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FIRE RESISTANCE TEST REPORT

PARTITION SYSTEM with SINGLE LAYER LINING

in accordance with **BS EN 1364-1: 1999** 0/240/240

Test Sponsor: Kingtec Building Materials (HK & Macau) Limited
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HOKLAS Approved Signatory:



Ir. Dr Chan Yuk Kit

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1. Scope of Test

This report is a record of a fire resistance test conducted by Forte Testing and Consultants Co., Ltd, in conformity with requirements in *BS EN 1364-1: 1999 "Fire resistance tests for non-loadbearing elements – Part 1: Walls"* and particular requirements in *BS EN 1363-1: 1999 "Fire resistance tests – Part 1: General requirements"*.

The test subject was a partition system. The partition comprised of a single layer of "Hawk Pan" fire board lining with nominal thickness of 9 mm, and steel framework which was protected by 9 mm thick fillet boards. The specimen was supplied for test by Kingtec Building Materials (HK & Macau) Limited, the Sponsor.

The specimen achieved the following fire resistance:

INTEGRITY (E)		INSULATION (I)	
Sustained Flaming	255 Minutes	Average Temp. Rise	6 Minutes
Gap Gauge	255 Minutes	Max. Temp. Rise	7 Minutes
Cotton Pad	255 Minutes		

2. Test Information

Test Laboratory:	FORTE Testing and Consultants Company Limited	
Test Location:	West Side of Huan Xiang Shan, Xin Yu Road, Shajin, Baoan District, Shenzhen, Guangdong Province, China.	
Test Sponsor:	Kingtec Building Materials (HK & Macau) Limited	
ID no. of the Specimen:	QT 14-223A	
Date Received:	2014-08-25	
Test Number:	QT 14-223	
Date Tested:	2014-09-02	Start Time: 14:26
Approved Test Operators from FORTE:	Ms. Cheng San Mei, Sammi	
Witness of the Test:	Mr. Sammy Chan, Mr. James Yung and Ms. Lilian Tse– Official Delegates of the Sponsor	
Report Issue Record:	Version 1 – 2014- 10 - 20	

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3. Construction Details of Specimen

3.1 Specimen Description

3.1.1 Board Configuration

The partition system has an overall size 3070 mm (width) x 3100 mm (height) comprised of a single layer of nominal 9 mm (thick) surface board. The surface was consisted of 5 sheets of boards including 2 numbers of board with nominal sizes 2440 mm (w) x 1220 mm (h), 1 number of board with nominal sizes 2440 mm (w) x 660 mm (h), 1 number of board with nominal sizes 2440 mm (w) x 630 mm (h) and 1 number of board with nominal sizes 630 mm (w) x 660 mm (h).

Surface boards were fixed to the framework by Ø3.5 mm X 35 mm flat screws at 160 – 200 mm centre to centre.

70 mm (w) x nominal 9 mm (t) board fillets were fixed on the exposed side of the steel framework under the surface boards. The fillets were fixed to the framework by Ø3.5 mm X 35 mm flat screws at approximate 150 – 200 mm centre to centre.

Fire sealant was caulked at all board joints and between the edges between boards and framework on the specimen.

The space between the space between free edge and the concrete support frame was filled by ceramic fibre.

3.1.2 Structural Framework

The structural framework of the partition was made of horizontal galvanized steel channels and vertical galvanized steel studs. The framework was secured to the test rig by M6 x 60 mm anchor bolts at 550 – 600 mm centre to centre.

Steel studs were sized 32 mm (flange) x 50 mm (depth) x 0.5 mm (t). First stud were for made of single stud; whereas the second to fifth studs were formed as double-stud configuration, which were made by fixing two studs back to back by screws at 500 – 600 mm centre to centre. Steel studs were inserted in between the head and base channels with 2-5 mm expansion gap at both ends of studs. Each end of the studs was fixed to channels by aluminium rivets.

Steel channels were sized of 24 mm (flange) x 50 mm (depth) x 0.5 mm (t). Head, base and three rows of stiffening horizontal channels were fixed to the boards. The stiffening channels were fitted between vertical studs and fixed to the studs at both end by aluminium rivets.

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3.2 Material Schedule

Parts specifications of the specimen were summarized in the following tables.

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

Fire Board

Supplier:	Kingtec Building Materials (HK & Macau) Limited
Brand:	Hawk Pan
Material:	Calcium Silicate *
Nominal Density:	950 kg/m ³ *
Nominal Thickness:	9 mm
Location Applied:	Linings of the Specimen and Fillet on the Structural Framework

U-channel

Supplier:	Kingtec Building Materials (HK & Macau) Limited
Material:	Galvanized Steel
Sizes:	24 mm x 50 mm x 0.5 mm

C-channel

Supplier:	Kingtec Building Materials (HK & Macau) Limited
Material:	Galvanized Steel
Sizes:	32 mm x 50 mm x 0.5 mm

Fixing – Screws

Supplier:	Kingtec Building Materials (HK & Macau) Limited
Type:	Self-tapping Screws
Sizes:	Ø3.5 mm X 35 mm

Fixing – Rivets

Supplier:	Kingtec Building Materials (HK & Macau) Limited
Type:	Blind Rivet
Material:	Aluminum
Sizes:	Ø4 mm X 10 mm

