measured.

One doorset had been submitted by the test sponsor had the overall dimensions of 1,845mm wide by 2,850mm high by 80mm frame thickness. The doorset incorporated of two unequal-width door leaf with sizes of 1,160mm wide by 2,605mm high and 560mm wide by 2,605mm high, respectively. The thickness of the door leave was 60mm thick. The doorset consisted of a top transom panel with overall sizes of 245mm high by 1,845mm wide. The door leaves and the glazed transom panel were fitted with 25mm thick "Protech" fire rated glass. The framework of the door was composed of 30mm by 50mm by 2mm thick RHS and sandwiched by one layer of 12mm thick fire rated boards on each side. The door frame was composed of 50mm by 50mm by 2mm thick SHS sandwiched by one layer of 12mm thick fire rated boards.

The door leaves were hung by a top pivot and "Dorma BTS-65 & BTS-80" floor spring. The doorset was fitted with surface mounted pull handleless. A "Gamma ML 532" lockset was fitted at the bottom corner of the larger door leave, and a "HIKVISION" electric lockset was incorporated at the top corner of the smaller door leave.

The doorsets were fitted with smoke control seals as follows:

Door Frame

- i) "Fan Qiu FQ-CZ-2004", 20mm by 4mm thick intumescent body with 4mm high double-fins at the centre. One no. of seal was fitted full height and full width at the reveal of the door frame. The seal was full interrupted at the electric lockset, and the pivot hinge location.

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3.1 R21H02-1A

Door Leaves

ii) "Fan Qiu FQ-CZ-2004", 20mm wide by 4mm thick intumescent body with 4mm high double-fins at the centre. One no. of seal was fitted full height at the meeting edge of the door leaf without interruption.

i) "Fan Qiu FQ-CS-2004", 20mm wide by 4mm thick intumescent body with 4mm high single fin at each side of the seal. One no. of seal was fitted full height and full width at the top and vertical edges (except one of the meeting edge) of the door leaf. The seal was slightly modified at the flush bolt, striking plate position without interruption to the fins.

ii) "Fan Qiu FQ-CD-2004" 20mm wide by 4mm thick with intumescent body with 8mm high single fin at each side of the seal. The seal was fitted at the bottom sill of the door leaf full width without interruption to the fins.

The smoke leakage rates of the doorsets were summarized as below:

Test	Temp	Leakage rate Q_{spec} (m^3/h) at pressure difference of			S_m Criterion (m^3/h)	Linear leakage rate Q_l ($m^3/h/m$) at pressure difference of		S_a Criterion ($m^3/h/m$)
		10 Pa	25 Pa	50 Pa		10 Pa	25 Pa	
1	Ambient	4.17	7.6	11.6	< 30	0.44	0.79	< 30
2	Medium	2.57	5.6	9.77	< 30	N/A	N/A	N/A

The performance criteria of the smoke leakage rate (S_a) and (S_m) as mentioned in the BS EN 1634-3: 2004 shall be referenced to BS EN 13501-2: 2007 + A1: 2009 where

Smoke leakage (S_m) - when the maximum leakage rate measured at both ambient temperature and 200°C and up to a pressure of 50 Pa does not exceed 30 m^3/h for a double-leaf doorset;

Smoke leakage (S_a) - when the maximum leakage rate measured at ambient temperature, and at a pressure of up to 25 Pa only, does not exceed 3 m^3/h per meter length of gap between the fixed and movable components of the doorset, excluding leakage at the threshold.

According to the performance criteria as given in BS EN 13501-2: 2007 + A1: 2009, it can be concluded that the tested double-leaf doorset satisfied both the S_a and S_m requirements.

Test Date : 23rd September, 2021

Test Sponsor : HK Pro-Tech Fire Prevention Building Materials Ltd.

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ASSESSMENT REPORT ON THE SMOKE CONTROL PERFORMANCE OF A FIRE RESISTANT GLASS DOORSET

3.2 R21H02-2A

Smoke control test conducted in accordance with BS EN 1634-3: 2004 on double-acting, single-leaf, glazed doorset.

A specimen of double-acting, single-leaf, glazed doorset had been subjected to the tests in accordance with BS EN 1634-3 : 2004, in order to determine the smoke leakage (S_a and S_m) from one side to the other under the ambient and medium temperature at pressure differences of 10 Pa, 25 Pa and 50 Pa. As requested by the test sponsor, the specimens were mounted within concrete lined specimen holders and the fixing details were as shown in the test sponsor's drawings (see the appendix). Since the specimen was symmetrical in design, therefore only the leakage rate from the closing face of the doorset was measured.

