CHINA UNION BUILDING MATERIALS

We believe that passive fire protection is a crucial element of building safety that can save lives and prevent property damage.

We're provide wide range of fireproof board for building.

KINGTEC
HAWK PAN BOARD

4-hours Fire Rated Board Partition System

WE BUILD SAFE SPACES FOR EVERYONE.

Our fireproof board complies with BS and BS EN standards.

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INTRODUCTION

Depending on its location and function within a building, a wall, ceiling and E&M enclosure may need to meet various requirements during a fire. Fire-resisting walls that partition spaces and enclose compartments must act as a barrier to prevent the spread of fire from either side. Therefore, it is essential for these walls to meet all relevant criteria: integrity, insulation, and, if applicable, load-bearing capacity; all from both sides for the specified fire resistance duration.

Fire Compartmentation

Fire-resistant partitions serve as a means of compartmentalization, effectively separating various fire hazards.

Fire safe exit passage ways

In a fire, exit routes must be fire safe and fully compartmented to prevent fire spread. It's crucial to limit thermal heat transfer in walls to ensure a safe environment for occupants escaping.

Fire resistant party walls and Ceiling

One cannot control the fire risks posed by neighbors who share a common wall delineating different properties. Fire-resistant party walls and ceiling are essential in preventing the spread of fire from one unit to an adjacent one, thereby enhancing safety for all occupants.

INTRODUCTION

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Hawk Pan calcium silicate fire board systems are fire-resistant, lightweight, clean, and easy to install, making them ideal for a variety of building projects.

These products provide exceptional thermal insulation and fire protection across numerous applications. They are particularly well-suited for internal partitions, ceilings, and electrical and mechanical enclosures, especially within drywall construction.

In addition to protecting lives and assets, Hawk Pan help conserve space and energy, reduce CO2 emissions, and enhance overall efficiency.

Designed to safeguard timber, concrete, or steel structures, these boards can also function as self-supporting elements, such as partition walls and ceilings. With their aesthetically pleasing finish, they serve as an all-in-one architectural feature that facilitates quick construction while optimizing space.

Manufactures Certification

Hawk Pan under a Quality Management System compliant with the International Standard ISO 9001:2008.

TESTING AND THIRO-PARTY CERTIFICATION

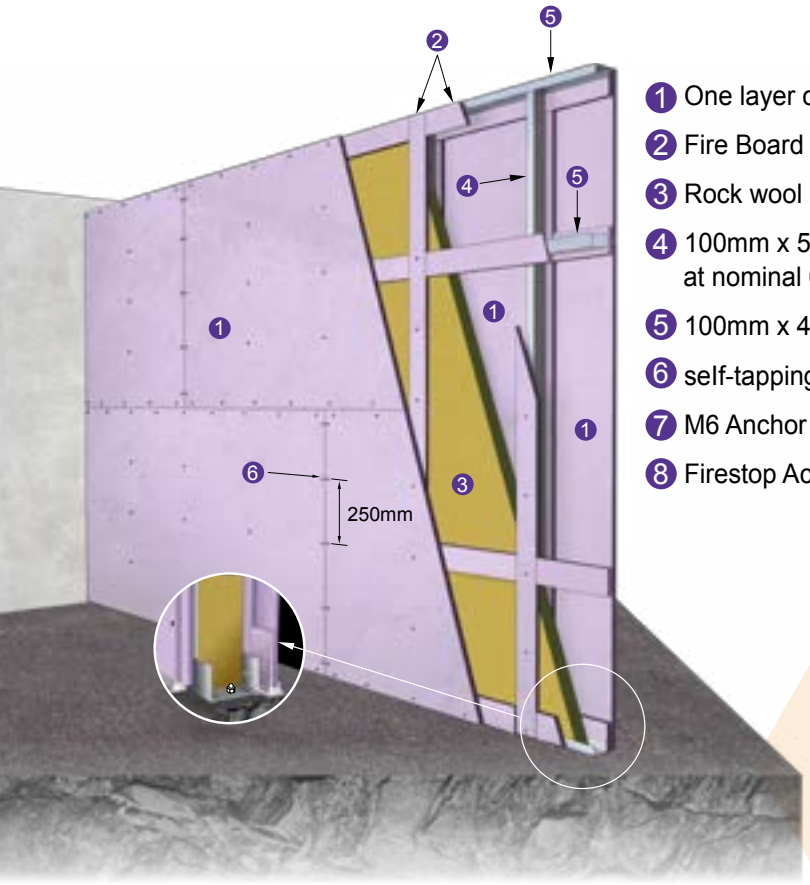
Hawk Pan calcium silicate board systems have been rigorously tested and evaluated to comply with the following standards:

BS 476: Part 4, 6 & 7
BS 476: Part 20: 1987
BS 476: Part 22: 1987

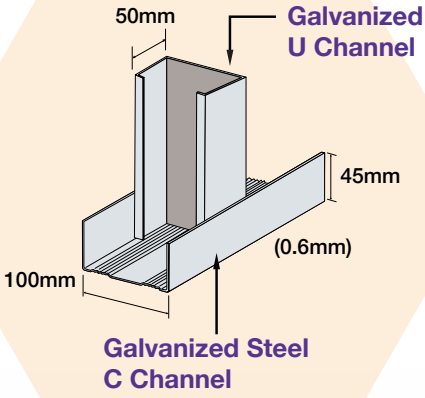
Key Benefits of Hawk Pan:

- Fire-resistant
- Extremely low thermal conductivity
- Excellent mechanical integrity
- Minimal shrinkage
- Non-combustible
- Corrosion-resistant
- Impact-resistant
- Moisture-resistant
- Low to no maintenance required
- Environmentally friendly and safe
- Compliant with international fire protection standards
- High thermal resistance and stability up to 1,100 degrees Celsius

4 - hours fire insulation and integrity with fiew on either side

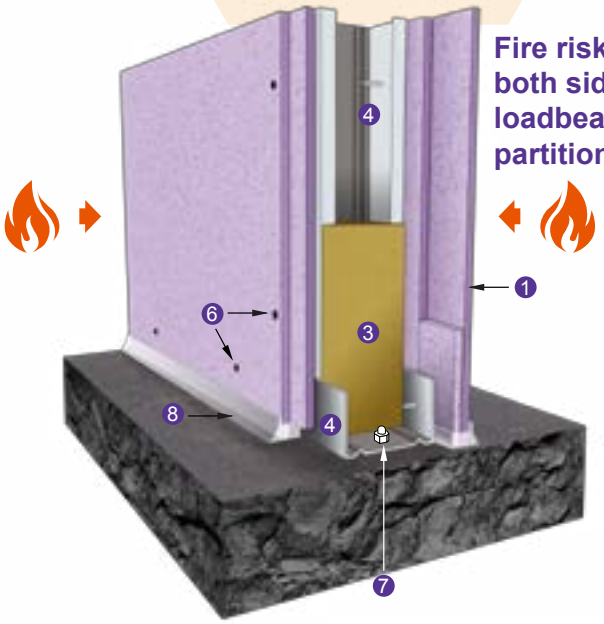


1. One layer of 12mm thick HAWK Pan (fire rated board)
2. Fire Board Fillet (100 x 12mm)
3. Rock wool 100mm x 110kg/m^3
4. 100mm x 50mm x 0.6mm thick Galvanized Steel U Channel at nominal 610mm by 1220mm centres
5. 100mm x 45mm x 0.6mm thick Galvanized Steel C Channel
6. self-tapping screws M3.5 at nominal 250mm centres
7. M6 Anchor bolts at nominal 500mm centres
8. Firestop Acrylic Sealant



Fire resistance	FRL	-/240/240
	Standard	BS EN 1364: Part 1: 1999 BS EN 1363: Part 1: 1999
	Approval	IT 14-1919 FORTE
Acousitc	Standard #STC	ASTM E90-09, ASTM E413-10 45, 58
	Standard #RW	ISO140: Part 1&3: 1996 48 DB
	Predicted assessment	(A + A)*L 20th August 2015
Construction	Maximum height	6000mm
	Partition length	Unlimited
	Partition thickness	Nominal 148mm
	Partition mass	From 60kg/m^2

#Margin of error is generally within ±3dB



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Basic knowledge

Sound is the vibration of an object that is felt through the human auditory organ. Acoustics involves many disciplines such as natural science, psychology, and art.

The normal hearing frequency range of the human ear is 20 - 20KHz, 5OOHz and below is low frequency, 500Hz - 2000Hz is medium frequency, and 2000Hz is high frequency. The sound level is used to describe the size of the sound, which is calculated by adding the sound of each frequency. Generally, the A sound level is used. The hearing sound level range of the human ear is 0-120dB. Below 15dB is an extremely quiet environment, 25-30dB is a quiet environment, 30-35dB is a quiet environment, and above 40-50dB is a noisy environment.

Noise damages hearing, affects health, and interferes with work and normal life, so it should be controlled.

The sound insulation of a wall is an indicator of the wall's ability to isolate noise. The larger the value, the better the sound insulation effect.

2.Principle of air sound insulation

Sound is the vibration of an object that is felt through the human auditory organ. Acoustics involves many disciplines such as natural science, psychology, and art.

The normal hearing frequency range of the human ear is 20 - 20KHz, 5OOHz and below is low frequency, 500Hz - 2000Hz is medium frequency, and 2000Hz is high frequency. The sound level is used to describe the size of the sound, which is calculated by adding the sound of each frequency. Generally, the A sound level is used. The hearing sound level range of the human ear is 0-120dB. Below 15dB is an extremely quiet environment, 25-30dB is a quiet environment, 30-35dB is a quiet environment, and above 40-50dB is a noisy environment.

Noise damages hearing, affects health, and interferes with work and normal life, so it should be controlled.

The sound insulation of a wall is an indicator of the wall's ability to isolate noise. The larger the value, the better the sound insulation effect.

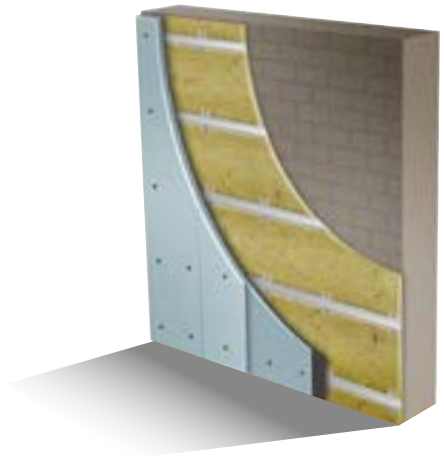
3. Inspection standards

The air sound insulation of KT partition walls complies with the "Building Sound Insulation Evaluation Standard" (GB/T19889.3-2005)

KT partition wall air sound insulation testing complies with the "Sound Insulation Measurement of Acoustic Buildings and Building Components" (GB/T19889.3-2005)

Sound insulation prediction

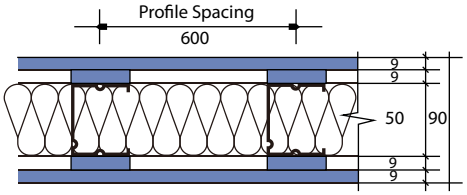
Based on the accumulation of a large number of sound insulation test databases, dry wall sound insulation prediction is carried out as a design guide. The relationship between the actual sound insulation of the wall on site and the laboratory test value is complicated by influencing factors (such as the influence of lateral sound transmission, etc.). In the design, when using laboratory test data, a margin should be left based on the actual situation.



Airborne sound insulation standards

Building Type	Partition area	Calculate sound insulation			
		Special	Level 1	Level 2	Level 3
Residential	Resident/Resident (partition wall)	-	≧50	≧45	≧40
SCHOOL	Classroom/Classroom	-	≧50	≧45	≧40
	Ward/ward	-	≧45	≧40	≧35
	Sick room/noise room	-	≧50	≧50	≧45
hospital	Operating room/ward	-	≧50	≧45	≧40
	Operating room/noise room	-	≧50	≧50	≧45
	Audiometry Room/Other Rooms	-	≧50		
Hotel	Guest Rooms/Guest Rooms	≧50	≧45	≧40	≧40
	Guest Rooms/Corridor (including door)	≧40	≧40	≧35	≧30

STC 45

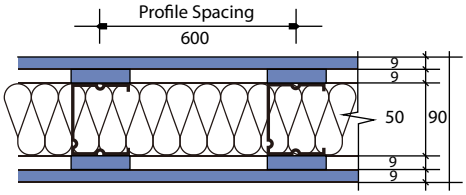


Fire-rated Partition System

The partition system was constructed in the test opening between Receiving Room and Source Room and consisted of:

Face layer : 9mm Klngtec Hawk Pan calcium silicate board (9kg/m²)
Base layer : 9mm x 50mm Klngtec Hawk Pan calcium silicate fillet (9kg/m²)
Metal Stud : 50mm Steel Stud
Acoustic Infill : 50mm Rockwool (5kg/m²)
Base layer : 9mm x 50mm Klngtec Hawk Pan calcium silicate fillet (9kg/m²)
Face layer : 9mm Kingtec Hawk Pan calcium silicate board (9kg/m²)

STC 48



Fire-rated Partition System

The partition system was constructed in the test opening between Receiving Room and Source Room and consisted of:

Face layer : 9mm Klngtec Hawk Pan calcium silicate board (9kg/m²)
Base layer : 9mm x 50mm Klngtec Hawk Pan calcium silicate fillet (9kg/m²)
Metal Stud : 50mm Steel Stud
Acoustic Infill : 50mm Rockwool (5kg/m²)
Base layer : 9mm x 50mm Klngtec Hawk Pan calcium silicate fillet (9kg/m²)
Face layer : 9mm Kingtec Hawk Pan calcium silicate board (9kg/m²)

STC 50A

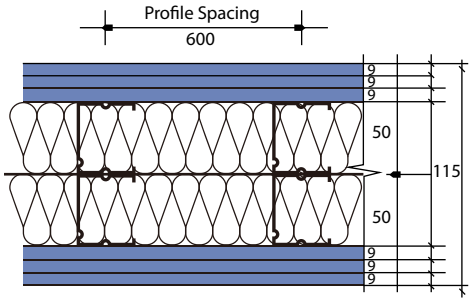


Figure 3.1: The proposed configuration of modified partition system Type A.

Type A:
The 150mm thick partition system compooeo of totally four layers of 12mm thick Kingtec Hawk Pan calcium silicate board with nominal density of 1000kg/m³, 2 x 50mm thick steel stud (at 600mm o.c.) with containing 50mm thick rockwool insulation (density: 100kg/m³).All gaps are fully caulked.