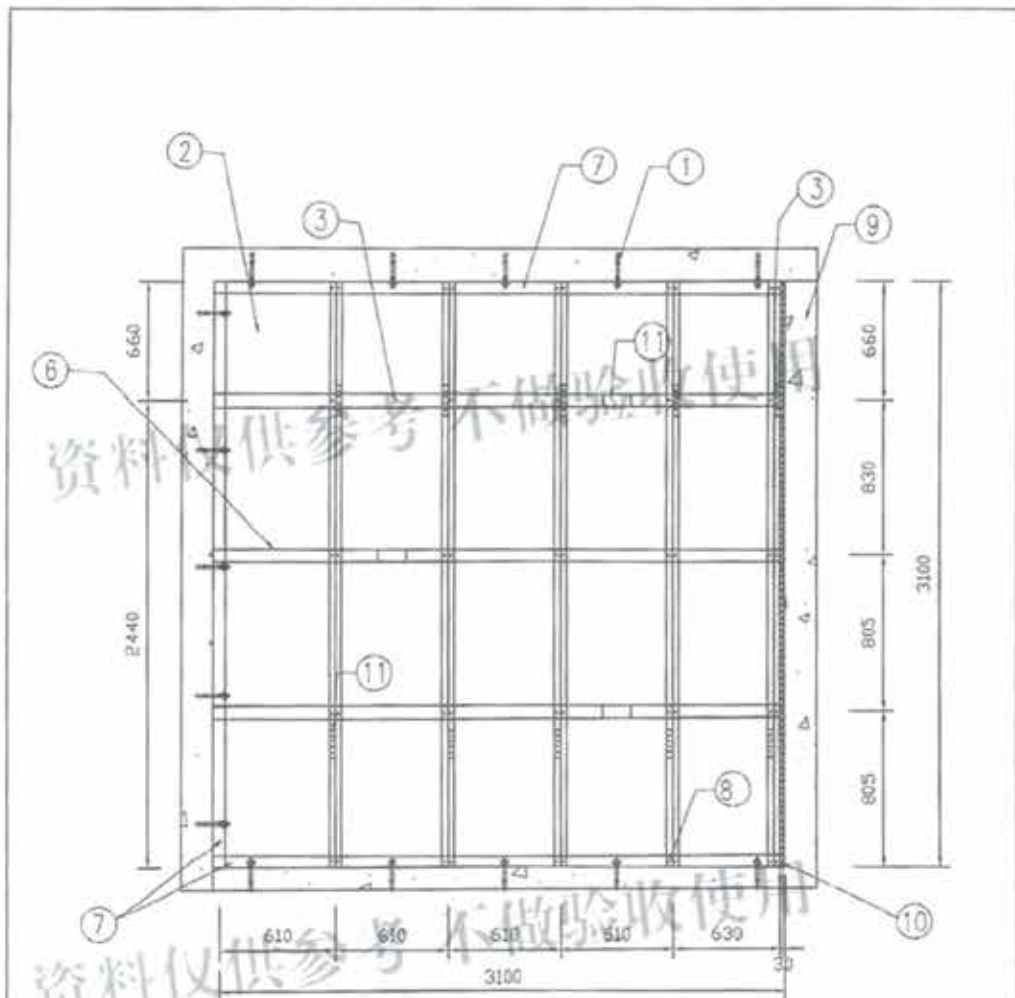
Fixing – Anchor Bolts

Supplier:	Kingtec Building Materials (HK & Macau) Limited
Type:	Expansion Anchor Bolt
Material:	Steel
Sizes:	Ø6 mm x 60 mm
Location Applied:	Perimeter Framework to Test Rig

Fire Sealant

Supplier:	Kingtec Building Materials (HK & Macau) Limited
Brand:	Lorient
Material:	Intumescent Mastics
Location Applied:	Joints Between Boards and Framework of Specimen – Fire and Non Fire Exposed Surface

3.3 Drawings on the Specimen provided by the Sponsor (Total 2 pages)



(STRUCTURAL FRAMEWORK)

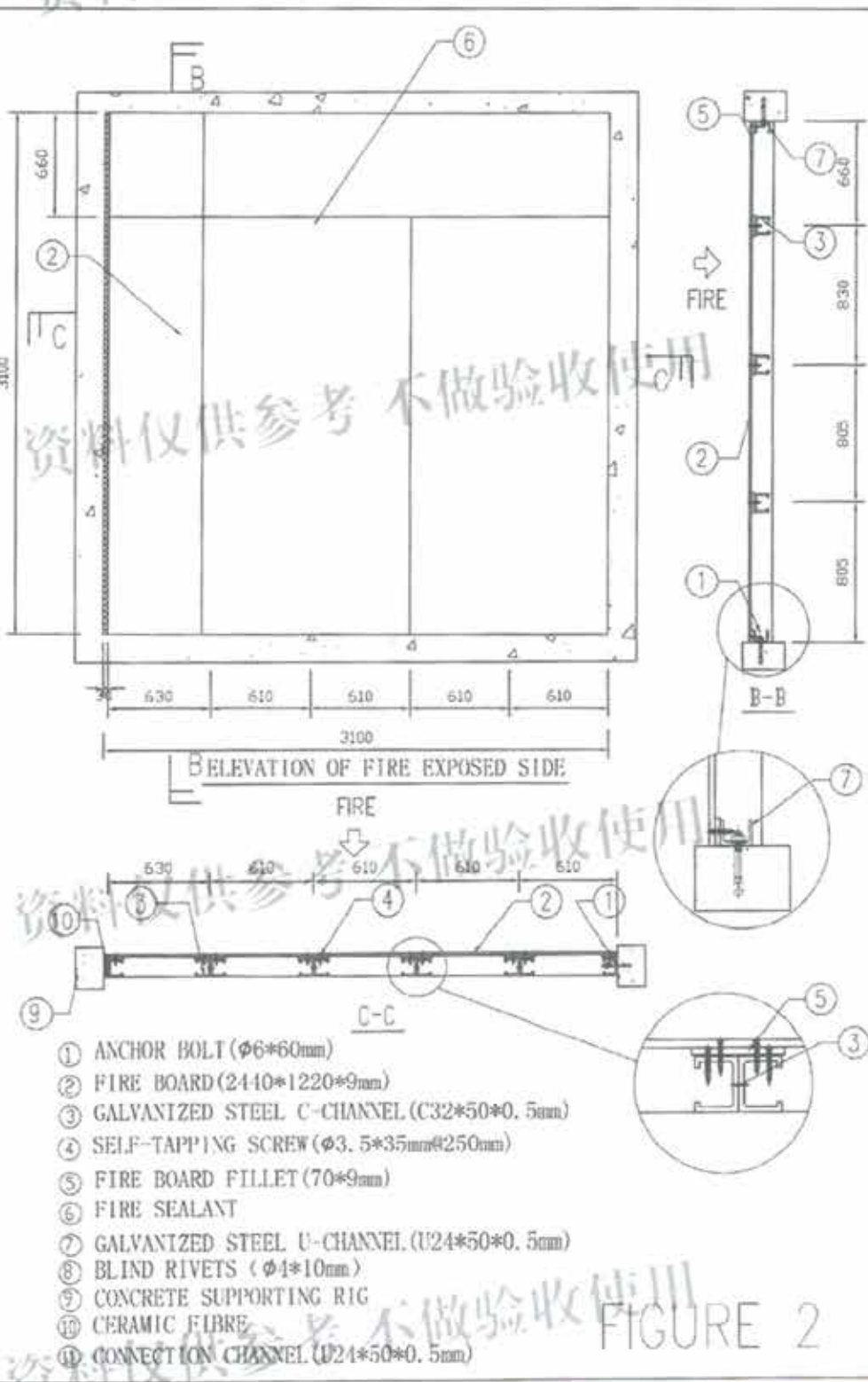
Drawings of Specimen provided by the Sponsor (1)

- ① ANCHOR BOLT ($\phi 6 \times 60\text{mm}$)
- ② FIRE BOARD ($2440 \times 1220 \times 9\text{mm}$)
- ③ GALVANIZED STEEL C-CHANNEL ($C32 \times 50 \times 0.5\text{mm}$)
- ④ SELF-TAPPING SCREW ($\phi 3.5 \times 35\text{mm} @ 250\text{mm}$)
- ⑤ FIRE BOARD FILLET ($70 \times 9\text{mm}$)
- ⑥ FIRE SEALANT
- ⑦ GALVANIZED STEEL U-CHANNEL ($U24 \times 50 \times 0.5\text{mm}$)
- ⑧ BLIND RIVETS ($\phi 4 \times 10\text{mm}$)
- ⑨ CONCRETE SUPPORTING RIG
- ⑩ CERAMIC FIBRE
- ⑪ CONNECTION CHANNEL ($U24 \times 50 \times 0.5\text{mm}$)

FIGURE 1

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Drawings of Specimen provided by the Sponsor (2)

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4. Specimen Condition

4.1 Selection of the Specimen

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

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

4.2 Verification of the Specimen

Additional components of the specimen such as lining and steel studs were transferred to the Test Location on 2014-08-25 by the Sponsor. Samples of the components were taken randomly for verification.