One doorset had been submitted by the test sponsor had the overall dimensions of 1,280mm wide by 2,850mm high by 80mm frame thickness. The doorset incorporated of a single door leaf with sizes of 1,160mm wide by 2,605mm high by 60mm thick. The doorset consisted of a top transom panel with overall sizes of 230mm high by 1,280mm wide. The door leaf and the top glazed transom panel were fitted with 25mm thick "Protech" fire rated glass. The framework of the door leaf was composed of 30mm by 40mm by 2mm thick RHS and sandwiched by one layer of 12mm thick fire rated boards on each side. The vertical members of door frame were composed of two nos. of 25mm by 50mm by 2mm SHS and the transom member was composed of 50mm by 50mm by 2mm thick SHS. The steel sections were sandwiched by one layer of 12mm thick fire rated boards.

The door leaf was hung by a top pivot and "Dorma BTS-75V" floor spring. The doorset was fitted with surface mounted pull handles. A "Gamma ML-532" lockset was fitted at the bottom corner of the door leaf, and a "HIKVISIONKAT108" electric lockset was incorporated at the top corner of the door leaf.

The doorsets were fitted with smoke control seals as follows:

Door Frame

- i) "Fan Qiu FQ-CZ-2004", 20mm by 4mm thick intumescent body with 4mm high double-fins at the centre. One no. of seal was fitted full height and full width at the reveal of the door frame. The seal was fully interrupted at the electric lockset, and the pivot hinge location.

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ASSESSMENT REPORT ON THE SMOKE CONTROL PERFORMANCE OF A FIRE RESISTANT GLASS DOORSET

3.2 R21H02-2A

Door Leaf

i) "Fan Qiu FQ-CS-2004", 20mm wide by 4mm thick intumescent body with 4mm high single fin at each side of the seal. One no. of seal was fitted full height and full width at the top and vertical edges (except one of the meeting edge) of the door leaf. The seal was slightly modified at the flush bolt, striking plate position without interruption to the fins.

ii) "Fan Qiu FQ-CD-2004" 20mm wide by 4mm thick with intumescent body with 8mm high single fin at each side of the seal. The seal was fitted at the bottom sill of the door leaf full width without interruption to the fins.

The smoke leakage rates of the doorsets were summarized as below:

Test	Temp	Leakage rate Q_{spec} (m ³ /h) at pressure difference of			S_m Criterion (m ³ /h)	Linear leakage rate Q_l (m ³ /h/m) at pressure difference of		S_a Criterion (m ³ /h/m)
		10 Pa	25 Pa	50 Pa		10 Pa	25 Pa	
1	Ambient	3.13	5.33	8.08	< 20	0.49	0.84	< 30
2	Medium	4.75	5.8	9.77	< 20	N/A	N/A	N/A

The performance criteria of the smoke leakage rate (S_a) and (S_m) as mentioned in the BS EN 1634-3: 2004 shall be referenced to BS EN 13501-2: 2007 + A1: 2009 where

Smoke leakage (S_m) - when the maximum leakage rate measured at both ambient temperature and 200°C and up to a pressure of 50 Pa does not exceed 20 m³/h for a single-leaf doorset;

Smoke leakage (S_a) - when the maximum leakage rate measured at ambient temperature, and at a pressure of up to 25 Pa only, does not exceed 3 m³/h per meter length of gap between the fixed and movable components of the doorset, excluding leakage at the threshold.

According to the performance criteria as given in BS EN 13501-2: 2007 + A1: 2009, it can be concluded that the tested single-leaf doorset satisfied both the S_a and S_m requirements.

Test Date : 3rd November 2021
Test Sponsor : HK Pro-Tech Fire Prevention Building Materials Ltd.

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ASSESSMENT REPORT ON THE SMOKE CONTROL PERFORMANCE OF A FIRE RESISTANT GLASS DOORSET

3.3 R20L41-2A

Fire resistance test conducted in accordance with BS EN 1634-1: 2014 + A1: 2018 on a double-acting, unequal double-leaf glazed doorset with side and transom panels.

A specimen of double-acting, unequal double-leaf glazed doorset with side and transom panels had been subjected to a test in accordance with BS EN 1634-1: 2014 + A1: 2018 in order to determine its fire resistance performance. As requested by the test sponsor, the specimen was mounted within concrete lined specimen holder by test sponsor such that the door leaves were swinging towards or away from the heating conditions. The doorset was asymmetrical and only one side of the specimen was tested, in which the fire side was determined by the test sponsor.