Face layer	: 12mm Klngtec Hawk Pan calcium silicate board (12kg/m²)
Base layer	: 12mm Klngtec Hawk Pan calcium silicate board (12kg/m²)
Metal Stud	: 2 x 50mm Steel Stud
Acoustic Infill	: 2 x 50mm Rockwool (5kg/m²)
Base layer	: 12mm Klngtec Hawk Pan calcium silicate board (12kg/m²)
Face layer	: 12mm Klngtec Hawk Pan calcium silicate board (12kg/m²)

STC 50B

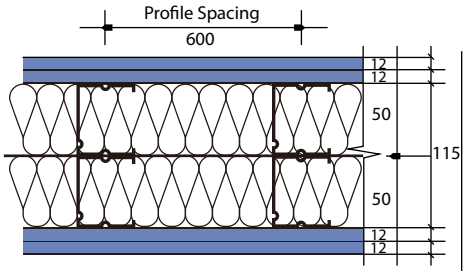
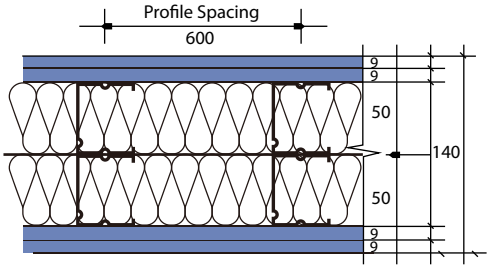


Figure 3.2: The proposed configuration of modified partition system Type B.

Type B:
The 150mm thick partition system compooeo of totally four layers of 12mm thick Kingtec Hawk Pan calcium silicate board with nominal density of 1000kg/m³, 2 x 50mm thick steel stud (at 600mm o.c.) with containing 50mm thick rockwool insulation (density: 100kg/m³).All gaps are fully caulked.

Face layer	: 12mm Klngtec Hawk Pan calcium silicate board (12kg/m²)
Base layer	: 12mm Klngtec Hawk Pan calcium silicate board (12kg/m²)
Metal Stud	: 2 x 50mm Steel Stud
Acoustic Infill	: 2 x 50mm Rockwool (5kg/m²)
Base layer	: 12mm Klngtec Hawk Pan calcium silicate board (12kg/m²)
Face layer	: 12mm Klngtec Hawk Pan calcium silicate board (12kg/m²)

STC 58

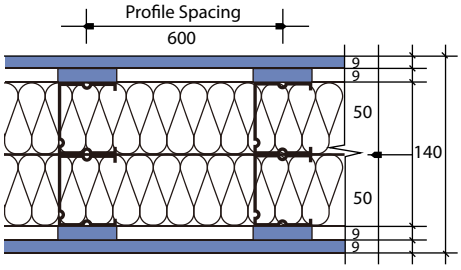


Fire-rated Partition System

The partition system was constructed in the test opening between Receiving Room and Source Room and consisted of:

Face layer	: 9mm Klngtec Hawk Pan calcium silicate board (12kg/m²)
Base layer	: 9mm Klngtec Hawk Pan calcium silicate board (12kg/m²)
Metal Stud	: 50mm Steel Stud x 2
Acoustic Infill	: 50mm Rockwool (5kg/m²) x 2
Base layer	: 9mm Klngtec Hawk Pan calcium silicate board (9kg/m²)
Face layer	: 9mm Klngtec Hawk Pan calcium silicate board (9kg/m²)

STC 59



Fire-rated Partition System

The partition system was constructed in the test opening between Receiving Room and Source Room and consisted of:

Face layer	: 9mm Klngtec Hawk Pan calcium silicate board (12kg/m²)
Base layer	: 9mm Klngtec Hawk Pan calcium silicate board (12kg/m²)
Metal Stud	: 50mm Steel Stud x 2
Acoustic Infill	: 50mm Rockwool (5kg/m²) x 2
Base layer	: 9mm Klngtec Hawk Pan calcium silicate board (9kg/m²)
Face layer	: 9mm Klngtec Hawk Pan calcium silicate board (9kg/m²)

FORTE
TESTING AND CONSULTANTS CO., LTD.

HOKLAS 191
TEST

FIRE RESISTANCE TEST REPORT

PARTITION SYSTEM with SINGLE LAYER LINING

in accordance with ***BS EN 1364-1: 1999***

Test Sponsor: **Kingtec Building Materials (HK & Macau) Limited**
Unit 1, 3/F., Block B, Shatin Industrial Centre,
5-7 Yuen Shun Circuit, Shatin, New Territories, Hong Kong.
Tel: 852-2640 8688 Fax: 852-2142 8128

Test Laboratory: **Forte Testing and Consultants Company Limited**
Contact Information:
Room 11, 2 Floor, Po Hong Centre, 2 Wang Tung Street,
Kowloon Bay, Kowloon, Hong Kong.
Tel: 852-2152 0638 Fax: 852-3186 2737

Report Number: **IT 14-190**

Date of Issue: **2014-10-20**

HOKLAS Approved Signatory: **Ir. Dr Chan Yuk Kit**

1. Scope of Test

This report is a record of a fire resistance test conducted by Forte Testing and Consultants Co., Ltd, in conformity with requirements in *BS EN 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

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.

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

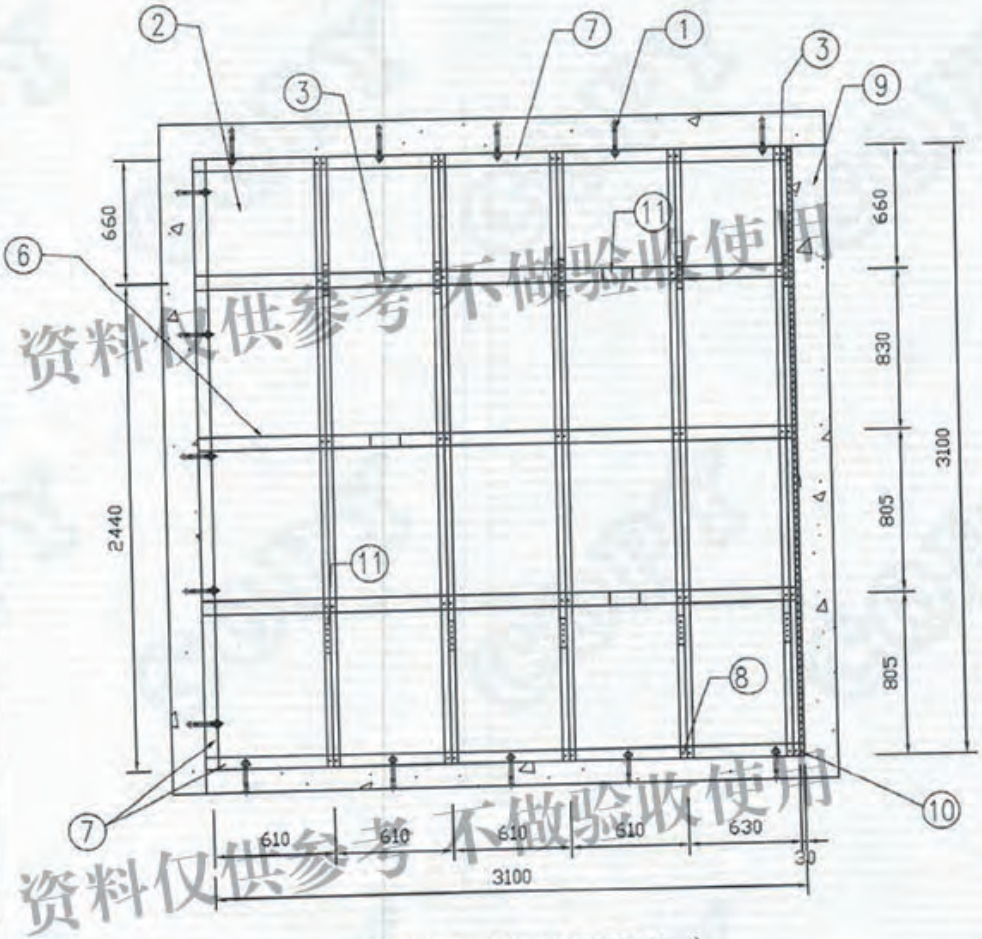
Supplier:	Kingtec Building Materials (HK & Macau) Limited
Type:	Expansion Anchor Bolt
Material:	Steel
Sizes:	Ø6 mm x 60 mm
Location Applied:	Perimeter Framework to Test Rig

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)

Drawings of Specimen provided by the Sponsor (1)



(STRUCTURAL FRAMEWORK)

① ANCHOR BOLT (φ6*60mm)
② FIRE BOARD (2440*1220*9mm)
③ GALVANIZED STEEL C-CHANNEL (C32*50*0.5mm)
④ SELF-TAPPING SCREW (φ3.5*35mm@250mm)
⑤ FIRE BOARD FILLET (70*9mm)
⑥ FIRE SEALANT
⑦ GALVANIZED STEEL U-CHANNEL (U24*50*0.5mm)
⑧ BLIND RIVETS (φ4*10mm)
⑨ CONCRETE SUPPORTING RIG
⑩ CERAMIC FIBRE
⑪ CONNECTION CHANNEL (U24*50*0.5mm)

FIGURE 1

Drawings of Specimen provided by the Sponsor (2)

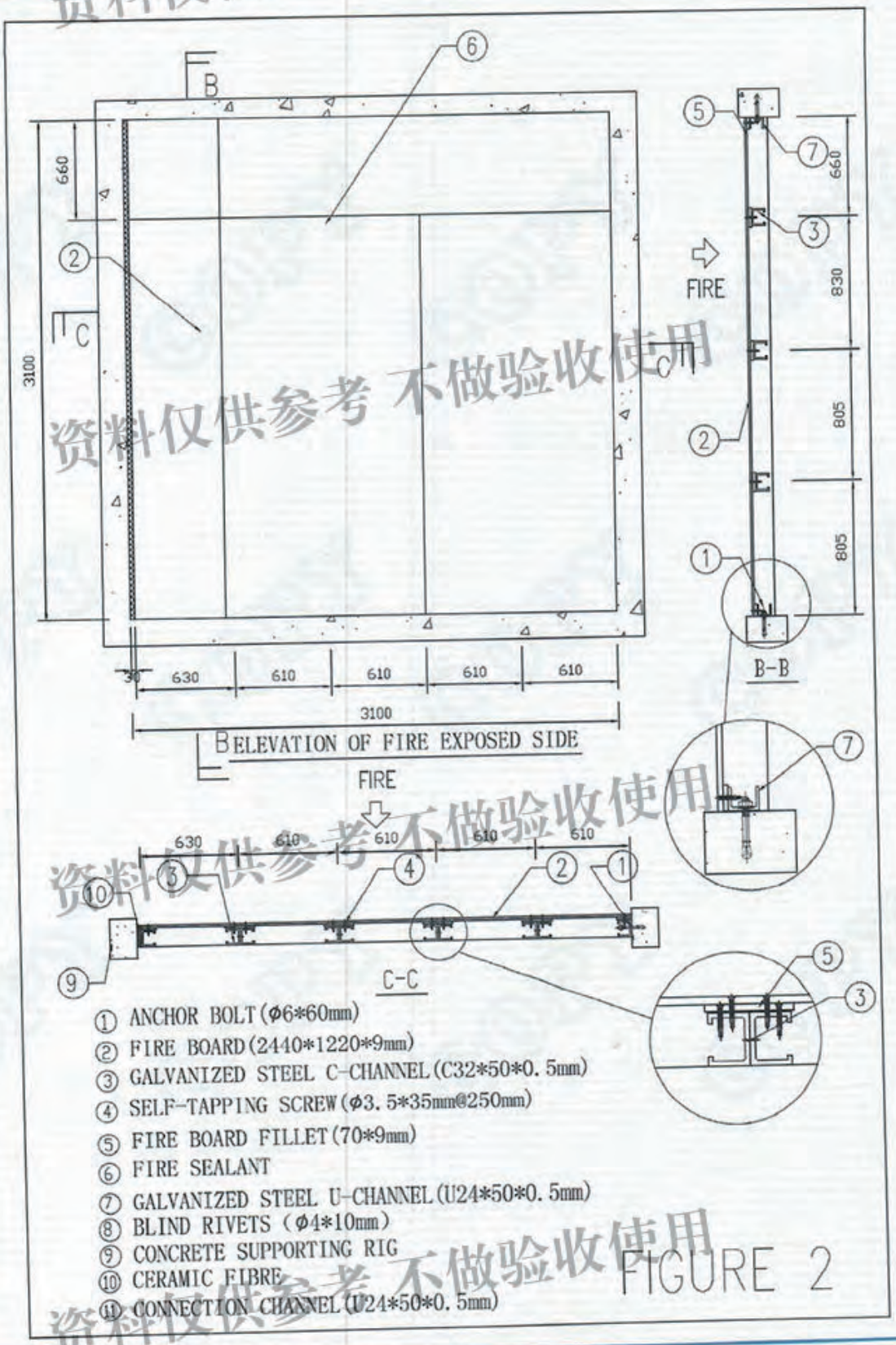


FIGURE 2

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.