FORTE verified the specimen description given by the Sponsor to the best of its ability. In section 3.2 of this report, items which had been verified by FORTE was clearly identified and distinguished from those relying on Sponsor's declaration.

4.3 Supporting Construction

The specimen was fixed into a supporting construction made of fully cured reinforced normal density concrete slabs provided by FORTE. The concrete slabs formed a structural opening 3110 mm (w) x 3110 mm (h).

4.4 Installation of the Specimen

The specimen was assembled and installed by workers delegated by the Sponsor on 2014-08-26 to 2014-08-29.

4.5 Specimen Conditioning

The specimen was stored in the Test Location from 2014-08-25, the date which components of the specimen were received, to 2014-09-02, the date which fire resistance test performed.

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

Ambient Temperature (°C)	Relative Humidity (%)
32 ± 5	70 ± 5

4.6 Direction of Fire Side and Others

The Sponsor designated and installed that the steel framework was standing on the unexposed side.

The vertical free edge was set adjacent to the smaller board on the exposed face.

5. Test Method

5.1 Ambient Temperature

The ambient temperature was measured by a type K thermocouple. The measuring junction was positioned approximately 1500 mm away the test construction.

5.2 Heating Condition

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

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

Where,

T is the average furnace temperature, in degree Celsius

t is the time, in minutes

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

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

5.3 Unexposed Surface Temperature

The unexposed surface temperatures of specimen were measured by 15 numbers of type K thermocouples. These thermocouples were positioned and fixed on unexposed surface of specimen in conformity with *BS EN 1364-1: 1999*.

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

Thermocouple	Description
U1 – U5	For average and maximum unexposed surface temperature rise
U6 – U14	For maximum unexposed surface temperature rise
U15 – U26	For additional information only and NOT assessed against insulation criterion; Data shown in Appendix A

5.4 Pressure Condition

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

5.5 Deflection Measurements

Measurements of the deflection of the specimen were taken with a steel rule from cross line laser across the mid-height of the specimen with reference to *BS EN 1364-1:1999*.

The positions of deflection measurement points are shown in *Figure 2*.

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

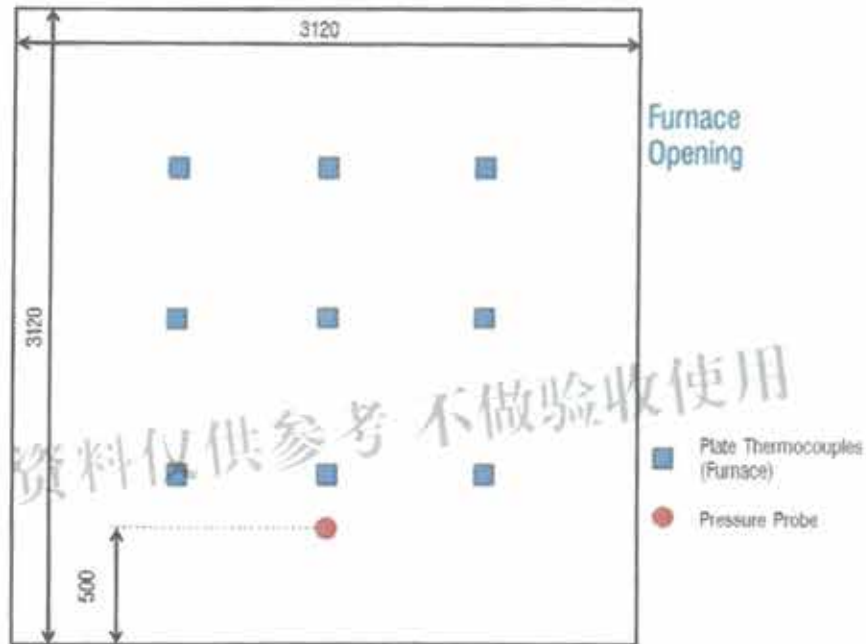
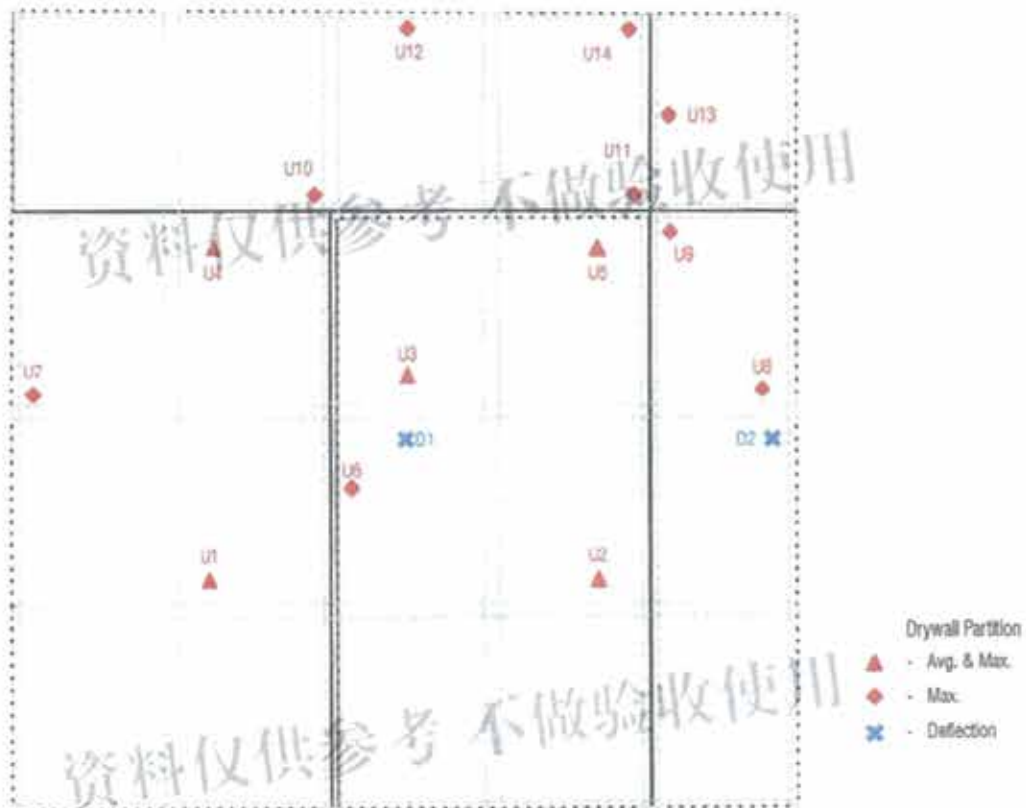


Figure 2. Positions of fixed surface thermocouples (U) and deflection measuring points (D) on the specimen.