The specimen had overall dimensions of 3,400mm wide by 3,200mm high. It was comprised of a double-acting, unequal double-leaf glazed doorset with three (3) nos. of transom panel and two (2) nos. of side panels. It was comprised of totally 7 nos. of glass panes, namely panes 'A' to 'G' (refer to photo 1). The leaf door leaf was with sizes of 1,160mm wide by 2,605mm high and the right door leaf was with sizes of 560mm wide by 2,605mm high. Both door leaves were hung to the door frame by 'Dorma' floor springs. The frame of transom and side panels was constructed by 30mm by 50mm by 2mm thick and 25mm by 50mm by 2mm thick G.M.S. hollow sections and the frame of door leaves was constructed by 50mm by 30mm by 2mm thick G.M.S. hollow sections. All hollow sections were sandwiched by 1 layer of nominal 3mm thick ceramic tape, 1 layer of nominal 12mm thick fire rated board and 1 layer of nominal 1mm thick stainless steel cladding at both sides.

All panes were of nominal 25mm thick 'Protech' insulated glass. Pane 'A' was with vision sizes 1,000mm wide by 2,400mm high. Pane 'B' was with vision sizes of 400mm wide by 2,400mm high. Pane 'C' was with vision sizes of 1,020mm wide by 2,560mm high. Pane 'D' was with vision sizes of 1,020mm wide by 450mm high. Pane 'E' was with vision sizes of 1,710mm wide by 450mm high. Pane 'F' was with vision sizes of 400mm wide by 450mm high. Pane 'G' was with vision sizes of 400mm wide by 2,560mm high. One (1) no. of intumescent fire seal with sizes of 20mm wide by 4mm thick was installed each jamb and head of door frame and four edges of both door leaves. A lockset was installed at bottom corner of leaf door leaf, top corner of right door leaf and meeting edge of left door leaf. A flush bolt was installed at top and bottom of right door left. An electric lockset was installed at the head of door frame, above left door leaf. A surface mounted hand was installed at both sides of both door leaves. A free edge was applied to the left vertical edge and infilled with mineral wool. The doorset was unbolted, unlocked and unlatched during the test.



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3.3 R20L41-2A

The specimen satisfied the performance requirements specified in BS EN 1634-1: 2014 + A1: 2018 for the following periods:

Integrity :

Cotton Pan	114 Minutes
Gap Gauge	119 Minutes (No failure)
Sustained Flaming	119 Minutes (No failure)

Insulation (I_1 doorset excluding transom and side panels) :	106 Minutes
Insulation (I_1 transom and side panels) :	108 Minutes

The test was discontinued after a heating period of 119 minutes.

Test Date : 22nd January, 2021
Test Sponsor : HK Pro-Tech Fire Prevention Building Materials Ltd.

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ASSESSMENT REPORT ON THE SMOKE CONTROL PERFORMANCE OF A FIRE RESISTANT GLASS DOORSET

4.0 Proposal

It is proposed to evaluate the smoke control performance of fire resistance timber doorset of the same general construction as the sample tested in test reports R21H02-1A and R21H02-2A. The assessment is based on the actual data obtained from the sample subjected to the full test shown in that report satisfied the performance requirement of S_a and S_m of BS EN 1634-3: 2004 as below:

Smoke leakage S_m - When the maximum leakage rate measured at both ambient temperature and 200°C and up to a pressure of 50 Pa does not exceed 20m³/h for single leaf doorset, or 30m³/h for a double leaf doorset.

Smoke leakage S_a - When the maximum leakage rate measured at ambient temperature, and at a pressure of up to 25 Pa only, does not exceed 3m³/h per meter length of gap between the fixed and movable components of the doorset (e.g. between the door leaf and door frame), excluding leakage at the threshold.

The construction shall remain essentially unchanged with the following exception.

4.1 With evidence of smoke control performance report R21H02-1A and R21H02-2A. The proposed glazed door configuration may be altered to single door leaf, equal double door leaves and unequal double door leaves doorset, with or without transom panel.

4.2 The size of the door leaf may be increased.

4.3 The proposed doorset may be with or without lockset.

4.4 Material of the cladding may be altered, and on top of the cladding decorative facing may be added.

4.5 Alternative of building hardware manufacturer. The brand of the building hardware mentioned on test report R21H02-1A and R21H02-2A may be altered with same size and same material.

4.6 Shape of the door frame and meeting edge may be altered.

4.7 The proposed doorset may be altered to four side frame.

4.8 The proposed doorset may be used as smoke control performance and fire resistance door when the reference smoke control doorset stated in R21H02-1A and fire resistance doorset stated in R20L41-2A are identical.