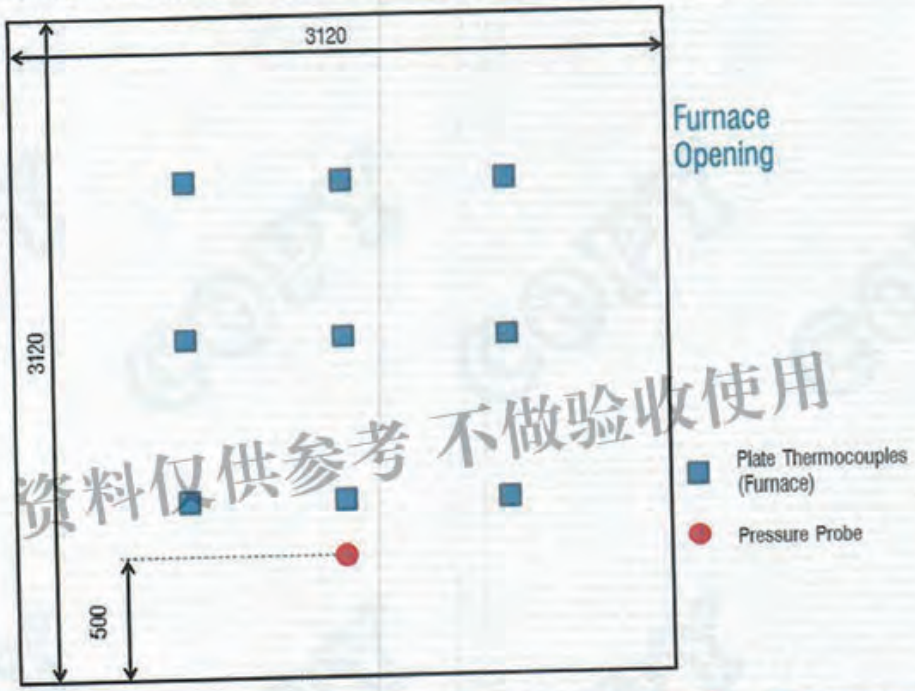
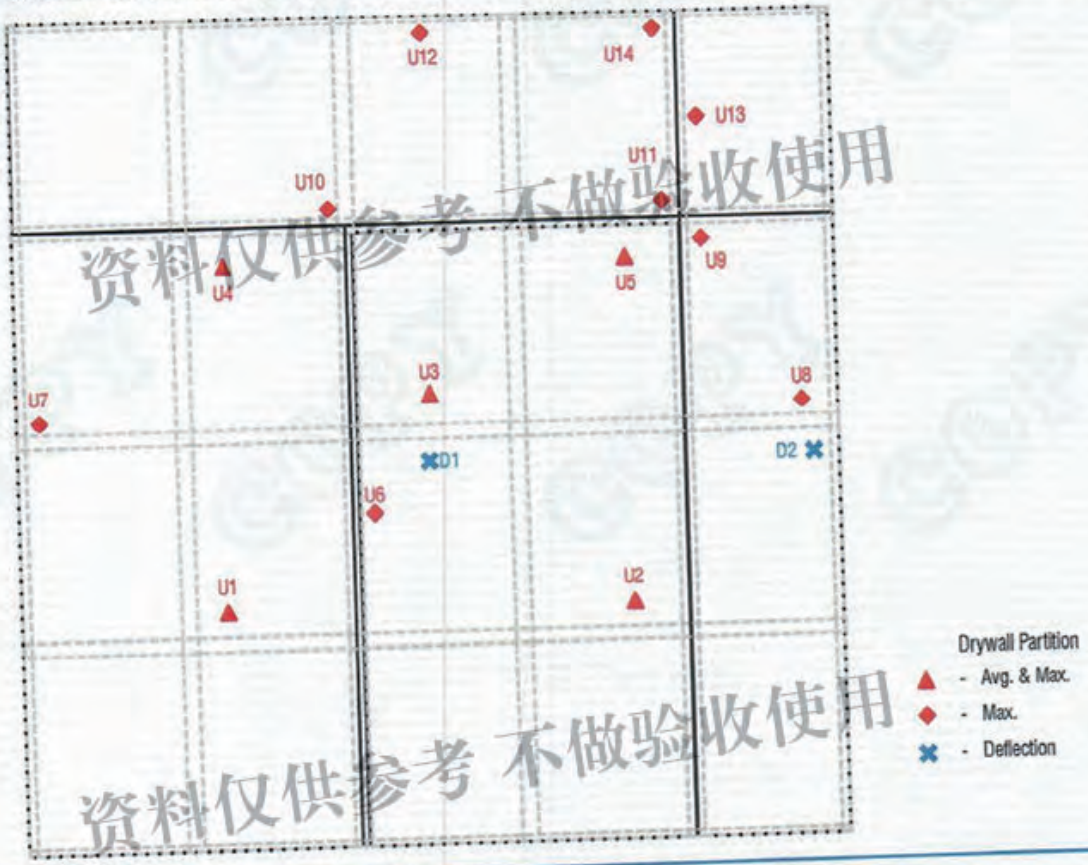


Figure 2. Positions of fixed surface thermocouples (U) and deflection measuring points (D) on the specimen.

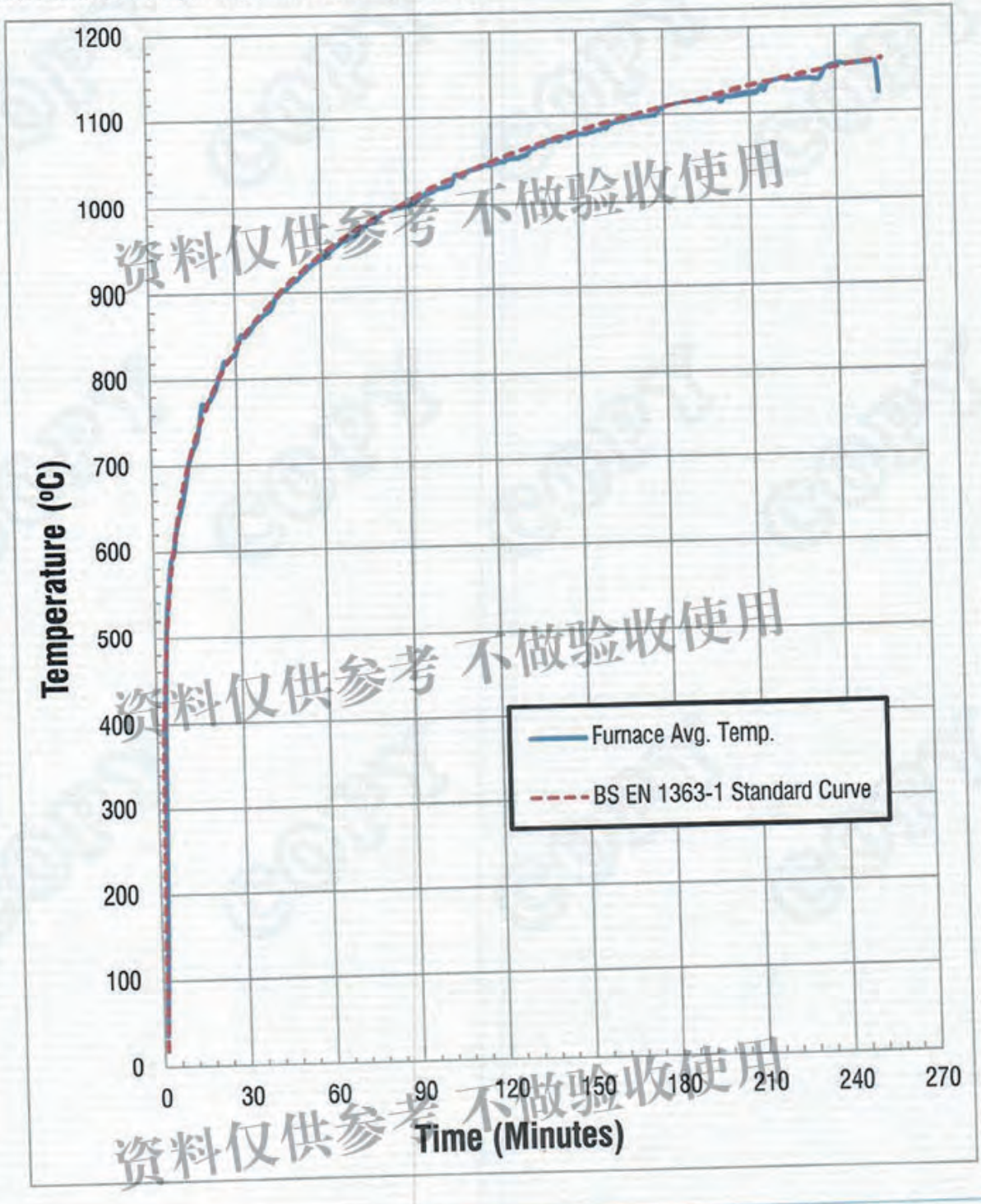


6. Test Data

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.



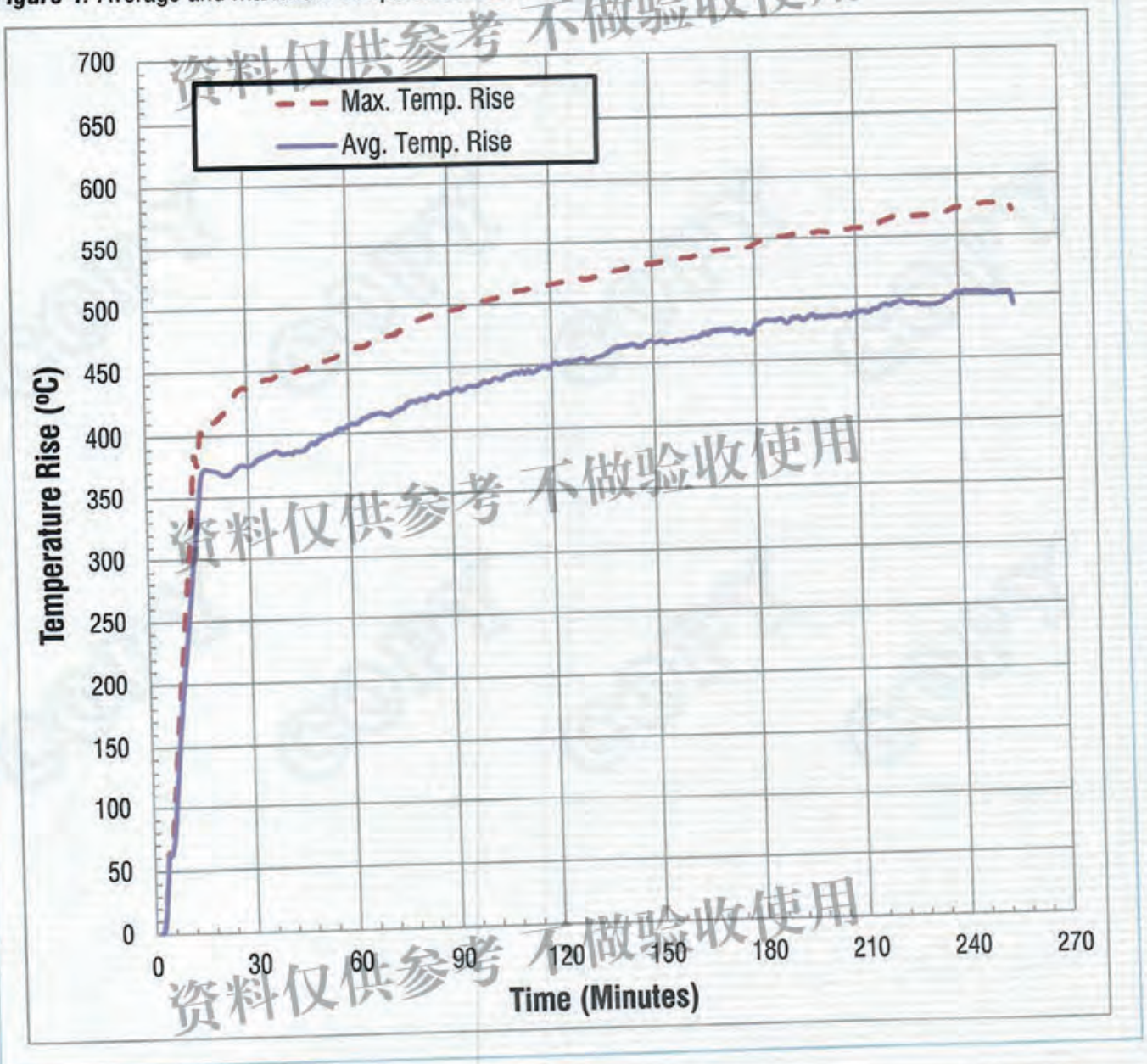
6.2 Unexposed Surface Temperature Rise

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	159.3	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.

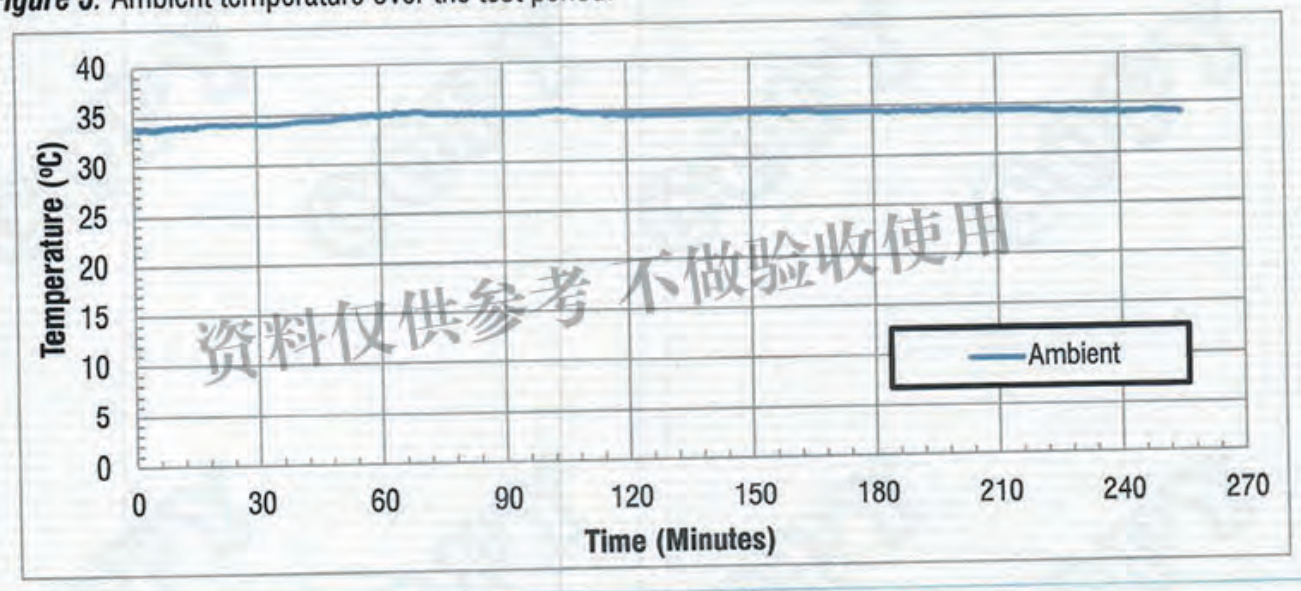
Time (min)	Pressure: 500 mm above notional floor level	Time (min)	Pressure: 500 mm above notional floor level
6	-2.5	140	0.8
10	-2.0	150	1.2
20	1.7	160	-1.5
30	1.5	170	1.1
40	-0.2	180	0.2
50	-0.9	190	0.5
60	2.8	200	-1.2
70	-1.0	210	-0.4
80	-0.7	220	-1.8
90	-1.4	230	0.5
100	-0.8	240	1.3
110	-1.2	250	-2.0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

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

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.**

6.7 Photos

Photo 1. Exposed surface of the specimen before test.