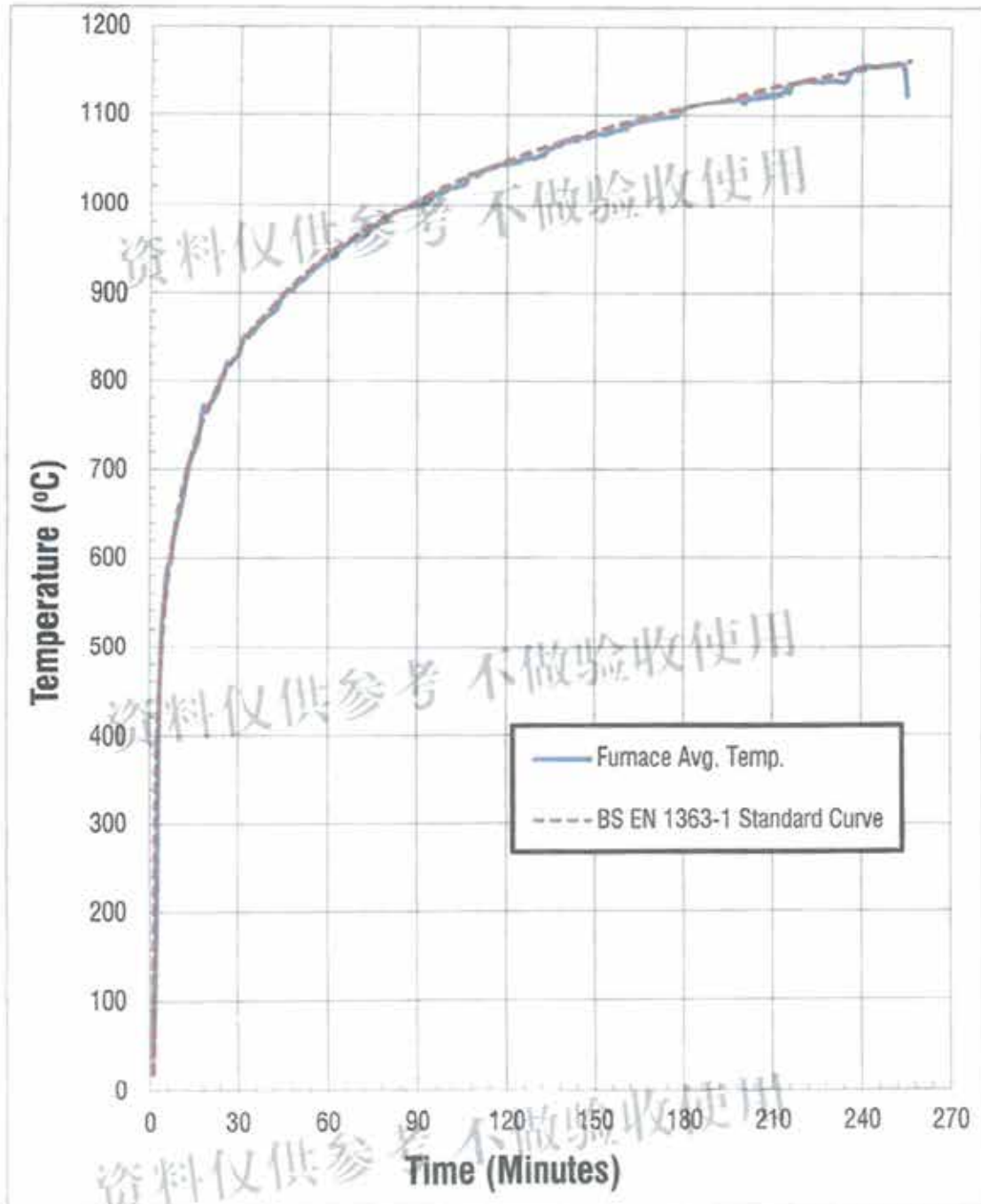
6. Test Data

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6.1 Furnace Temperature

The furnace average temperature over the test period is shown in *Figure 3*.

Figure 3. Furnace average temperature over the test period.



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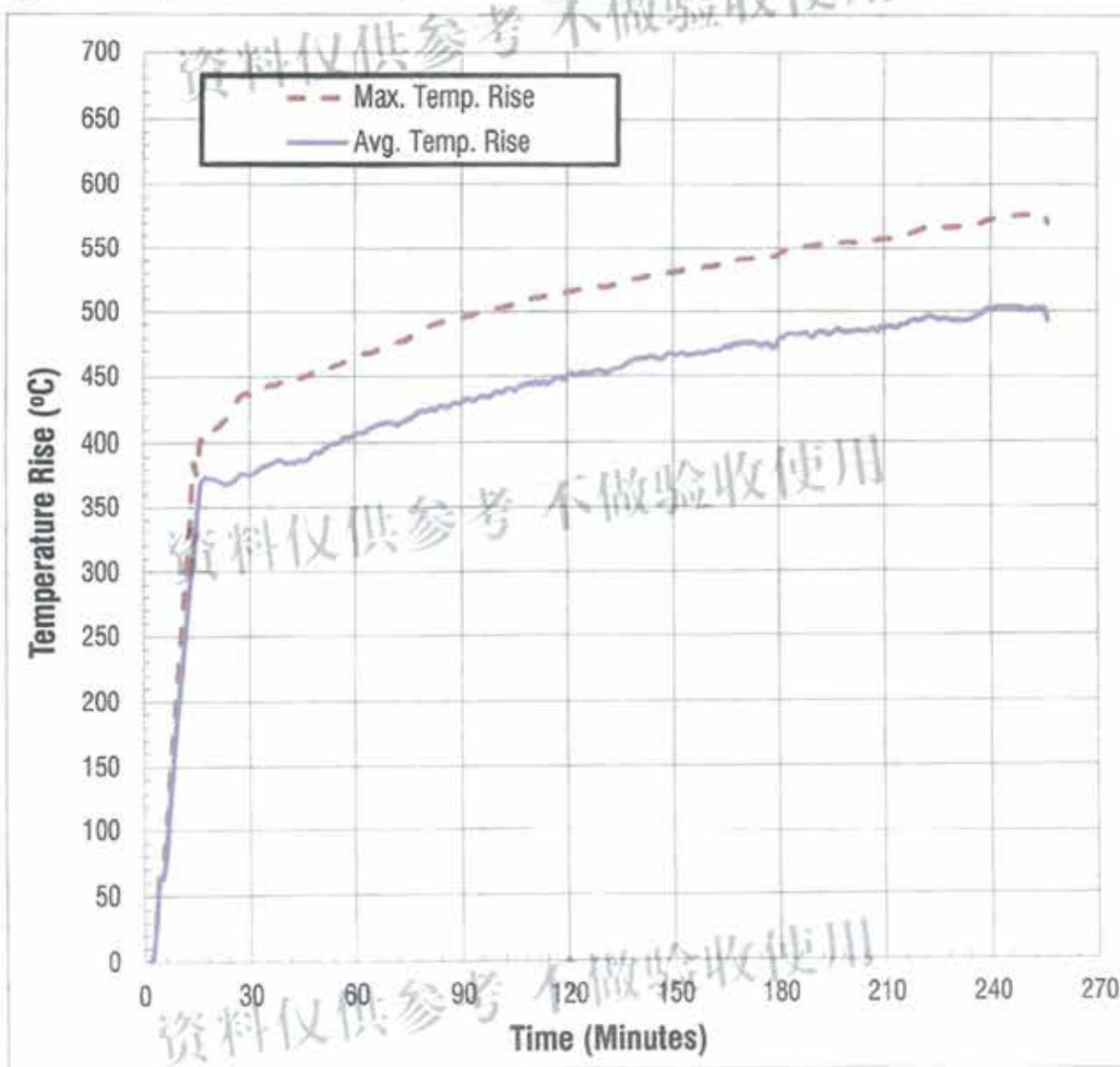
6.2 Unexposed Surface Temperature Rise

6.2.1 Fixed surface thermocouples

The temperature rises of unexposed surface of specimen measured by fixed surface thermocouples over the test period are shown in *Figure 4*.