Reference has been made to BS EN 15269-20 : 2009 for the extended application of fire test results for timber doorset in the preparation of this report.



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5.0 Discussion

As shown in test report R21H02-1A and R21H02-2A of the glazed doorsets, incorporated a glazed transom, were tested according to BS EN 1634-3: 2004, met the performance requirement of S_a and S_m .

When the materials and design of the tested timber doorset may be altered with the following variations, it is expected that the proposed doorset will also meet the above mentioned performance requirement of S_a and S_m .

5.1 With evidence of smoke control performance report R21H02-1A and R21H02-2A. The proposed glazed door configuration may be altered to single door leaf, equal double door leaves and unequal double door leaves doorset, with or without transom panel.

For the proposed door to single door leaf and unequal double door leaves doorset with or without transom panels, with evidence of smoke control performance report R21H02-1A and R21H02-2A, the doorsets met the requirements of S_m and S_a value, the doorset need to be satisfied the below critical:

Smoke leakage S_m - When the maximum leakage rate measured at both ambient temperature and 200°C and up to a pressure of 50 Pa does not exceed 20m³/h for single leaf doorset, or 30m³/h for a double leaf doorset.

Smoke leakage S_a - When the maximum leakage rate measured at ambient temperature, and at a pressure of up to 25 Pa only, does not exceed 3m³/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.

As shown in test report R21H02-1A and R21H02-2A; glazed doorsets. Both of them incorporated a glazed transom, was tested according to BS EN 1634-3: 2004, met the performance requirement of S_a and S_m values where on test report R21H02-1A double leaves door set of the closing face was measured, on test report R21H02-2A single leaf door set. Also with accordance with BS EN 15269-20: 2009 Annex B, the reference doorset may be altered to the proposed arrangements of single door leaf and unequal double door leaves doorset, with or without transom panel. For equal double door leaves, the maximum area allowance increase of unequal double door leaves doorset stated in R21H02-1A is 20%, in this case, 15% of increase in area of the unequal double door leaves (Active and passive leaves), then divided by 2 to form a equal double door leaves doorset. Therefore three kind of proposed glazed door configurations may be altered. (see figure 1a, 1b and 1c)

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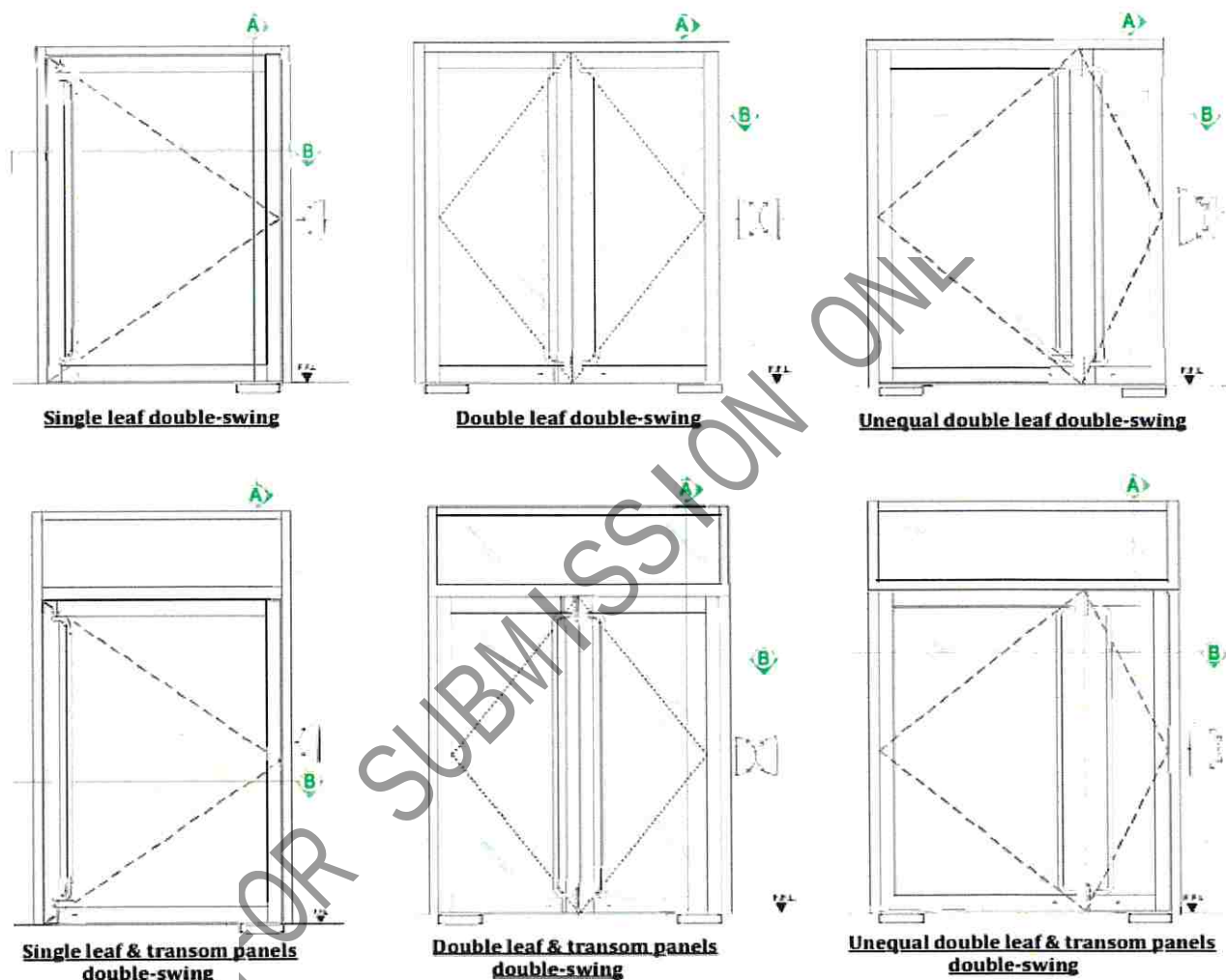