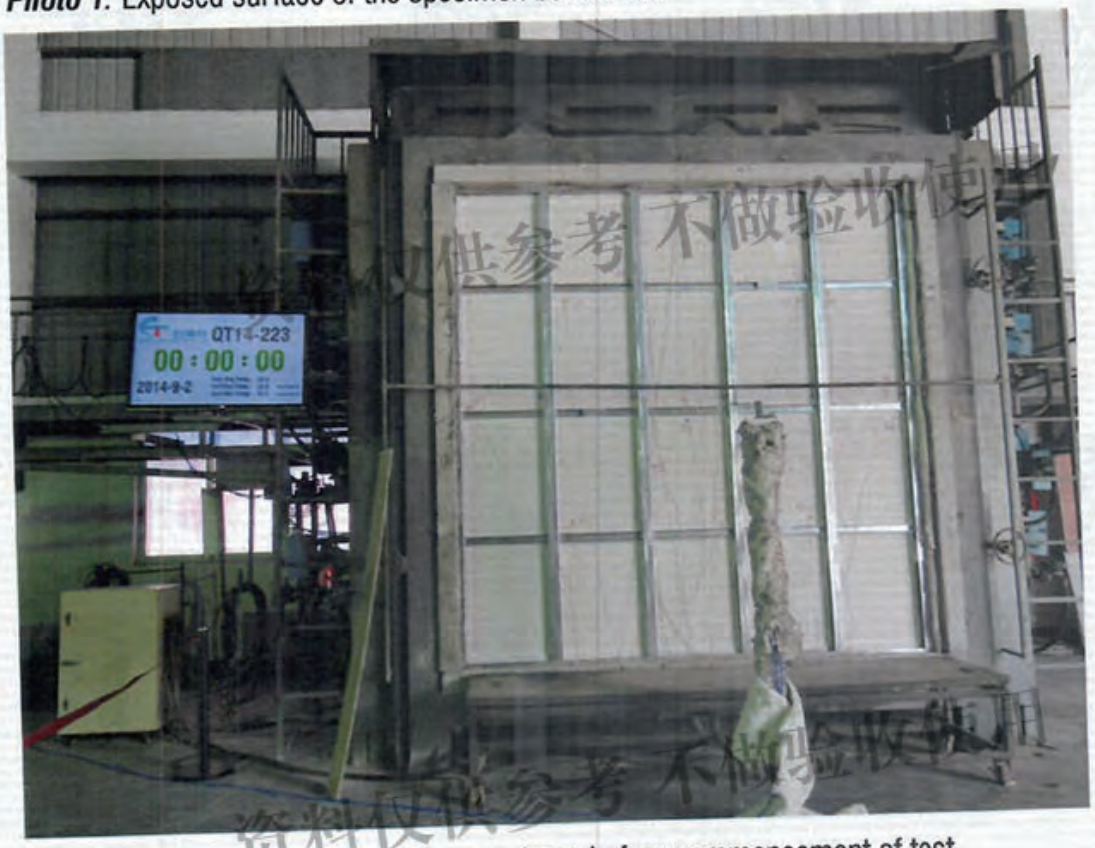


Photo 2. Unexposed surface of the specimen before commencement of test.

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

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

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

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

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

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

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

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

Photo 11. Exposed surface of the specimen after test.

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.

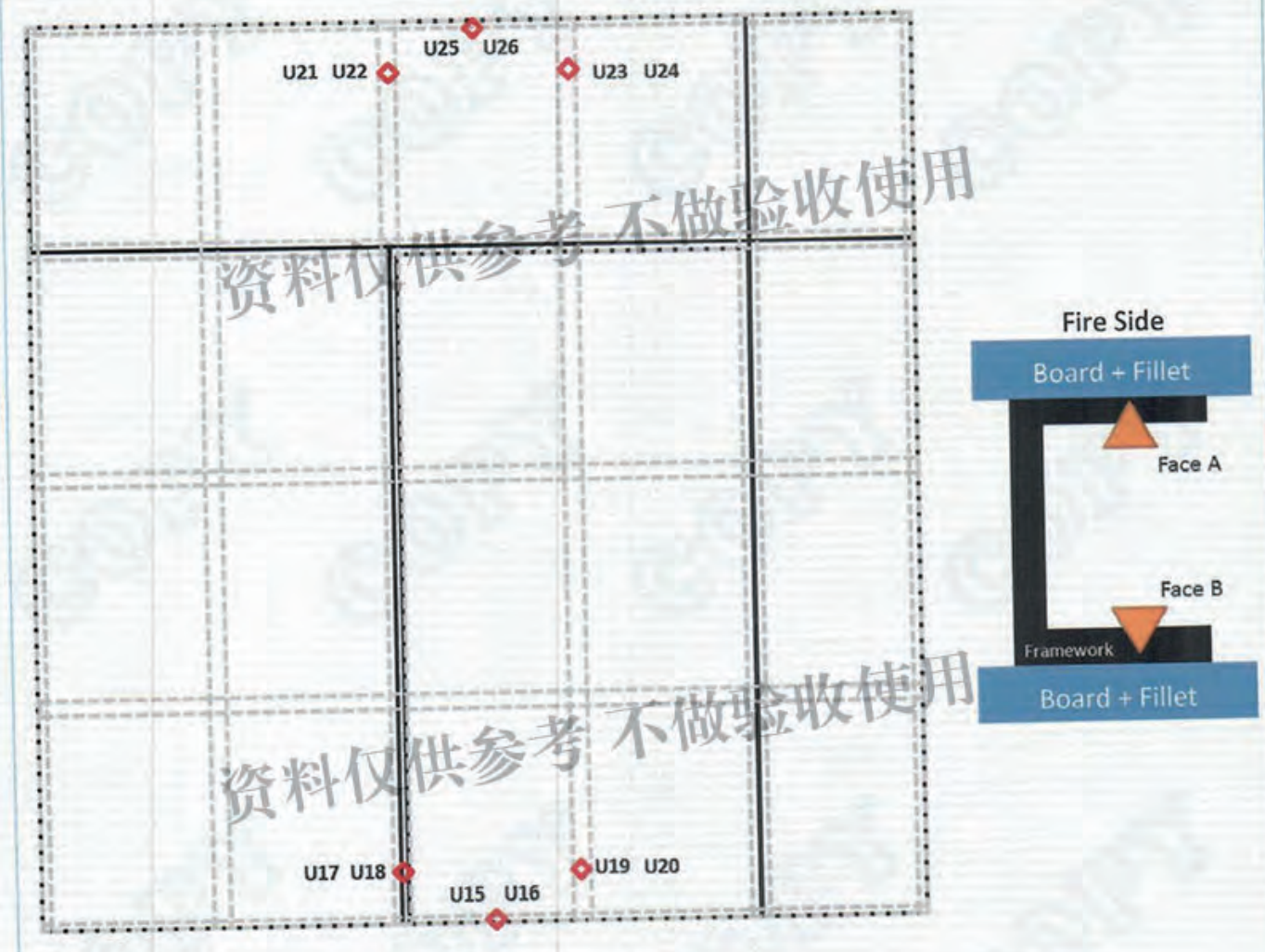
The series of rules and guidelines are defined in *Clause 13 "Field of direct application of test results", BS EN 1364-1: 1999* and relevant clauses and annexes.

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.

Appendix A

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

A.2 Additional Thermocouples – Detailed Temperature Records

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

Temperature outputs from unexposed surface temperature U15 to U20

Time (min)	U15	U16	U17	U18	U19	U20
0.0	32.8	32.0	34.0	33.8	34.2	34.2
5.0	39.7	36.2	57.4	44.4	58.3	43.8
10.0	93.2	68.5	97.7	85.2	97.2	84.7
20.0	98.3	91.4	159.9	120.6	171.5	120.2
30.0	151.6	110.4	236.2	150.4	252.0	158.2
40.0	188.6	132.2	278.7	174.0	288.9	180.3
50.0	201.4	142.7	298.4	186.0	305.3	188.8
60.0	215.7	150.8	312.7	193.6	316.4	195.4
70.0	223.8	150.8	318.4	190.9	321.1	193.4
80.0	228.8	153.3	318.1	187.4	320.3	190.4
90.0	235.8	158.0	321.7	188.9	322.4	191.4
100.0	242.8	161.7	327.3	191.5	325.1	194.1
110.0	250.3	167.6	332.2	196.1	328.8	196.1
120.0	256.1	172.9	335.2	198.2	332.7	197.8
130.0	262.5	176.8	336.4	198.4	334.4	199.1
140.0	270.4	186.9	343.2	205.1	340.5	204.8
150.0	274.4	187.9	343.6	204.7	341.7	204.1
160.0	279.4	192.5	343.3	207.8	344.2	207.9
170.0	285.2	196.8	345.9	209.4	349.2	212.5
180.0	285.1	196.4	343.9	206.3	346.4	207.7
190.0	290.1	199.5	347.6	208.2	348.9	209.1
200.0	292.8	199.9	349.1	209.0	348.7	208.2
210.0	296.6	204.4	352.6	212.5	351.4	212.4
220.0	299.6	208.4	356.3	215.6	354.0	215.5
230.0	301.9	207.9	356.6	214.8	353.3	211.6
240.0	304.2	211.0	360.5	218.6	357.5	218.5
250.0	306.4	213.2	362.6	217.6	356.9	213.3
255.0	307.6	213.6	361.4	214.9	356.3	215.1

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

END OF REPORT

FORTE
TESTING AND CONSULTANTS CO., LTD.

Flat 31, 5/F., My Loft, 9 Hoi Wing Road,
Tuen Mun, Hong Kong.
Tel.: (852) 2152 0638 Fax: (852) 3186 2723

Kingtec Building Materials (HK & Macau) Limited

Unit 1, 3/F., Block B, Shatin Industrial Centre,

5-7 Yuen Shun Circuit, Shatin, New Territories, Hong Kong.

Report Reference: IA15-030

Date: 22 April 2015

ASSESSEMENT 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.

Contents

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.

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.

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:

CHENG San Mei, Sammi
Laboratory Manager

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

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 Wai

Signed:

For and on behalf of : 金特建材(港澳)有限公司

FORTE
TESTING AND CONSULTANTS CO., LTD.

HOKLAS 191
TEST

FIRE RESISTANCE TEST REPORT

DRYWALL PARTITION SYSTEM
with SINGLE LAYER LINING and ROCK WOOL INFILL

in accordance with ***BS EN 1364-1: 1999***

Test Sponsor: **Kingtec Building Materials (HK & Macau) Limited**
Unit 1, 3/F., Block B, Shatin Industrial Centre,
5-7 Yuen Shun Circuit, Shatin, New Territories, Hong Kong.
Tel: 852-2640 8688 Fax: 852-2142 8128

Test Laboratory: **Forte Testing and Consultants Company Limited**
Contact Information:
Flat 31, 5/F., My Loft, 9 Hoi Wang Road,
Tuen Mun, New Territories, Hong Kong.
Tel: 852-2152 0638 Fax: 852-3186 2737

Report Number: **IT 14-191**

Date of Issue: **2015-01-26**

HKAS has accredited Forte Testing and Consultants Company Limited (Reg. No. 191 – TEST) under HOKLAS for specific laboratory activities as listed in the HOKLAS directory of accredited laboratories. The results shown in this report were determined by this laboratory in accordance with terms of accreditation. This report may not be reproduced, except in full, without prior written approval from FORTE.

HOKLAS Approved Signatory: **Ir. Dr Chan Yuk Kit**

1. Scope of Test

This report is a record of a fire resistance test conducted by Forte Testing and Consultants Co., Ltd, in conformity with requirements in *BS EN 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 drywall partition system. The drywall partition comprised of a single layer of "Hawk Pan" fire board lining with nominal thickness of 12 mm, and steel framework which was protected by 12 mm thick fillet boards with rock wool infill. 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	271 Minutes	Average Temp. Rise	271 Minutes
	Gap Gauge	271 Minutes	Max. Temp. Rise	271 Minutes
	Cotton Pad	271 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
Specimen Manufacturer:	Yichun Kingtec Building Materials Industrial Company Limited
ID no. of the Specimen:	QT 14-224A
Date Received:	2014-11-26
Test Number:	QT 14-224
Date Tested:	2014-12-04 **Start Time:** 10:47
Approved Test Operators from FORTE:	Ms. Cheng San Mei, Sammi/ Ms. Dong Xingmei
Witness of the Test:	Mr. Eddie Lau, Ms. Denise Chow and Ms. Lilian Tse– Official Delegates of the Sponsor
Report Issue Record:	Version 1 – 2015-01-26

3. Construction Details of Specimen

3.1 Specimen Description

3.1.1 Board Configuration

The drywall partition system has an overall size 3060 mm (width) x 3110 mm (height). The exposed surface of the drywall was consisted of 6 sheets of fire boards including 2 numbers of board with nominal sizes 1220 mm (w) x 2440 mm (h), 1 number of board with nominal sized 2440 mm (w) x 670 mm (h) , 1 number of board with nominal sizes 620 mm (w) x 2440 mm (h), 1 number of board with nominal sized 620 mm (w) x 555 mm (h) and 1 number of board with nominal sized 620 mm (w) x 115 mm (h).

The unexposed surfaces of the drywall was consisted of 5 sheets of fire boards including 2 numbers of board with nominal sizes 1220 mm (w) x 2440 mm (h), 1 numbers of board with nominal sizes 2440 mm (w) x 670 mm (h), 1 number of board with nominal sizes 620 mm (w) x 2440 mm (h) and 1 number of board with nominal sizes 620 mm (w) x 670 mm (h).

Surface fire boards with nominal 12 mm (thick) were fixed to the framework by ø3.5 mm X 40 mm self-tapping screws at 140 – 200 mm centre to centre horizontally and 200 – 300 centre to centre vertically.

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

The space between fixed edges of the specimen and the concrete support frame was caulked with fire sealant; whereas the space between free edge and the concrete support frame was filled by ceramic fibre.

3.1.2 Structural Framework

The perimeter framework of the drywall partition was made of galvanized steel U-channels sized 45 mm (flange) x 100 mm (depth) x 0.6 mm (t) and they were secured to the test rig by ø6 mm x 60 mm anchor bolts at 300 – 440 mm centre to centre.

Within the perimeter framework, there were four vertical galvanized steel studs each sized 50 mm (flange) x 100 mm (depth) x 0.6 mm (t), which was fixed to the perimeter framework by 2 number of ø4 mm x 10 mm rivets at each joint.

100 mm (w) x 12 mm (t) fire board fillets were fixed on both exposed and unexposed sides of the structural framework.

The horizontal galvanized steel U-channels sized 45 mm (flange) x 100 mm (depth) x 0.6 mm (t) were fixed between the C-channels at 670 mm above the sill level on the exposed side and 670 mm below the top.

The fillets were fixed to the structural framework by ø3.5 mm X 25 mm self-tapping screws at approximate 150 – 250 mm centre to centre. A single line of fire sealant was applied between the fire board fillet and the structural framework.

3.1.3 Infill

Space of the channels and in between exposed and unexposed surface board was fully filled by rock wool with nominal thickness of 100 mm and nominal density 110 kg/m^3.