The maximum temperature rise measured on U6 at 7.24 minute of test was 180.8°C, which was in excess of 180°C limit. The average temperature rise measured at specimen at 6.48 minute of test was 141.8°C, which was in excess of 140°C limit.

Figure 4. Average and maximum temperature rise of specimen over the test period.



6.2.2 Fixed surface thermocouples – Detailed Temperature Records

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

Temperature outputs from unexposed surface temperature U1 to U8

Time (min)	U1	U2	U3	U4	U5	U6	U7	U8
0.0	34.7	34.7	34.9	34.8	35.2	34.4	33.6	33.4
1.0	35.8	35.9	36.5	36.7	37.0	36.3	34.9	34.2
2.0	49.3	52.9	57.0	56.5	63.7	57.4	48.6	46.7
3.0	94.3	94.6	95.9	98.4	97.7	95.1	88.4	89.9
4.0	95.4	96.6	97.0	98.9	100.1	97.9	94.8	94.0
5.0	97.6	106.0	110.8	122.0	131.5	128.0	101.9	95.3
6.0	128.6	141.2	147.5	159.5	169.2	167.7	136.1	109.4
7.0	162.9	172.1	180.8	194.3	200.2	202.5	162.6	140.8
8.0	198.3	204.6	212.9	225.2	230.1	239.1	195.8	170.5
9.0	227.9	230.6	241.5	250.4	255.4	272.3	218.0	196.5
10.0	256.0	258.1	271.5	278.1	280.5	307.3	236.9	223.3
20.0	378.8	395.3	400.0	428.1	428.4	407.7	369.5	422.3
30.0	381.4	404.8	402.8	435.7	435.9	420.7	397.5	400.1
40.0	392.4	412.0	406.9	446.9	443.6	426.4	421.1	414.1
50.0	402.0	426.6	419.1	452.5	455.8	441.2	424.0	414.7
60.0	413.1	437.0	431.5	466.2	466.6	454.9	437.1	426.0
70.0	417.2	442.5	436.4	477.4	474.8	462.5	433.6	439.4
80.0	428.3	450.3	444.8	489.2	488.4	474.6	441.6	443.5
90.0	434.2	455.0	454.1	497.4	496.1	481.6	450.7	448.5
100.0	440.0	459.2	458.4	503.8	501.6	492.0	457.5	457.0
110.0	444.7	470.5	467.4	510.5	512.0	497.8	468.8	467.3
120.0	451.5	477.5	474.9	516.4	517.5	501.4	475.0	473.8
130.0	453.8	475.9	476.4	519.4	516.1	508.1	483.9	474.7
140.0	460.5	486.6	489.7	526.7	531.0	511.6	487.1	489.2
150.0	463.1	490.4	491.0	532.2	533.9	515.1	492.9	489.9
160.0	467.8	496.9	491.2	536.0	534.7	517.5	500.9	494.5
170.0	473.1	503.5	494.8	542.7	540.6	524.2	501.5	500.3
180.0	475.2	503.9	501.4	550.4	542.9	526.4	515.8	505.9
190.0	481.0	511.3	502.6	553.1	546.5	532.7	512.9	510.3
200.0	480.4	511.5	503.8	554.1	547.9	534.0	515.2	510.4
210.0	484.5	513.9	508.0	559.7	550.0	536.2	523.8	515.7
220.0	489.0	524.0	515.0	562.5	558.3	543.5	517.2	521.6
230.0	488.0	521.2	510.5	562.7	556.8	545.7	518.1	520.7
240.0	495.7	530.0	521.5	570.3	568.6	552.0	524.4	527.1
250.0	497.1	529.6	520.1	570.7	565.0	553.6	528.0	528.6
255.0	487.1	521.7	512.6	561.2	556.4	541.1	521.2	522.3

Temperature outputs from unexposed surface temperature U9 to U14

Time (min)	U9	U10	U11	U12	U13	U14
0.0	33.4	34.4	34.3	34.8	34.2	35.0
1.0	34.2	35.7	36.2	36.2	35.6	36.3
2.0	46.7	56.8	55.6	55.1	55.0	53.7
3.0	89.9	97.3	96.8	95.9	97.2	96.3
4.0	94.0	98.3	98.1	97.8	98.1	98.2
5.0	95.3	124.1	125.1	122.5	121.6	118.1
6.0	109.4	158.8	162.7	157.4	159.9	154.3
7.0	140.8	188.2	194.9	187.1	187.5	181.4
8.0	170.5	215.6	223.4	213.5	212.8	207.2
9.0	196.5	239.3	246.7	234.8	231.3	227.9
10.0	261.3	272.8	257.0	251.7	247.7	232.9
20.0	422.1	447.7	441.0	438.7	424.5	441.5
30.0	440.9	471.6	465.1	443.0	428.7	454.9
40.0	448.0	484.4	477.7	451.1	438.2	461.4
50.0	456.8	488.9	483.5	453.4	444.0	470.5
60.0	467.7	501.7	490.7	463.2	456.2	476.3
70.0	474.5	511.9	500.5	474.1	462.6	485.9
80.0	481.2	523.7	512.3	490.1	475.9	498.8
90.0	489.7	530.9	521.4	498.8	484.7	509.0
100.0	494.1	538.3	527.6	504.3	489.1	516.4
110.0	503.4	545.9	536.7	510.3	498.0	523.6
120.0	507.2	551.2	542.1	515.2	504.5	529.0
130.0	517.2	554.5	547.4	518.1	506.9	534.5
140.0	520.9	561.8	556.2	524.6	515.7	541.3
150.0	522.6	566.5	560.6	529.5	518.7	546.4
160.0	526.7	570.0	560.9	532.2	521.6	546.7
170.0	528.2	576.5	564.1	538.7	525.5	550.6
180.0	532.1	582.4	570.1	542.8	529.3	555.0
190.0	537.9	588.5	574.8	548.7	532.9	561.5
200.0	540.3	589.8	576.6	550.5	534.1	563.7
210.0	538.5	593.1	580.2	552.3	537.4	565.5
220.0	546.4	600.7	588.1	560.5	544.9	573.9
230.0	547.5	601.9	589.7	561.6	544.5	576.7
240.0	556.9	608.2	597.8	569.3	555.4	583.9
250.0	556.8	610.8	601.4	571.0	555.1	587.7
255.0	548.3	604.8	592.1	560.2	546.9	578.4

6.3 Pressure

The furnace pressure over the test period is summarized in the following table.