Figure 1a
Drawing provided by Client

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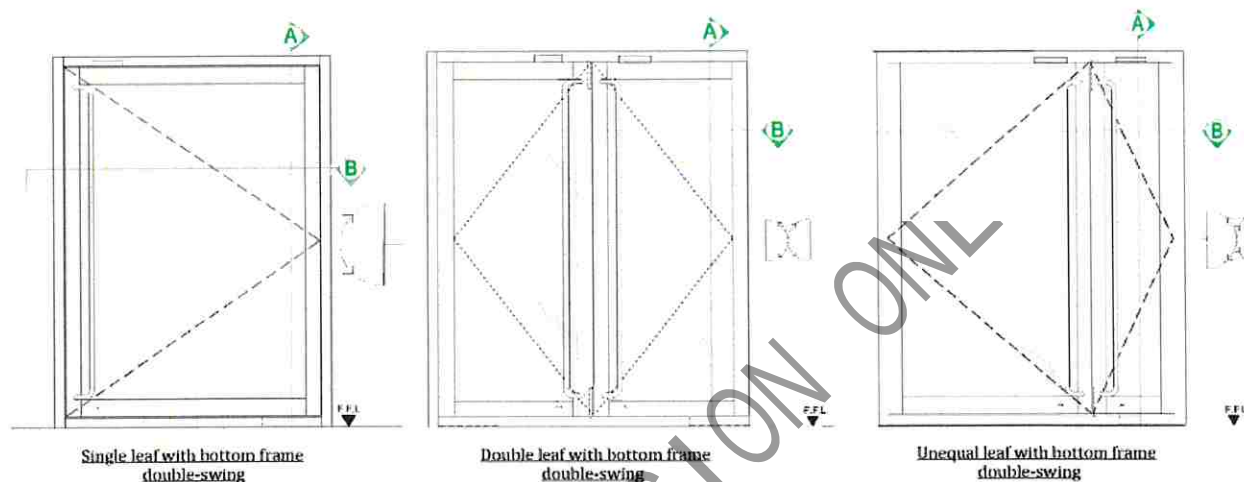