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:	1050 kg/m^3
Measured Density:	1056 kg/m^3
Nominal Thickness:	12 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:	100 mm x 45 mm x 0.6 mm

C-channel

Supplier:	Kingtec Building Materials (HK & Macau) Limited
Material:	Galvanized Steel
Sizes:	100 mm x 50 mm x 0.6 mm

Infill

Supplier:	Kingtec Building Materials (HK & Macau) Limited
Brand:	ROCKWOOL
Type:	CurtainRock 80 Plus
Material:	Rock Wool *
Nominal Density:	110 kg/m^3
Measured Density:	108 kg/m^3
Nominal Thickness:	100 mm

Fixing – Screws

Supplier:	Kingtec Building Materials (HK & Macau) Limited	
Type:	Self-tapping Screws	
Material:	Galvanized Steel	
Sizes:	Ø3.5 mm X 25 mm	Ø3.5 mm X 40 mm

Fixing – Rivets

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

Fixing – Anchor Bolts

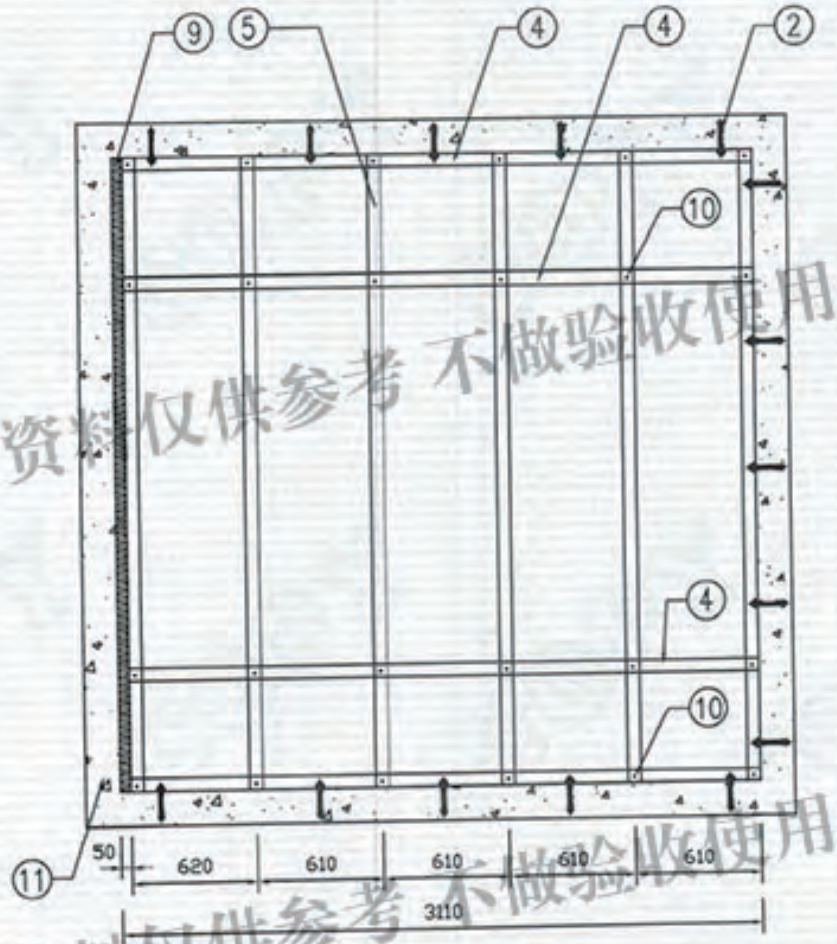
Supplier:	Kingtec Building Materials (HK & Macau) Limited
Type:	Expansion Anchor Bolt
Material:	Steel
Sizes:	Ø6 mm x 60 mm
Location Applied:	Perimeter Framework to Test Rig

Fire Sealant

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

3.3 Drawings on the Specimen provided by the Sponsor (Total 3 pages)

Drawings of Specimen provided by the Sponsor (1)

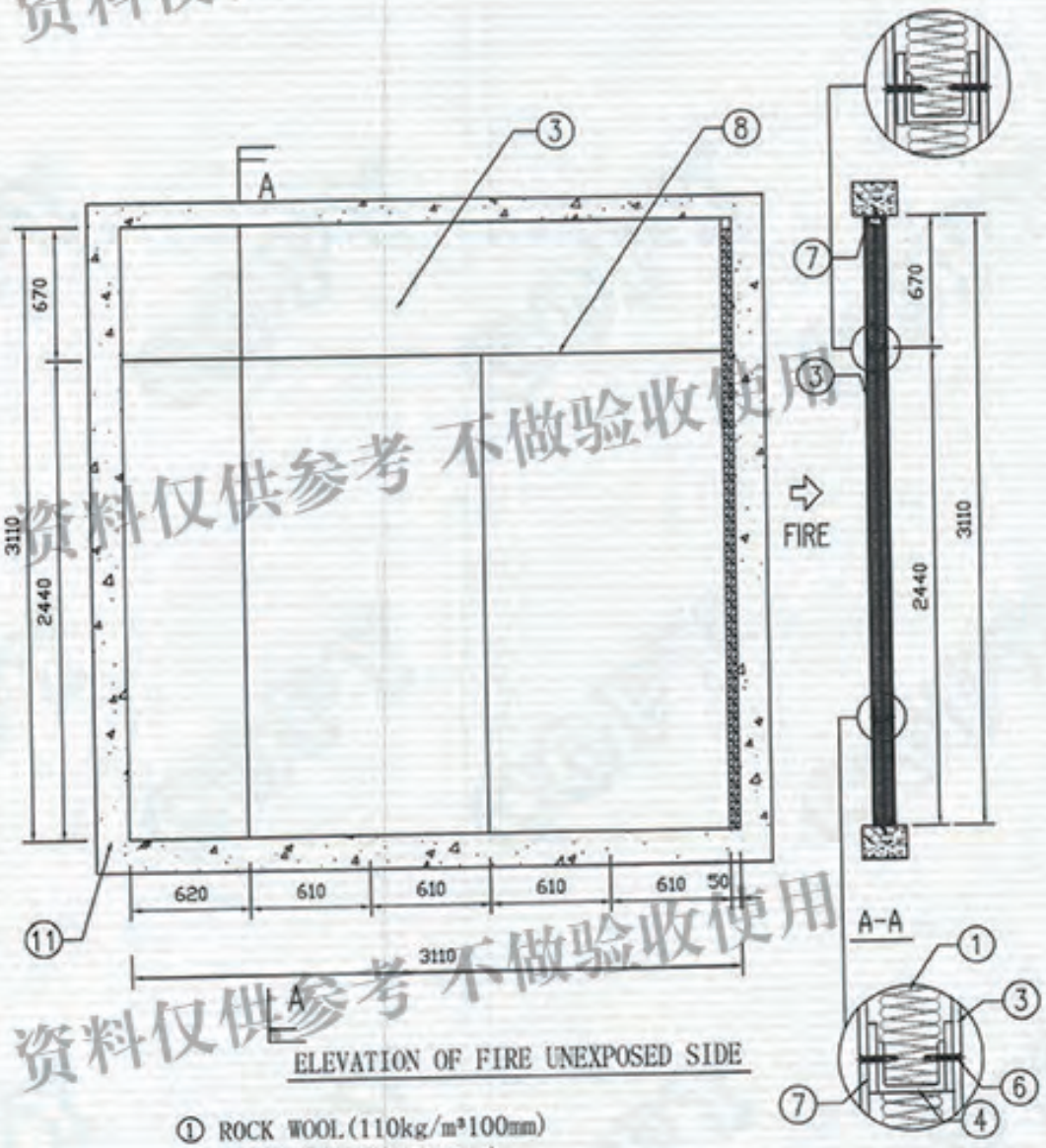


(STRUCTURAL FRAMEWORK)

① ROCK WOOL(110kg/m³100mm)
② ANCHOR BOLT(φ6*60mm)
③ FIRE BOARD(2440*1220*12mm)
④ GALVANIZED STEEL U-CHANNEL(U100*45*0.6mm)
⑤ GALVANIZED STEEL C-CHANNEL (C100*50*0.6mm)
⑥ SELF-TAPPING SCREW(φ3.5*40mm@250mm)
⑦ FIRE BOARD FILLET(100*12mm)
⑧ FIRE SEALANT
⑨ CERAMIC FIBRE
⑩ BLIND RIVETS (φ4*10mm)
⑪ CONCRETE SUPPORTING RIG
⑫ SELF-TAPPING SCREW(φ3.5*25mm@250mm)

FIGURE 1

Drawings of Specimen provided by the Sponsor (2)

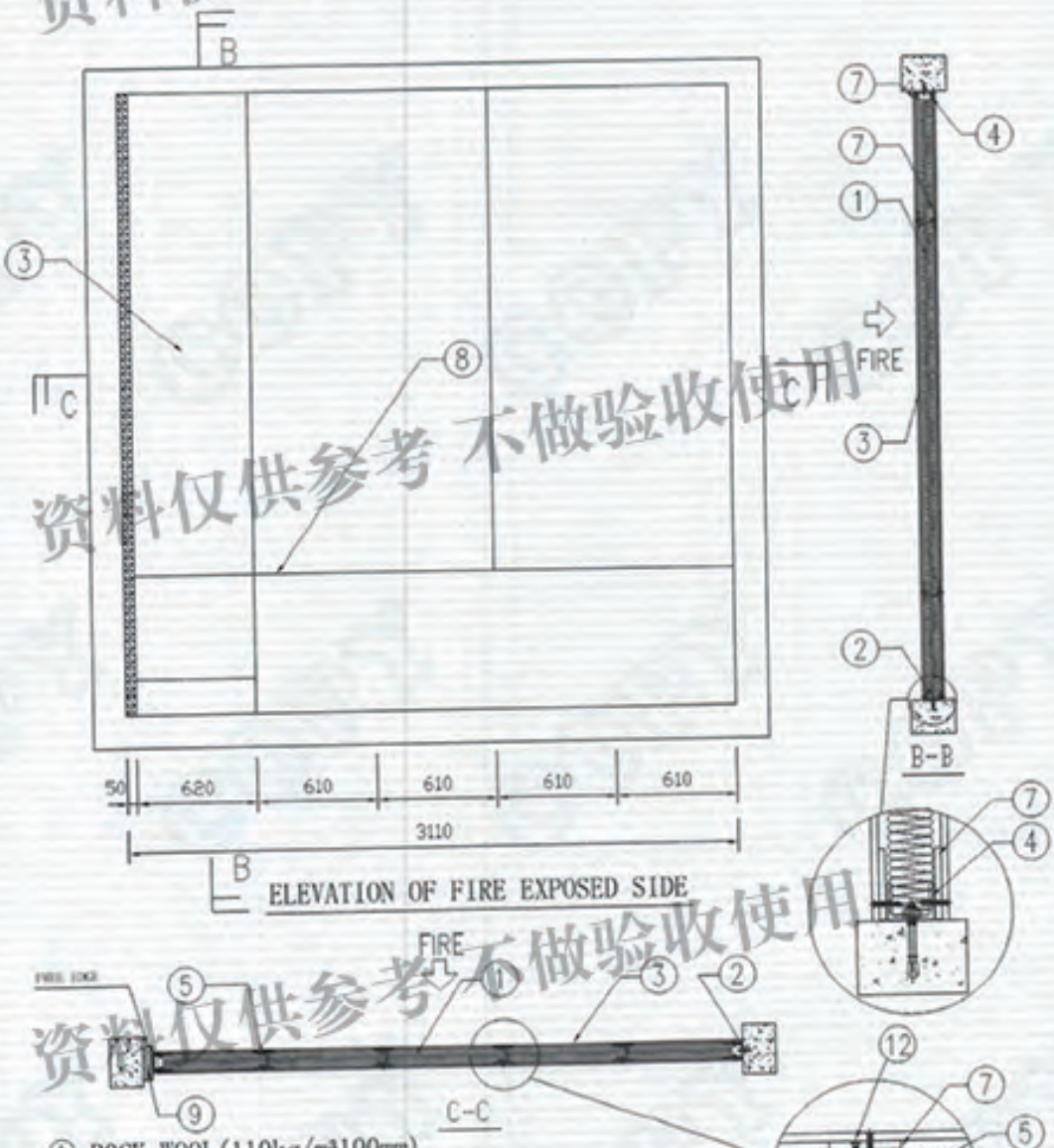


ELEVATION OF FIRE UNEXPOSED SIDE

① ROCK WOOL(110kg/m³100mm)
② ANCHOR BOLT(φ6*60mm)
③ FIRE BOARD(2440*1220*12mm)
④ GALVANIZED STEEL U-CHANNEL(U100*45*0.6mm)
⑤ GALVANIZED STEEL C-CHANNEL (C100*50*0.6mm)
⑥ SELF-TAPPING SCREW(φ3.5*40mm@250mm)
⑦ FIRE BOARD FILLET(100*12mm)
⑧ FIRE SEALANT
⑨ CERAMIC FIBRE
⑩ BLIND RIVETS (φ4*10mm)
⑪ CONCRETE SUPPORTING RIG
⑫ SELF-TAPPING SCREW(φ3.5*25mm@250mm)

FIGURE 2

Drawings of Specimen provided by the Sponsor (3)



① ROCK WOOL (110kg/m³*100mm)
② ANCHOR BOLT (φ6*60mm)
③ FIRE BOARD (2440*1220*12mm)
④ GALVANIZED STEEL U-CHANNEL (U100*45*0.6mm)
⑤ GALVANIZED STEEL C-CHANNEL (C100*50*0.6mm)
⑥ SELF-TAPPING SCREW (φ3.5*40mm@250mm)
⑦ FIRE BOARD FILLET (100*12mm)
⑧ FIRE SEALANT
⑨ CERAMIC FIBRE
⑩ BLIND RIVETS (φ4*10mm)
⑪ CONCRETE SUPPORTING RIG
⑫ SELF-TAPPING SCREW (φ3.5*25mm@250mm)

FIGURE 3

4. Specimen Condition

4.1 Selection of the Specimen

Additional components of the specimen such as lining and steel studs were transferred to the Test Location on 2014-11-26 by the Sponsor. Components for test were randomly selected by FORTE delegates.

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

4.2 Verification of the Specimen

Extra components of the specimen such as lining and steel studs were verified by FORTE delegates.
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 2014-12-01 to 2014-12-02.

4.5 Specimen Conditioning

The specimen was stored in the Test Location from 2014-11-26, the date which components of the specimen were received, to 2014-12-04, the date which fire resistance test performed.

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

Ambient Temperature (°C)	Relative Humidity (%)
12 ± 5	83 ± 5

4.6 Direction of Fire Side and Others

The Sponsor designated and installed that the board configuration on both sides of the drywall partition system was in stagger arrangement. The specimen was symmetrical along the plane parallel to the furnace opening.

Vertical, horizontal and cross joints were present on the specimen.

The vertical free edge was set adjacent to the smaller board on the exposed face and it was sealed up by ceramic fibre.

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 14 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 of temperature rise on the framework 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.