Time (min)	Pressure: 500 mm above notional floor level	Time (min)	Pressure: 500 mm above notional floor level
6	-2.5	140	0.8
10	-2.0	150	1.2
20	1.7	160	-1.5
30	1.5	170	1.1
40	-0.2	180	0.2
50	-0.9	190	0.5
60	2.8	200	-1.2
70	-1.0	210	-0.4
80	-0.7	220	-1.8
90	-1.4	230	0.5
100	-0.8	240	1.3
110	-1.2	250	-2.0
120	0.0	260	0.8
130	0.1	263	-1.7

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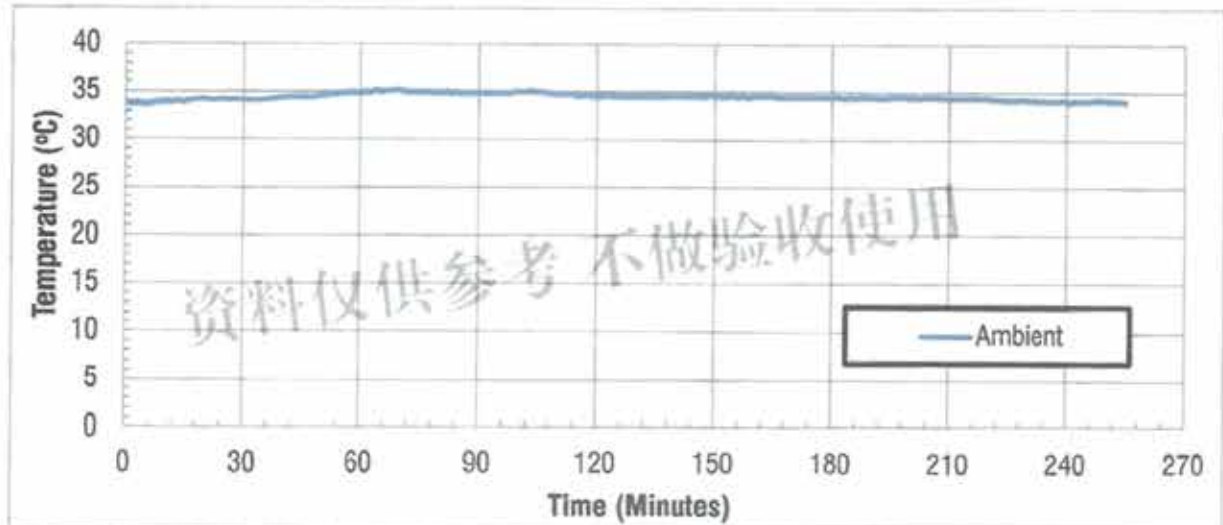
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6.4 Ambient Temperature

The ambient temperature over the test period was recorded and is shown in *Figure 5*.

The ambient temperature at the commencement of test was 32.3°C.

Figure 5. Ambient temperature over the test period.



6.5 Lateral Deflections

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

Measurements were taken in mm.

Maximum deflection measured on specimen was +68 mm at D1 at 240 and 250 minute of the test period.

Position \ Time (min)	0	30	60	90	120	150	180	210	220	
D1	+0	+25	+57	+63	+63	+65	+66	+66	+66	
D2	+0	+5	+10	+14	+14	+16	+13	+15	+18	
Position \ Time (min)	230	240	250							
D1	+67	+68	+68							
D2	+18	+14	+19							

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6.6 Observations

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

Time (min.sec)	Observation (from unexposed side)
00.00	Test Started.
07.06	The boards turned dull in appearance. Fire sealants at the gap between framework and fire board turned yellowish.
15.30	The boards turned deeper in color.
20.19	Smoke was released from the seams. A portion of the fire board turned dark brown at the top position of the specimen.
30.00	No integrity failure had occurred.
33.35	Light smoke was released from the seams.
35.28	Cotton fibre pad test was carried out over the lower right region on the specimen. No flaming or glowing on the cotton pad was observed.
49.53	The specimen was slightly deformed towards to furnace.
45.00	The specimen was stable. The center of the specimen move into the furnace.
60.00	No integrity failure had occurred.
95.00	The specimen was stable.
119.48	The specimen was stable.
120.00	No integrity failure had occurred.
146.31	Cotton fibre pad test was carried out over the upper left region on the specimen. No flaming or glowing on the cotton pad was observed.
168.08	The specimen was deformed towards to furnace.
178.16	Cotton fibre pad test was carried out over the upper left region on the specimen. No flaming or glowing on the cotton pad was observed.
179.59	Cotton fibre pad test was carried out over the upper right region on the specimen. No flaming or glowing on the cotton pad was observed.
180.00	The specimen was stable.
201.54	Glowing spots were observed at the crossing corner along second horizontal stud.
207.18	Cotton fibre pad test was carried out over the upper right region on the specimen. No flaming or glowing on the cotton pad was observed.
208.38	Cotton fibre pad test was carried out over the upper middle region on the specimen. No flaming or glowing on the cotton pad was observed.

Time (min.sec)	Observation Con't (from unexposed side)
209.43	Cotton fibre pad test was carried out over the upper left region on the specimen. No flaming or glowing on the cotton pad was observed.
220.08	The specimen was deformed towards to furnace.
235.45	Cotton fibre pad test was carried out over the upper left region on the specimen. No flaming or glowing on the cotton pad was observed.
236.34	Cotton fibre pad test was carried out over the upper right region on the specimen. No flaming or glowing on the cotton pad was observed.
237.30	Cotton fibre pad test was carried out over the upper left region on the specimen. No flaming or glowing on the cotton pad was observed.
240.00	No integrity failure had occurred.
250.00	The specimen was stable.
255.00	Test was terminated at request of the Sponsor.

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6.7 Photos

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Photo 1. Exposed surface of the specimen before test.



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

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Photo 3. Unexposed surface of the specimen at 30 minute of test.



Photo 4. Unexposed surface of the specimen at 60 minute of test.

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Photo 5. Unexposed surface of the specimen at 100 minute of test.



Photo 6. Unexposed surface of the specimen at 140 minute of test.

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Photo 7. Unexposed surface of the specimen at 180 minute of test.



Photo 8. Unexposed surface of the specimen at 210 minute of test.

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Photo 9. Unexposed surface of the specimen at 240 minute of test.



Photo 10. Unexposed surface of the specimen after the test.

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Photo 11. Exposed surface of the specimen after test.

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Test Results

Test was terminated after a period of 255 minutes at request of the Sponsor.

The test data obtained from the fire resistance test was assessed against performance criteria given in BS EN 1364-1: 1999. The test results are summarized in the following table.

Performance Criteria		Elapsed Time before Failure Occurrence
Integrity (E)		255 minutes
Criteria of Failure	Description	Elapsed Time before Failure Occurrence
Sustained Flaming	Continuous flaming for a period of time greater than 10 seconds on unexposed surface	255 minutes (No Failure)
Gap Gauge	Ø6 mm Penetration of the gauge into the furnace through the specimens and movable along a 150 mm gap	255 minutes (No Failure)
	Ø25 mm Penetration of the gauge into the furnace through the specimens	
Cotton Pad	Ignition of the cotton pad	255 minutes (No Failure)
Performance Criteria		Elapsed Time before Failure Occurrence
Insulation (I)		6 minutes
Criteria of Failure	Description	Elapsed Time before Failure Occurrence
Integrity Failure	The performance criterion "insulation" shall automatically be assumed not to be satisfied when the "integrity" criterion ceases to be satisfied	255 minutes (No Failure)
Average Temperature Rise	An increase of the average temperature of unexposed surface of the specimens above the initial average temperature by more than 140 °C	6 minutes
Maximum Temperature Rise	An increase of temperature at any other point of the specimens above the initial average temperature by more than 180 °C	7 minutes

7. Limitations

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

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

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8. Field of Direct Applications of Test Results

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

The series of rules and guidelines are defined in *Clause 13 "Field of direct application of test results"*, *BS EN 1364-1: 1999* and relevant clauses and annexes.