Figure 1b
Drawing provided by Client

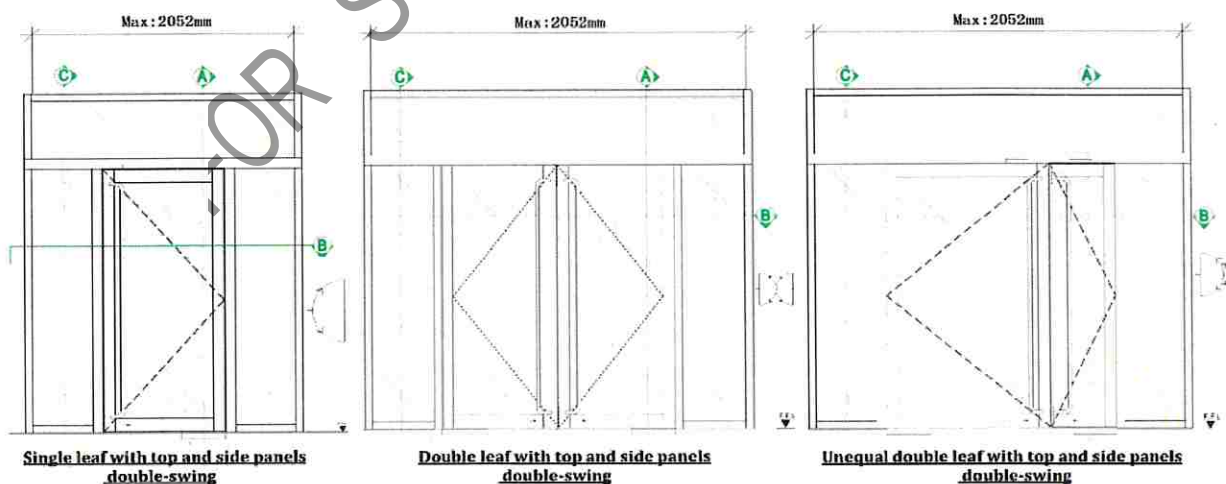


Figure 1c
Drawing provided by Client

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5.2 The size of the door leaf may be increased.

The size variation of the door leaf may be increased in terms of width, height and area, according to extended application of BS EN 15269-20:2009; providing the construction, design, installation method with intumescent seals and the position of fixing shall be same as tested in the report R21H02-1A and R21H02-2A. It is also possible to increase the dimension of the door leaf or panel providing the sealing system is unchanged and any interruptions for hardware are in equal or less proportion to the test specimen. With accordance of extended application of BS EN 15269-20:2009. For the proposed glazed door leaves, S_m doorsets with maximum leakage rate of 50% (single leaf doorsets with 10 m³/h and for double doorsets with 15 m³/h of the leakage rate referred in EN 13501-2 for Hinged unlatched doors size increase is permitted up to 15% in height, 15% width and 20% area providing the closing device is of an appropriate power size for the leaf size. In this case test reports R21H02-1A and R21H02-2A both fulfill this requirements.

It is expected that the size of above mentioned tested door leaves are permitted up to : --

- 15% height
- 15% width
- 20% area

The maximum permissible dimensions are shown on the table 1

Test Report	Dimension of Door Leaf pane	Maximum Permissible Dimension			Maximum Allowance Area (mm ²)
		Height (mm)	Width (mm)	Extended Area (mm ²)	
R21H02-2A Single leaf doorset	2505mm x 1060mm x 25mm	2880	1106	3185280	3186360
		2613	1219	3185247	
R21H02-1A Double leaves doorset	2505mm x 1060mm x 25mm active leaf	2880	1106	3185280	3186360
		2613	1219	3185247	
	2505mm x 460mm x 25mm Passive leaf	2880	480	1382400	1382760
		2613	529	1382277	

Table 1



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5.3 The proposed doorset may be with or without lockset.

With evidence of smoke control performance report R21H02-1A and R21H02-2A, both of them with two different kind of lockset and one electronic lockset on double leaves doorset and the other one is on single leaf doorset, both of them had met the requirement of S_m and S_a smoke leakage value.

Also With evidence of smoke control performance report R21H02-1A and R21H02-2A, both kind of the lockset and one electronic lockset are unlocked. It's possible to remove the lockset providing it does not interfere with the smoke seal more than tested.

5.4 Material of the cladding may be altered, and on top of the cladding decorative facing may be added.

With accordance of extended application of BS EN 15269-20:2009 test report R21H02-1A and R21H02-2A of the glazed doorsets satisfied the requirements of the S_a and S_m value, therefore it's possible to altered the cladding material from 1mm G.M.S to aluminum, also decorative facing material like wall paper, paint, fire board, MDF board, plywood, marble, ceramic, tile, glass and mirror may be added on leaf, panel or frame up to 1.5mm providing the sealing system is unaffected.

5.5 Alternative of building hardware manufacturer. The brand of the building hardware mentioned on test report R21H02-1A and R21H02-2A may be altered with same size and same material.

With accordance of extended application of BS EN 15269-20:2009 test report R21H02-1A and R21H02-2A of the glazed doorsets satisfied the requirements of the S_a and S_m value. It's possible to alter the building hardware mentioned on test report R21H02-1A and R21H02-2A such as floor spring, lockset, electronic lockset and surface mounted handle to another brand provided the size, material and the position of the hardware are the same, and provided the hardware does not interfere with the smoke seal more than tested. All items of building hardware are in accordance with the relevant technical specification and that the door assembly onto which the building hardware will be fitted is appropriate to that class of use. When considering a change in a parameter of building hardware, the effect on the durability of self-closing shall be considered.