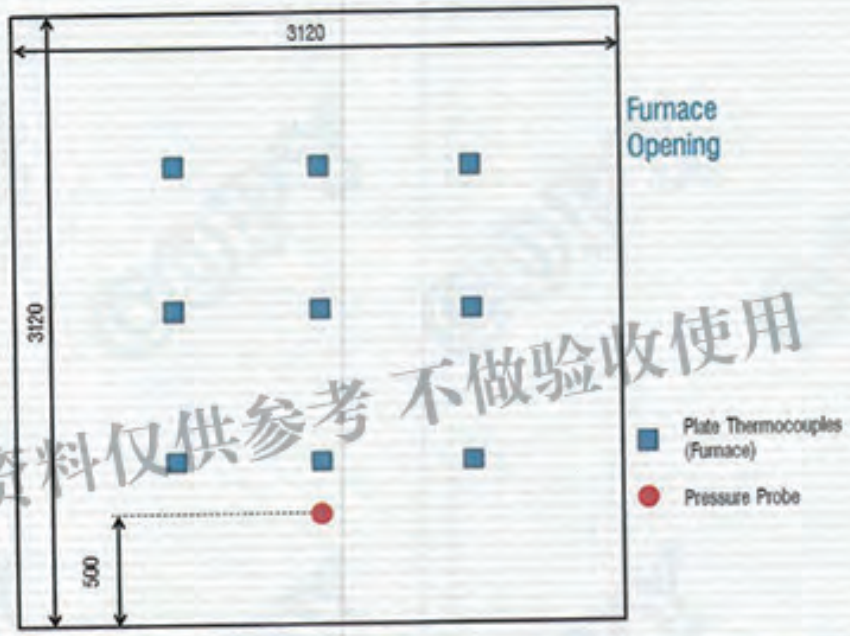
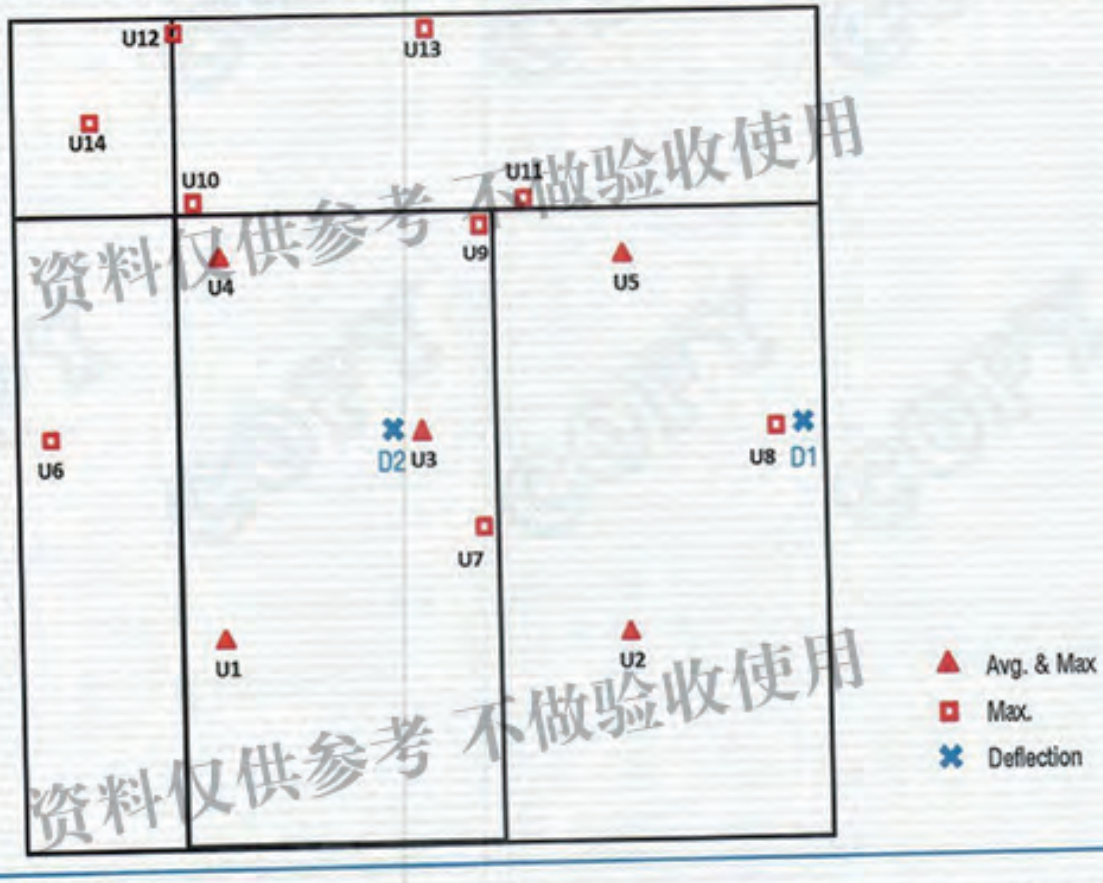


Figure 2. Positions of fixed surface thermocouples (U) and deflection measuring points (D) on the specimen.

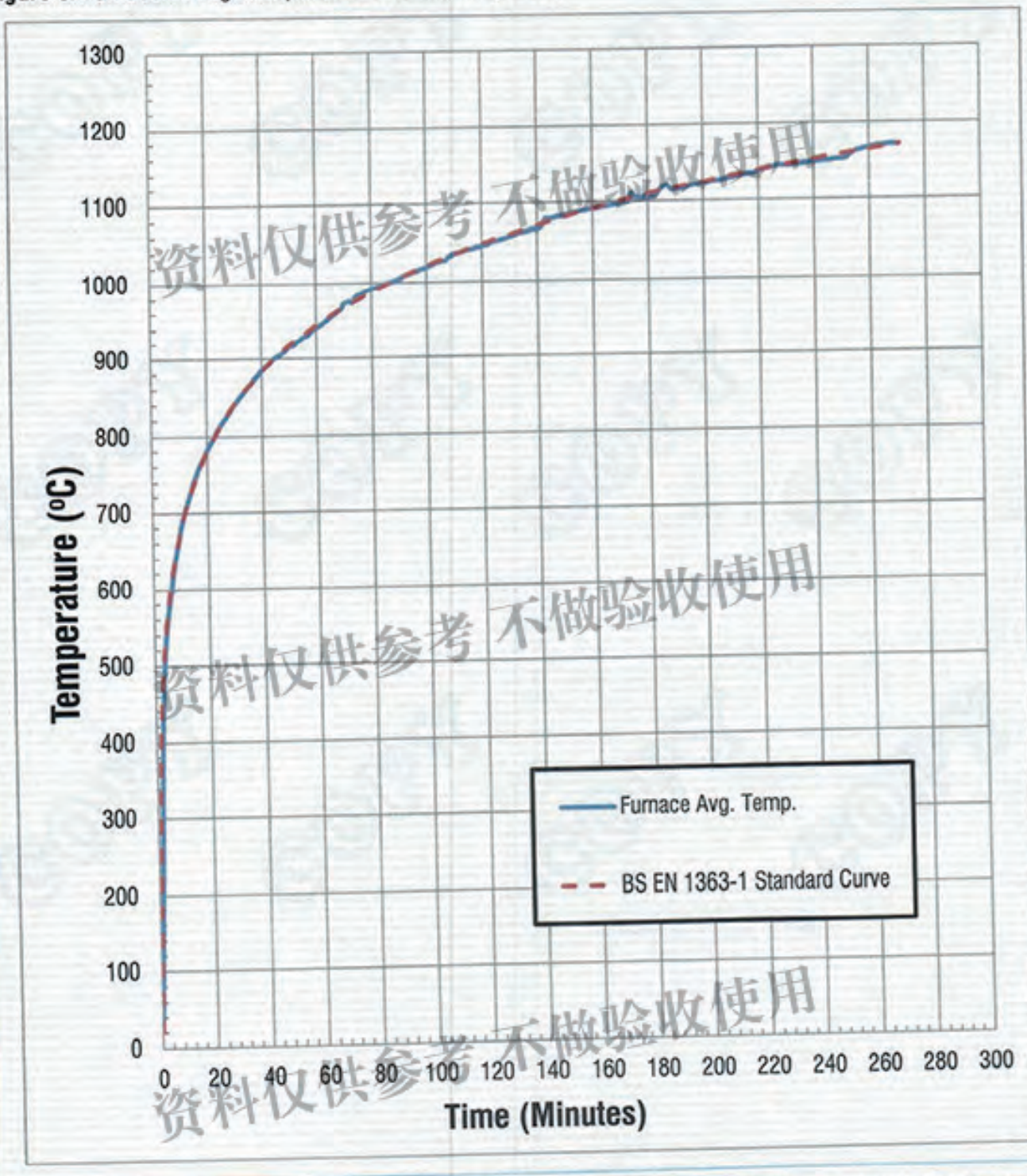


6. Test Data

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.

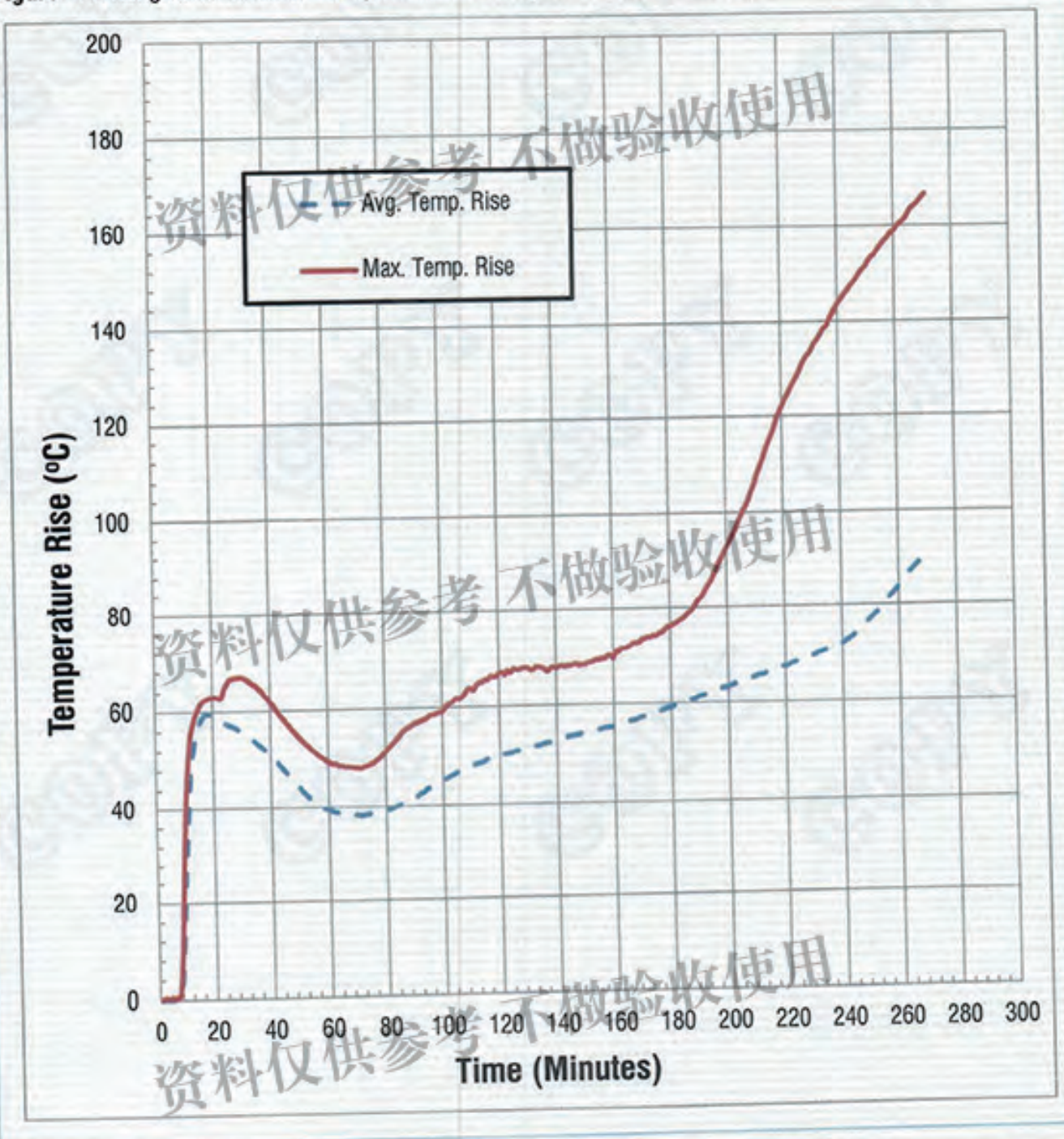


6.2 Unexposed Surface Temperature Rise

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*.

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 U10

Time (min)	U1	U2	U3	U4	U5	U6	U7	U8	U9	U10
0	11.4	11.1	11.1	11.6	11.6	10.3	9.6	9.1	10.8	10.8
20	69.9	67.6	69.4	70.6	74.5	70.1	47.6	66.9	63.0	64.1
40	58.0	62.7	57.9	63.8	70.2	60.6	57.8	59.0	63.5	65.9
60	48.1	47.8	47.5	53.5	56.6	49.7	51.3	47.7	56.9	60.8
80	49.0	44.2	51.1	53.2	54.6	49.5	51.8	45.8	58.3	62.9
100	55.7	51.3	58.5	58.0	59.6	54.5	61.3	50.7	63.8	70.6
110	59.0	54.9	60.8	60.1	62.2	57.0	66.9	53.2	66.8	75.3
120	61.5	58.1	62.6	61.9	64.0	59.3	72.1	56.0	69.1	78.3
130	63.0	60.0	63.5	63.2	65.4	61.2	74.4	57.6	70.9	79.3
140	63.9	62.0	65.3	65.3	66.5	62.7	75.5	58.7	73.2	79.2
150	65.3	62.8	67.3	66.4	67.3	63.4	77.7	59.6	76.5	79.8
160	65.7	63.2	69.7	67.7	68.9	63.6	80.8	60.2	80.3	81.1
170	67.3	63.9	72.3	69.4	70.7	64.5	82.8	61.0	83.3	84.9
180	68.8	65.0	74.9	71.0	73.5	65.2	85.6	61.3	87.2	87.6
190	71.1	66.8	77.8	73.2	75.7	65.6	87.6	62.0	93.0	91.2
200	73.2	68.2	79.8	74.9	77.5	66.5	95.4	63.7	104.2	100.3
210	75.3	70.6	82.2	76.9	79.5	67.7	109.4	65.3	115.9	117.5
220	77.5	72.2	83.9	78.7	81.8	68.7	122.9	67.0	127.1	133.5
230	79.3	74.1	86.0	81.2	84.1	70.1	132.7	68.6	137.5	144.7
240	81.4	76.4	90.3	82.8	86.9	71.8	142.0	70.7	147.6	154.9
250	83.5	79.0	102.0	86.0	92.5	73.6	148.9	72.7	156.4	162.9
260	85.7	81.1	113.4	93.0	104.1	75.4	155.5	75.1	164.5	170.2
265	87.1	82.4	117.4	98.9	109.8	76.3	158.8	76.3	168.3	173.8
266	87.5	82.5	118.1	99.8	110.8	76.5	159.6	76.5	168.9	174.7
267	87.8	82.7	118.8	100.9	111.9	76.8	159.9	76.9	169.5	175.2
268	87.9	83.3	119.7	102.0	113.0	77.0	160.5	77.1	170.3	175.7
269	88.6	83.5	120.3	103.2	113.8	77.1	161.3	77.5	171.3	176.4
270	89.2	83.6	120.8	104.0	114.8	77.3	162.0	77.8	172.3	177.2
271	89.4	83.7	121.2	105.0	115.8	77.5	162.6	78.0	172.9	177.8