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

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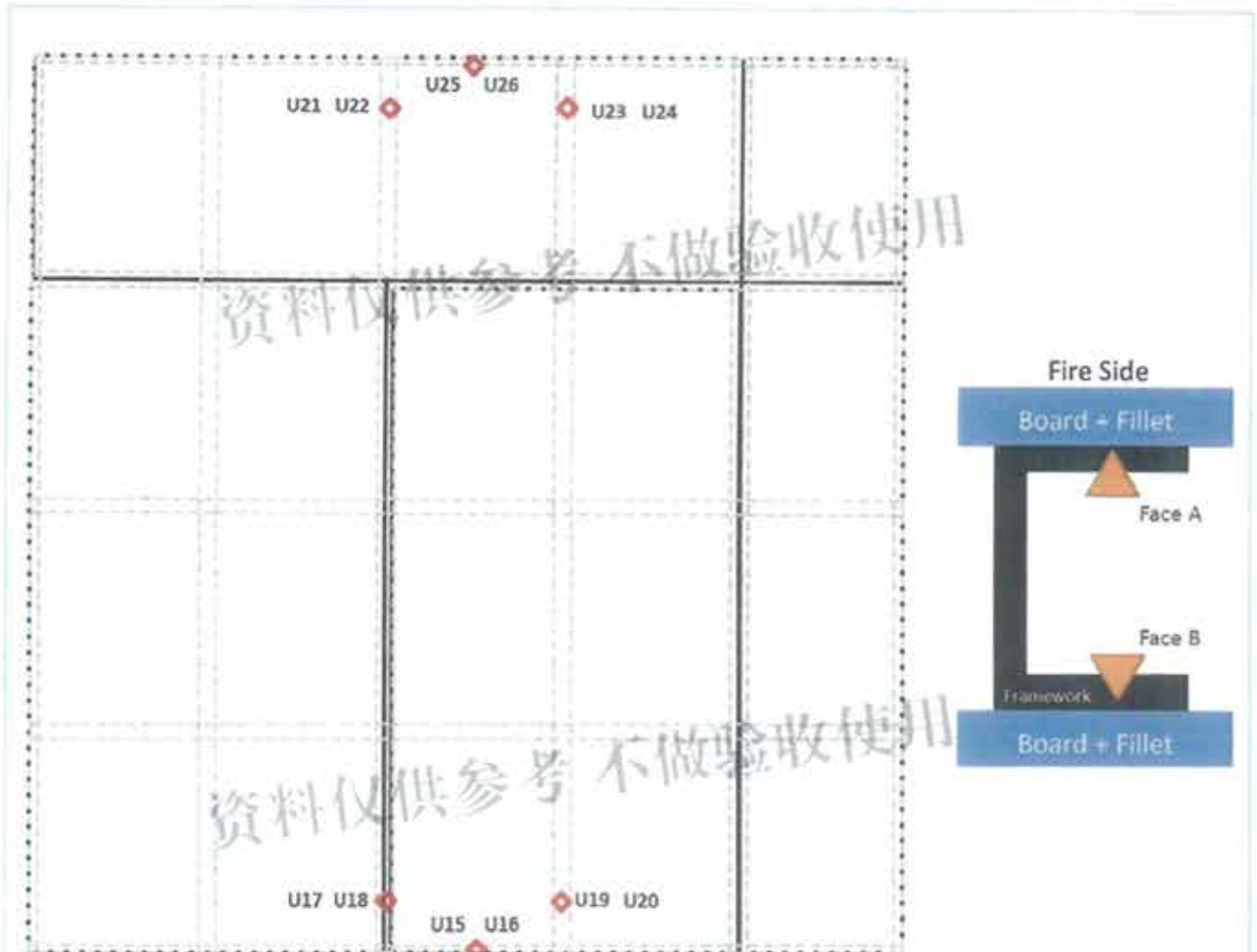
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Appendix A

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A.1 Additional Temperature – Framework

Fixed surface thermocouples were attached to different locations of the framework to obtain additional information. Locations of these thermocouples are shown and summarized in the following figure and table.



Location of Additional Thermocouples

Position	Face A	Face B
100 mm below Top Edge	U22, U24	U21, U23
500 mm above Bottom Edge	U18, U20	U17, U19
Centre of Top Track	U26	U25
Centre of Bottom Track	U16	U15

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Temperature outputs from unexposed surface temperature U21 to U26

Time (min)	U21	U22	U23	U24	U25	U26
0.0	34.5	33.1	33.1	32.3	32.9	32.9
5.0	57.2	49.2	57.6	48.3	76.6	46.4
10.0	91.2	93.3	96.1	92.8	95.1	77.2
20.0	161.1	147.0	182.9	151.6	115.2	117.1
30.0	247.5	199.2	266.3	196.7	182.0	145.7
40.0	293.4	229.4	309.9	222.6	220.7	165.3
50.0	315.2	239.7	336.8	234.0	241.0	174.6
60.0	331.0	250.5	352.4	242.7	257.6	185.5
70.0	335.1	253.3	360.8	246.7	270.8	192.2
80.0	337.1	254.6	364.3	247.5	283.3	199.6
90.0	341.2	257.5	369.4	250.8	295.3	206.4
100.0	343.2	260.8	373.3	253.5	304.0	210.8
110.0	346.9	264.9	376.6	257.6	309.8	214.4
120.0	350.1	268.4	379.9	261.3	314.9	216.7
130.0	352.4	268.8	383.0	261.4	321.8	221.1
140.0	353.7	271.2	385.4	266.2	324.7	223.5
150.0	357.5	274.0	386.5	267.4	329.7	226.4
160.0	359.1	274.8	388.0	268.9	333.1	228.2
170.0	359.9	275.2	389.3	268.7	336.5	233.2
180.0	362.7	278.9	389.4	270.5	341.3	236.0
190.0	365.0	279.4	392.7	271.6	345.3	238.9
200.0	366.2	279.2	394.5	271.4	349.5	243.4
210.0	344.0	286.0	395.2	274.2	352.4	245.2
220.0	341.1	286.7	397.8	274.5	356.4	249.2
230.0	344.8	285.8	400.3	274.6	360.9	251.9
240.0	129.3	288.7	403.6	279.3	360.4	250.4
250.0	123.0	291.6	405.1	280.2	369.4	257.6
255.0	120.3	293.2	404.9	281.1	369.2	256.4

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END OF REPORT

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Report Reference: IA15-030

Date: 22 April 2015

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ASSESSMENT ON FIRE RESISTANCE OF
DRYWALL PARTITION SYSTEM WITH SINGLE LAYER LINING
(240 MINUTES INTEGRITY)

Introduction

We were requested by Kingtec Building Materials (HK & Macau) Limited to provide an assessment of the fire performance of drywall partition system with 9 mm Hawk Pan Board single layer lining. This assessment report presents an appraisal of fire resistance performance of drywall partition system, which will satisfy the integrity criteria of BS 476: Part 22: 1987 not less than 240 minutes.