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5.6 Shape of the door frame and meeting edge may be altered.

It is possible alter the shape of the door frame in accordance with extended application of BS EN 15269-20:2009 providing the door frame does not project beyond the face of the supporting construction more than tested. Also the external dimension may be increased providing the rebate depth is maintained (Figure 2). For the propose door drawing on Figure 2, the shape of the meeting edge is small fillet edge which is similar to the two reference reports R21H02-1A and R21H02-2A, we expected the smoke control performance would be satisfied the requirements of the S_a and S_m values. And with extended application of BS EN 15269-20:2009 the meeting edge may be altered to the equal and unequal rebate on Figure 3.

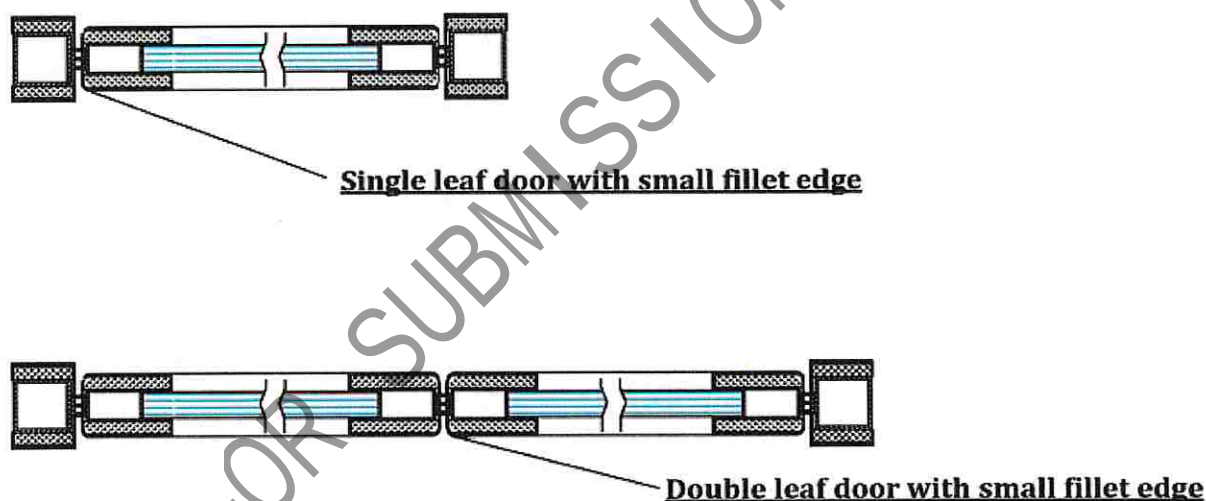


Figure 2

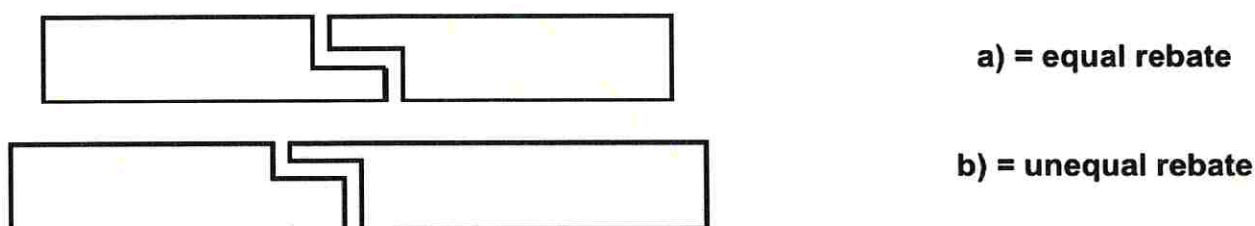


Figure 3

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5.7 The proposed doorset may be altered to four side frame. (Figure 4)

With evidence of smoke control performance reports R21H02-1A and R21H02-2A, both of them with transom, one is on double leaves doorset and the other one is on single leaf doorset, both of them had met the requirement of S_m and S_a smoke leakage value.

With accordance with BS EN 15269-20:2009 extended application. Threshold at the bottom of the door set may be added to form a four side frame, it is possible for S_a and possible for S_m providing the tested bottom sealing system is maintained or replaced by the sealing system tested at the upper edges of the door leaf. Therefore the proposed doorset may be with or without overhead panel on door frame, and may be altered to four side frame.