Temperature outputs from unexposed surface temperature U11 to U14

Time (min)	U11	U12	U13	U14
0	10.7	11.4	11.5	10.2
20	63.7	64.7	55.6	65.3
40	66.2	73.1	65.2	62.4
60	59.5	60.9	60.2	48.2
80	55.3	56.5	56.6	44.8
100	58.7	62.7	57.5	49.8
110	60.9	66.9	58.3	52.8
120	63.4	71.3	59.7	55.7
130	64.5	73.7	59.7	57.3
140	65.6	75.5	60.6	59.1
150	66.4	78.0	61.5	60.2
160	68.6	80.3	62.1	61.1
170	70.7	82.9	62.4	62.4
180	73.5	82.9	62.8	64.5
190	76.6	82.7	63.7	67.0
200	79.5	83.4	64.0	69.1
210	82.8	84.2	64.7	71.3
220	91.6	84.4	66.4	73.4
230	108.9	84.5	68.4	75.7
240	123.1	85.3	70.4	77.6
250	137.0	86.4	72.8	79.8
260	150.6	87.5	75.0	81.9
265	158.6	88.2	76.0	83.5
266	159.7	88.4	76.2	83.7
267	160.9	88.6	76.4	84.0
268	162.4	88.9	76.6	84.5
269	163.6	88.9	76.5	84.8
270	165.0	89.2	76.7	85.2
271	166.2	89.4	76.8	85.6

6.3 Pressure

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

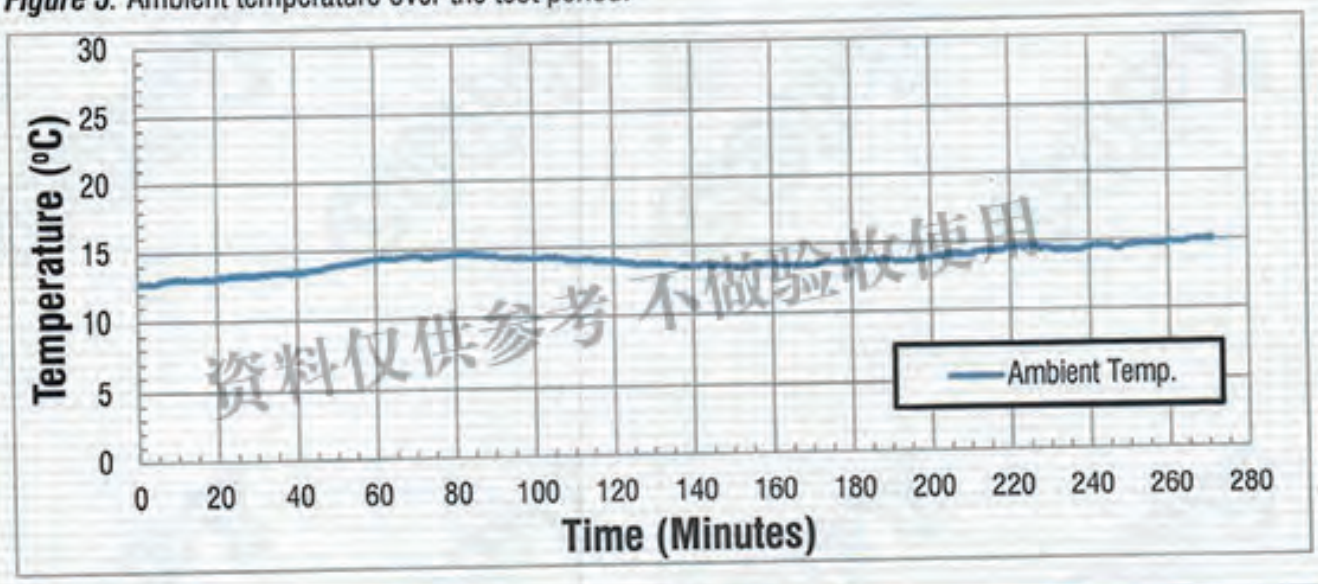
Time (min)	Pressure (Pa)	Time (min)	Pressure (Pa)	Time (min)	Pressure (Pa)
6	-0.1	95	1.4	185	-0.3
10	-0.6	100	0.4	190	-1.5
15	0.4	105	0.5	195	-0.5
20	-0.3	110	-1.8	200	-0.4
25	-1.7	115	0.4	205	0.1
30	-0.4	120	-0.1	210	0.1
35	-0.5	125	0.0	215	-0.1
40	1.3	130	0.9	220	-0.1
45	0.9	135	0.3	225	1.0
50	-1.4	140	0.2	230	1.0
55	0.2	145	-1.3	235	-0.4
60	1.9	150	-0.8	240	0.8
65	-0.7	155	1.4	245	0.5
70	0.9	160	0.6	250	0.0
75	0.0	165	0.2	255	1.1
80	1.7	170	-1.3	260	-0.4
85	-1.4	175	-0.3	270	0.1
90	0.9	180	0.8	271	0.2

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 12.8°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 -18 mm at D2 at 240, 250, 260 and 270 minute of the test period.

Position \ Time (min)	0	10	20	40	60	80	100	110	120	130
D1	+0	+0	+0	+0	+0	-3	-5	-5	-6	-7
D2	+0	+5	+4	+12	+14	+7	+6	+5	+4	-2

Position \ Time (min)	160	170	180	210	220	230	240	250	260	270
D1	-8	-8	-8	-9	-9	-8	-8	-8	-8	-8
D2	-3	-6	-8	-13	-14	-16	-18	-18	-18	-18

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.
09.57	Light smoke released from the top corners.
15.50	Light smoke released from vertical joints between support frame and fire boards, and the horizontal joint between panels.
18.34	Smoke from the joints and the free edge increased.
27.14	Smoke released from the horizontal join and the bottom of free edge.
30.00	**No integrity failure had occurred.**
30.31	Water mark appeared on the floor along the bottom edge of the specimen.
42.13	Light smoke released from the top gap between support frame and the right fire board.
56.32	The specimen fire resistance performance was stable.
60.00	**No integrity failure had occurred.**
89.36	Smoke released from the joints reduced.
96.30	The specimen fire resistance performance was stable.
118.56	The water mark on the floor dried out.
120.00	**No integrity failure had occurred.**
128.17	Smoke released from the horizontal joint between fire boards.
159.08	Smoke staining spots appeared at fire sealant of the horizontal joint.
180.00	A short smoke staining line was observed along the fire sealant of the horizontal joint.
205.16	The smoke staining line increased along the fire sealant of the horizontal joint.
219.27	A smoke staining spot appeared near the cross of the joints between fire boards.
224.32	Cotton fibre pad test was carried out at the smoke staining line of the horizontal joint on the specimen. No flaming or glowing on the cotton pad was observed.
240.00	**No integrity failure had occurred.**
245.12	Cotton fibre pad test was carried out at the smoke staining line of the horizontal joint on the specimen. No flaming or glowing on the cotton pad was observed.
255.46	Smoke continued releasing from the horizontal joint between fire boards. Smoke staining mark increased along the horizontal joint.
261.24	Cotton fibre pad test was carried out at the smoke staining line of the horizontal joint on the specimen. No flaming or glowing on the cotton pad was observed.
271.00	**Test was terminated at request of the Sponsor.**

6.7 Photos

Photo 1. Exposed surface of the specimen before test.

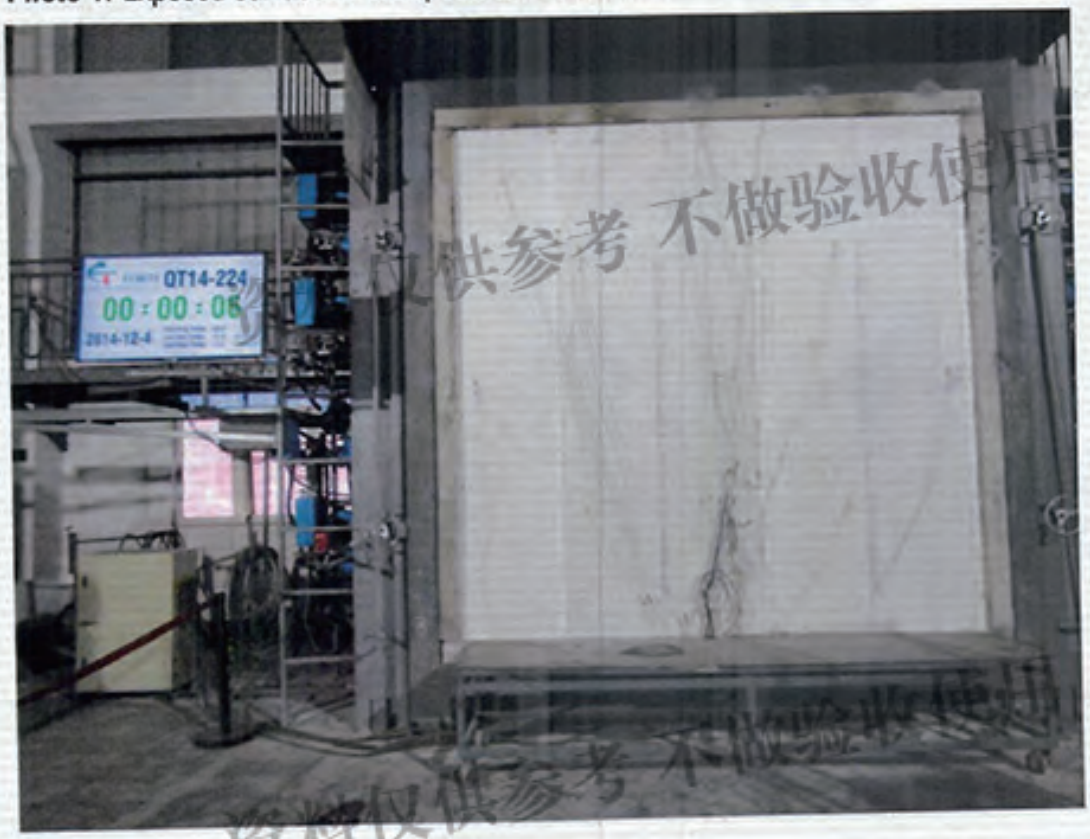


Photo 2. Unexposed surface of the specimen just after commencement of test.

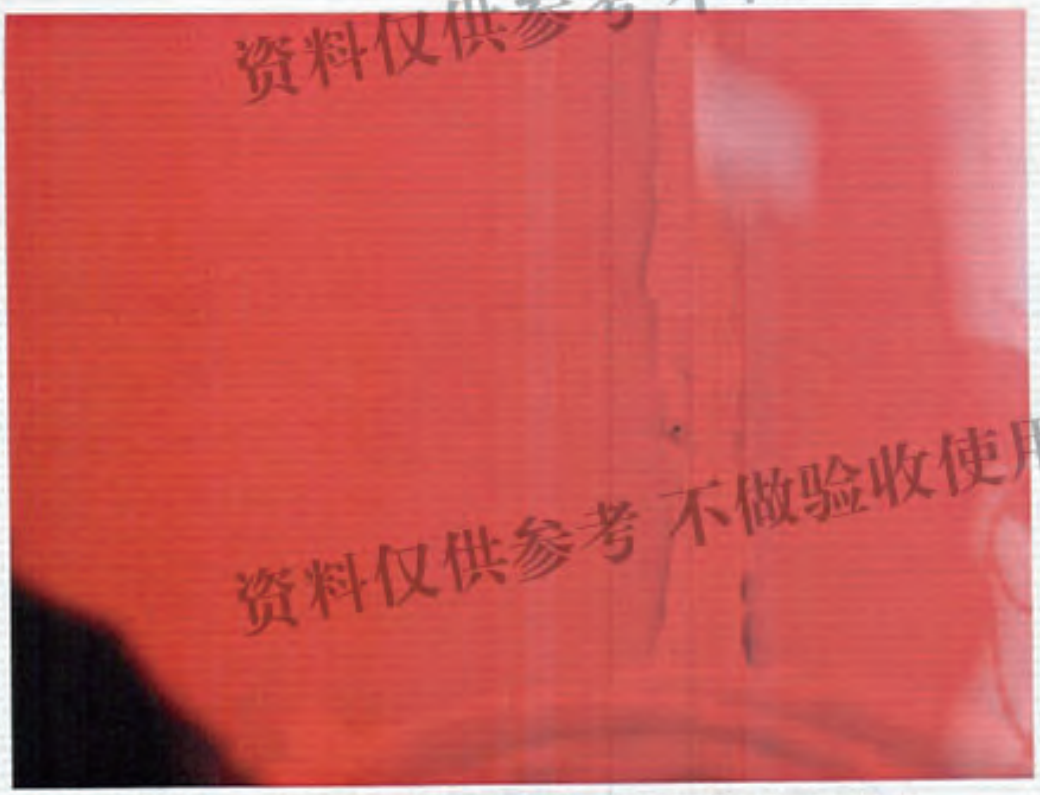


Photo 3. Part of the exposed surface of the Specimen at 25 minute of test.

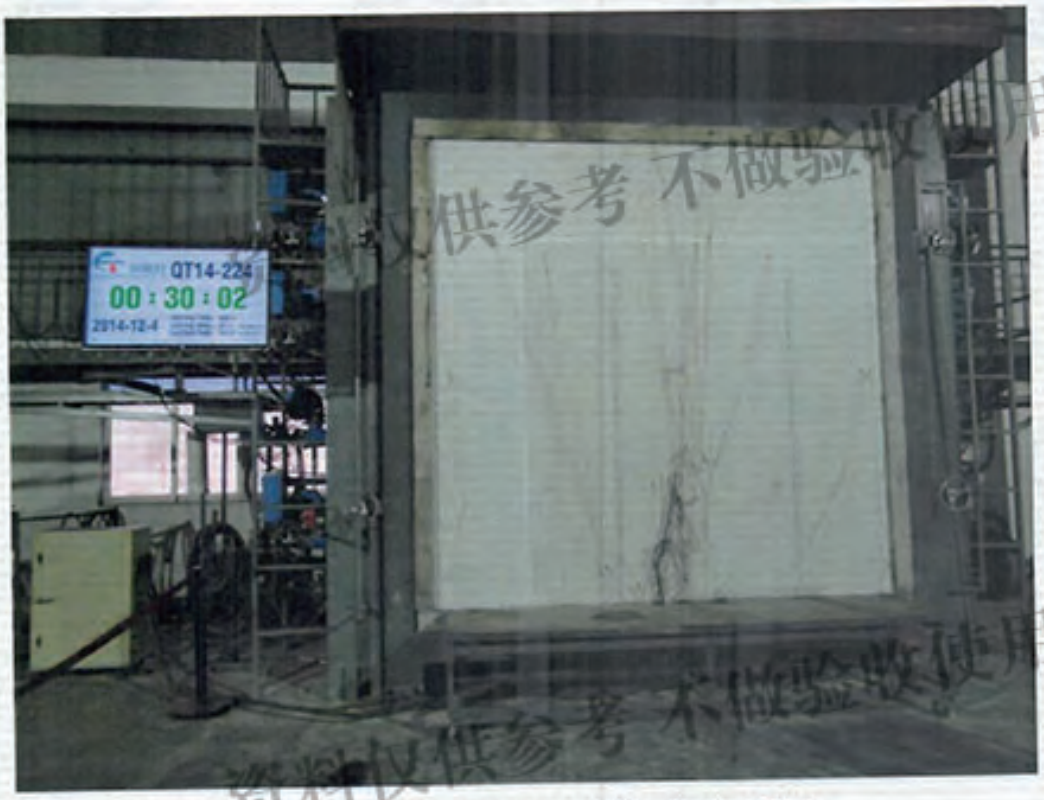


Photo 4. Unexposed surface of the specimen at 30 minute of test.