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2. Background
3. Analysis
4. Assessment/Conclusion
5. Term of validity
6. Declaration by the applicant

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1. Assumptions and Limitations

It is assumed that the proposed assembly will be installed to a masonry or reinforced concrete structure or equivalent, which can provide a particular stability, integrity and insulation of fire resistance period. The materials and constituents of the proposed assembly are in similar manners and quality as tested or otherwise appraised by Forte Testing and Consultants Company Limited (FORTE). This assessment may only be reproduced in full by applicant.

2. Background

2.1 Test Report No.IT 14-190

A fire resistance test was conducted by FORTE in accordance with BS EN 1364-1: 1999 on a specimen of non-loadbearing drywall partition system, to determine its fire resistance performance. The test sponsor was Kingtec Building Materials (HK & Macau) Limited. The overall sizes of the specimen were 3,050 mm width by 3,100 mm height. It was constructed with one layer of 9 mm thick Hawk Pan Board which fixed to a side of 0.5 mm thick steel stud framework through a 9 mm thick by 70 mm width Hawk Pan Board fillet. The dual steel studs spaced at maximum 600 mm centres and it was located on unexposed fire side. The specimen satisfied the integrity criterion of the standard for 255 minutes. Full construction details of the partition system and the test results were recorded in the test report numbered IT 14-190.

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3. Analysis

3.1 Drywall partition system with 240 integrity

It is proposed that the non-loadbearing drywall partition system construction 0.5 mm thick steel stud framework with 9 mm Hawk Pan Board fixed fillet on board side and single layer of 9 mm Hawk Pan Board lining on fire exposed side, will fulfill these requirements and acquire a fire resistance period of at not less than 240 minutes in accordance with integrity and insulation criteria of BS 476: Part 22:1987.

The details of the main components for proposed partition system are:

- 1) 9 mm Hawk Pan Board :
Maximum size per sheet – 1220 mm by 2440 mm
- 2) 9 mm Hawk Pan Board fillet with minimum 70 mm width
- 3) Galvanised steel U-channel:
Minimum size – 32 mm (flange) by 50 mm by 0.5 mm thick
24 mm (flange) by 50 mm by 0.5 mm thick

A layer of 9 mm Hawk Pan Board is screw fixed to a side of the steel stud framework. The spacing between the vertical steel channels is 600 mm. Minimum M4 self-tapping screws at 160 mm – 200 mm c/c are applied on the perimeter of the 9 mm thick Hawk Pan Board and framework members. The minimum 70 mm width fillet shall be located between the framework and the Hawk Pan Board and fixed on the steel framework by M4 flat screws with 150 mm – 200 mm c/c. All screws were located not less than 10 mm from board's edges. Fire sealant is applied to screws points and board's joints.

The fire resistance test report numbered IT14-190, demonstrated that non-loadbearing 9 mm thick Hawk Pan Board partition system has obtained more than 240 minutes integrity performance in accordance with BS 1364-1:1999. After detailed review of the test methods, BS 476: Part 22: 1987 and BS EN 1364-1: 1999, a summary of the primary differences of the test method is presented in Table 1.

Table 1: Gap analysis between BS 476: Part 22: 1987 and BS EN 1364-1: 1999

Parameter	BS 476 : Part 22	BS EN 1364-1: 1999
Standard fire curve	BS 476 : Part 20: 1987 $T = 345 \log_{10}(8t + 1) + 20$	EN 1363-1: 1999 $T = 345 \log_{10}(8t + 1) + 20$
Furnace thermocouple	Type K according to BS 4937.4 with diameter 0.75 mm - 1.5mm, insulated with twin bore porcelain insulators, hot junction project 25 mm from the insulator, or; Mineral insulated metal sheathed type K with overall diameter 1.5 mm, protected with porcelain insulator, hot junction project 25 mm from the insulator.	Plate thermometer, consisted of a mineral insulated steel sheathed type K according to IEC 584-1 with diameter 1 mm, connected to with a steel plate of final size 100 mm square
Furnace pressure	Neutral pressure plane at 1M	Neutral pressure plane at 500 mm
INTEGRITY: Sustained flaming Cotton pad Gap gauges	Failure shall be deemed to have occurred when one of the following occurs: Not less than 10s Applied for 10 – 15 seconds Employed after 5min: 6mm X 150mm (other than at sill level), 25mm dia. For any gap	Failure shall be deemed to have occurred when one of the following occurs: More than 10s Applied for 30 seconds Employed after 5min : 6mm X 150mm (other than at sill level), 25mm dia. For any gap
Deflection measurement	Monitor lateral deflection.	Deformation measurements to be made at specified locations.
Direct field of application	Not included.	Included.

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The test specification and failure criteria for both BS 476 and BS EN 1364-1 are shown in table 1. The time/temperature relationship is the same for both test standards; however, the EN test is controlled using plate thermometers that, due to their slow response, result in the EN test being more severe than the BS test during the early stages of a test. However, unexposed surface temperature measuring points for the partition system under BS EN 1364-1 are more than the requirements stated in the standard of BS 476: Part 22. The Hawk Pan Board with 9 mm thick on the unexposed surface of the partition system remained intact, no notable fractures and without insulation failure observed from the test reports numbered IT14-190. There is no integrity between the joint of the board system during the fire test. Based upon the test evidence, the tested specific partition system with single layer of 9 mm thick Hawk Pan Board and the steel framework located to the fire unexposed side would be capable of achieving the integrity of not less than 240 minutes in accordance with BS 476: Part 22: 1987.

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4. Assessment/Conclusion

It is concluded that the dry wall partition system with 9 mm Hawk Pan Board single lining detailed in Section 3 of this report will also achieve the fire resistance of not less than 240 minutes integrity if tests in accordance with BS 476: Part 22: 1987.

5. Term of validity


This assessment is issued on the basis of test data and information to hand at the time of issue and it is valid only if presented with proper test evidence(s) and all noted supporting data. If contradictory evidence becomes available to FORTE, the assessment will be unconditionally withdrawn and the applicant will be notified in writing. Similarly the assessment is invalidated if the assessed construction is subsequently tested since actual test data is deemed to take precedence over an expressed opinion. This assessment will expire on 22 April 2020, which time it is recommended that it be submitted to FORTE for re-appraisal.

For and on behalf of Forte Testing and Consultants Company Limited:

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CHENG San Mei, Sammi
Laboratory Manager



Ir Dr CHAN Yuk Kit, James, RPE (Fire)
Managing Director

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6. Declaration by the applicant

- We the undersigned confirm that we have read and complied with the obligations placed on us by this guide on undertaking assessments.
- 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.
- 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.
- We are not aware of any information that could affect the conclusions of this assessment.
- If we subsequently become aware of any such information we agree to ask FORTE to withdraw the assessment

Name: _____

Sammy Chan Choi Wan

Signed: _____

[Handwritten Signature]

For and on behalf of: _____