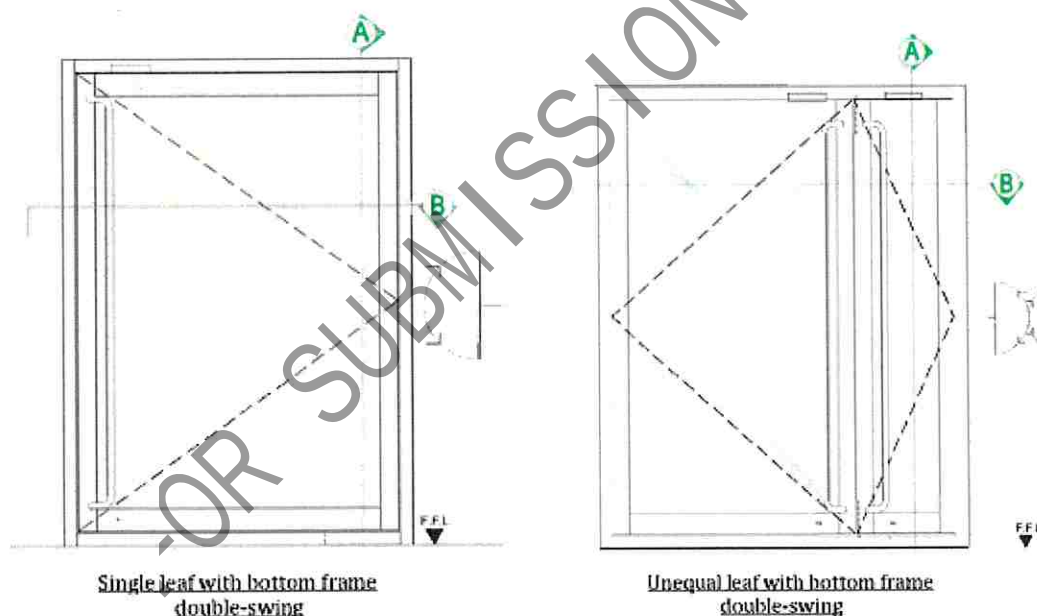


Figure 4

5.8 The proposed doorset may be used as smoke control performance and fire resistance door when the reference smoke control doorset stated in R21H02-1A and fire resistance doorset stated in R20L41-2A are identical.

For the proposed doorset may be used as smoke control performance and fire resistance door. When the construction, material used, fixing method, smoke seal and fire seal are of reference smoke control performance doorset and the fire resistance performance doorset are identical with the proposed doorset, which both smoke control met the requirement of S_m and S_a smoke leakage value, and fire resistance had met the requirement of the fire integrity and insulation, we would expected the proposed doorset may be used as smoke control performance and fire resistance door when it is identical to the drawing provided by client.



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6.0 Overall performance

- 6.1 The proposed smoke control timber doorset designs are based on the information from the smoke control performance specimen results allowing for the variations in the design and construction and taking into account the requirements indicated in section 5.0 of this assessment report.
- 6.2 The timber doorset designs have been positively assessed and satisfied the performance requirement of S_a and S_m of BS EN 1634-3: 2004.

7.0 Conclusion

If the smoke control timber doorset, as described in reports R21H02-1A and R21H02-2A had been varied as described in section 6.1 then the resulting timber doorset would be expected to attain the performance requirement of S_a and S_m of the original item when tested in a similar manner.

8.0 Declaration by the client

Client : HK Pro-Tech Fire Prevention Building Materials Ltd.

- 8.1 We confirm that the component or element of structure, which is the subject of this assessment, has not to our knowledge been subjected to a fire test to the standard against which this assessment is being made.
- 8.2 We agree to withdraw this assessment from circulation should the component or element of structure be the subject of a fire test to the standard against which this assessment is being made.
- 8.3 We are not aware of any information that could adversely affect the conclusions of this assessment.
- 8.4 We agree that should we become aware at any future date of any of the above information we will request Fugro Technical Services (Guangzhou) Limited to withdraw this assessment report.

Name : HK Pro-Tech Fire Prevention Building Materials Limited

Signed : *Eric Cheung*

For and on behalf of : Eric Cheung (General Manager)



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9.0 Validity

- 9.1** This assessment is issued on the basis of test data and information at the time of preparation. It is recommended that this assessment is valid for a period of five years.
- 9.2** This assessment related to those aspects of design, materials and structure on the fire resistance performance. It is not a complete specification for a purpose and long-term serviceability.
- 9.3** This assessment report is invalidated if assessment of variations other than those stated in this report are included.

Reviewed by : 
Chan Chun Wai, Ivan
Manager (Product Testing Laboratory)

Issue Date : 10 October 2022

****End of Report****