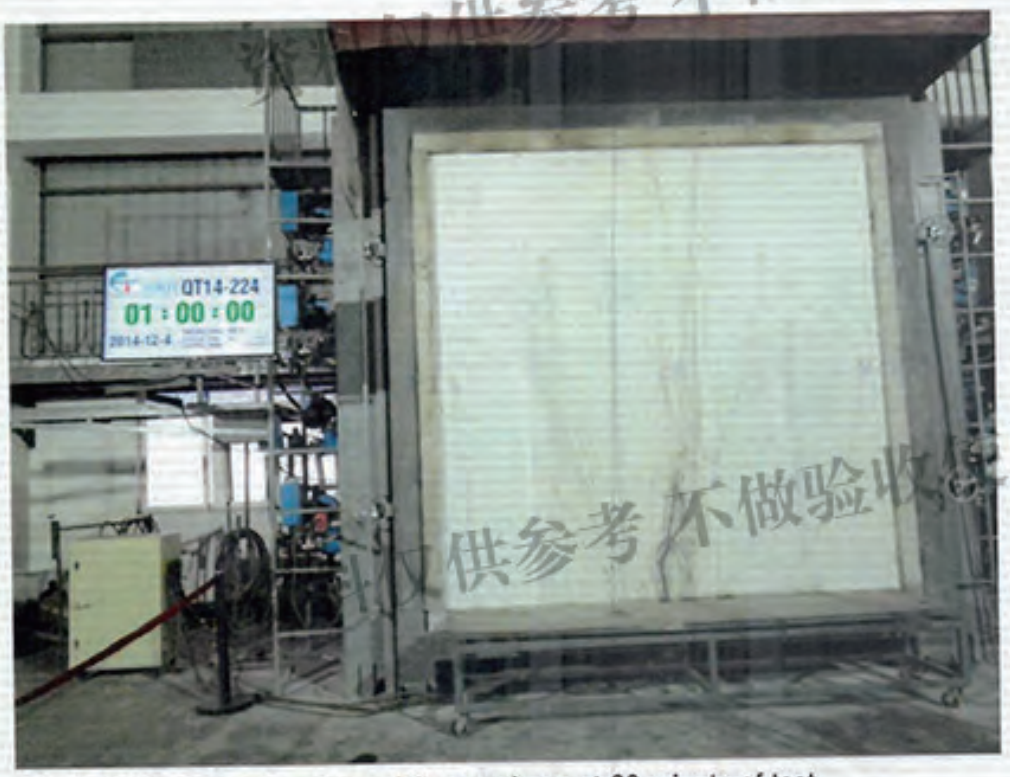


Photo 5. Unexposed surface of the specimen at 60 minute of test.

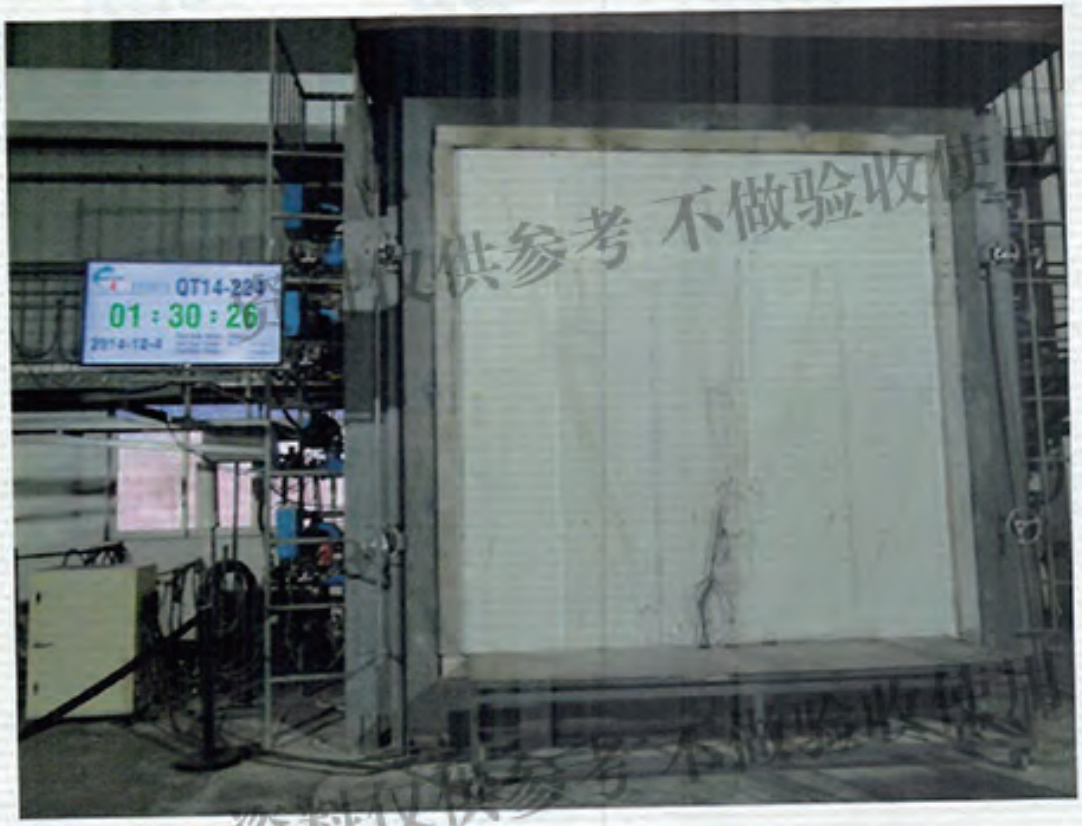


Photo 6. Unexposed surface of the specimen at 90 minute of test.

Photo 7. Unexposed surface of the specimen at 120 minute of test.

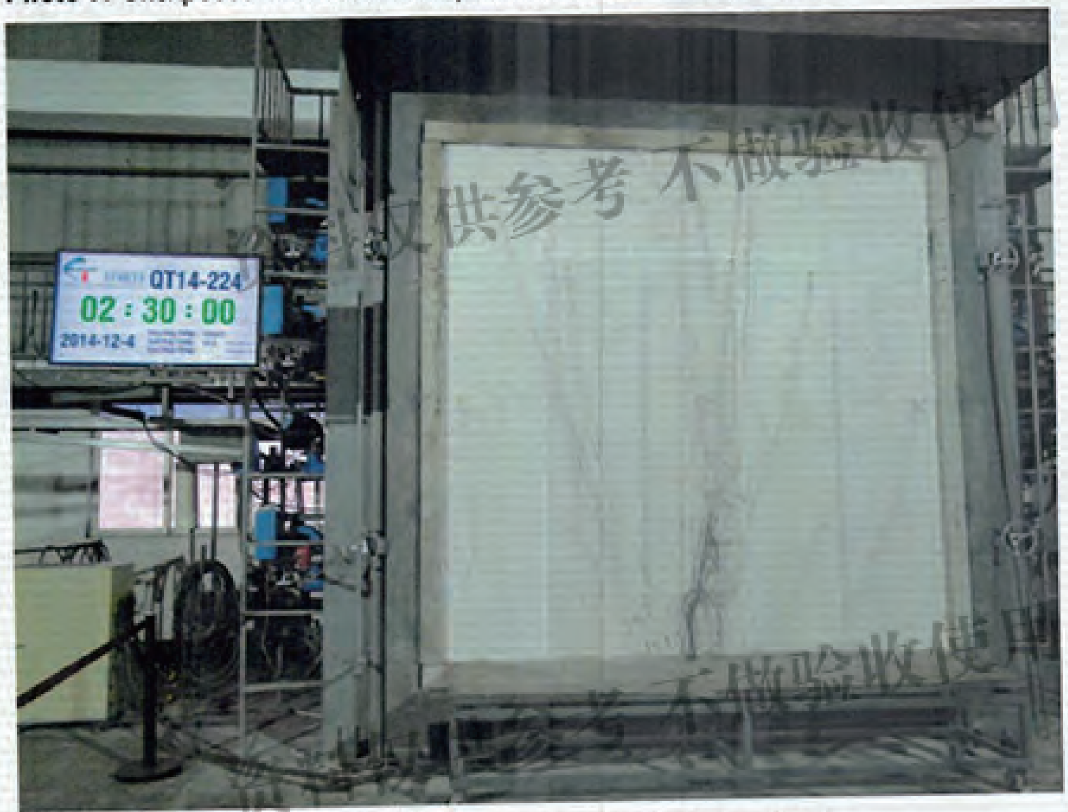


Photo 8. Unexposed surface of the specimen at 150 minute of test.

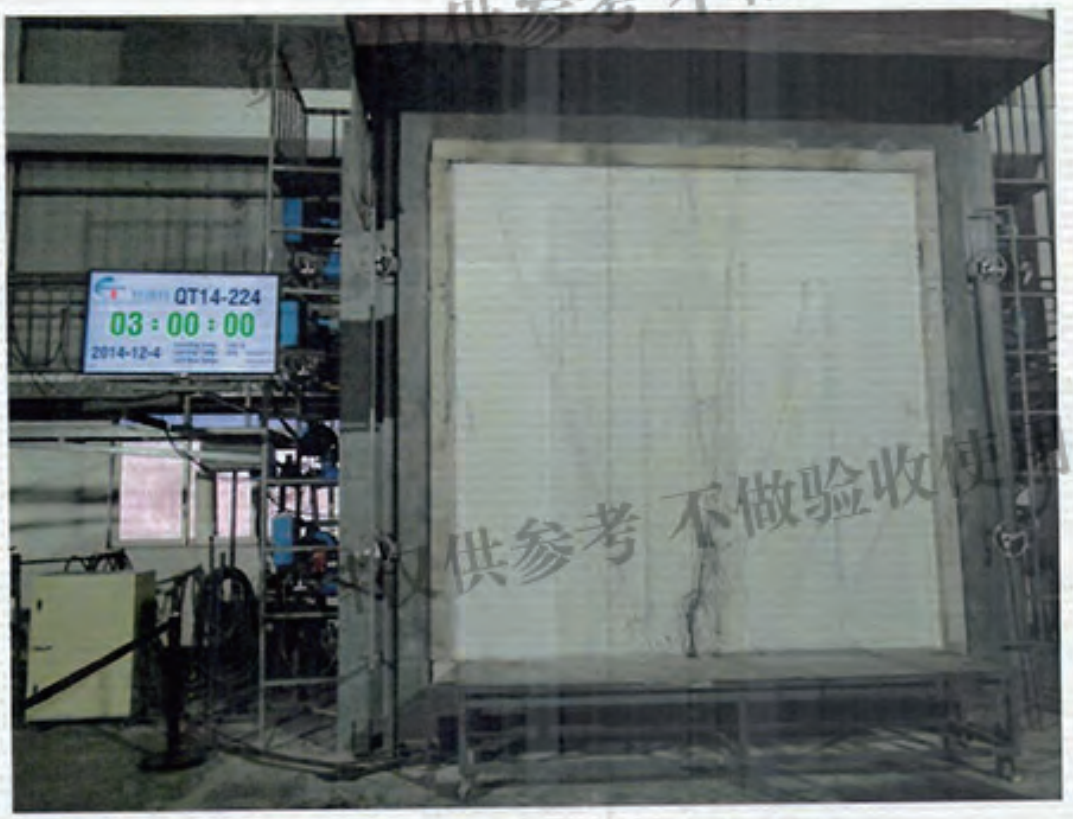


Photo 9. Unexposed surface of the specimen at 180 minute of test.

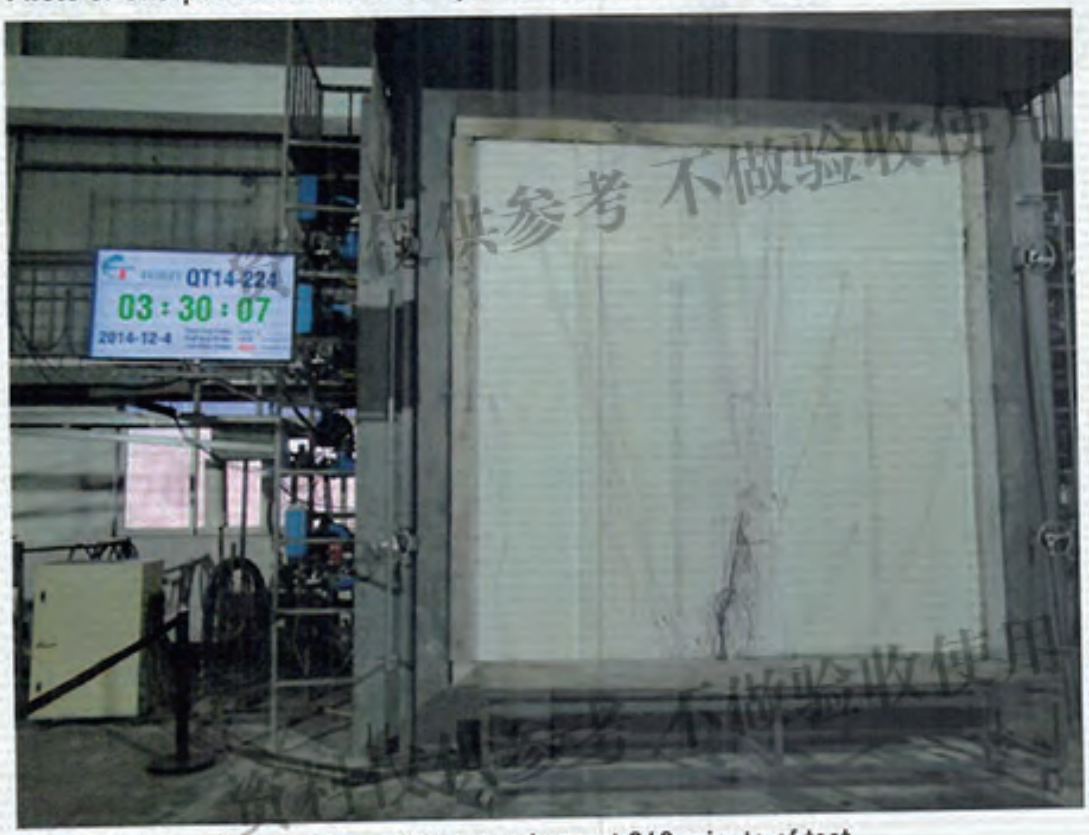


Photo 10. Unexposed surface of the specimen at 210 minute of test.

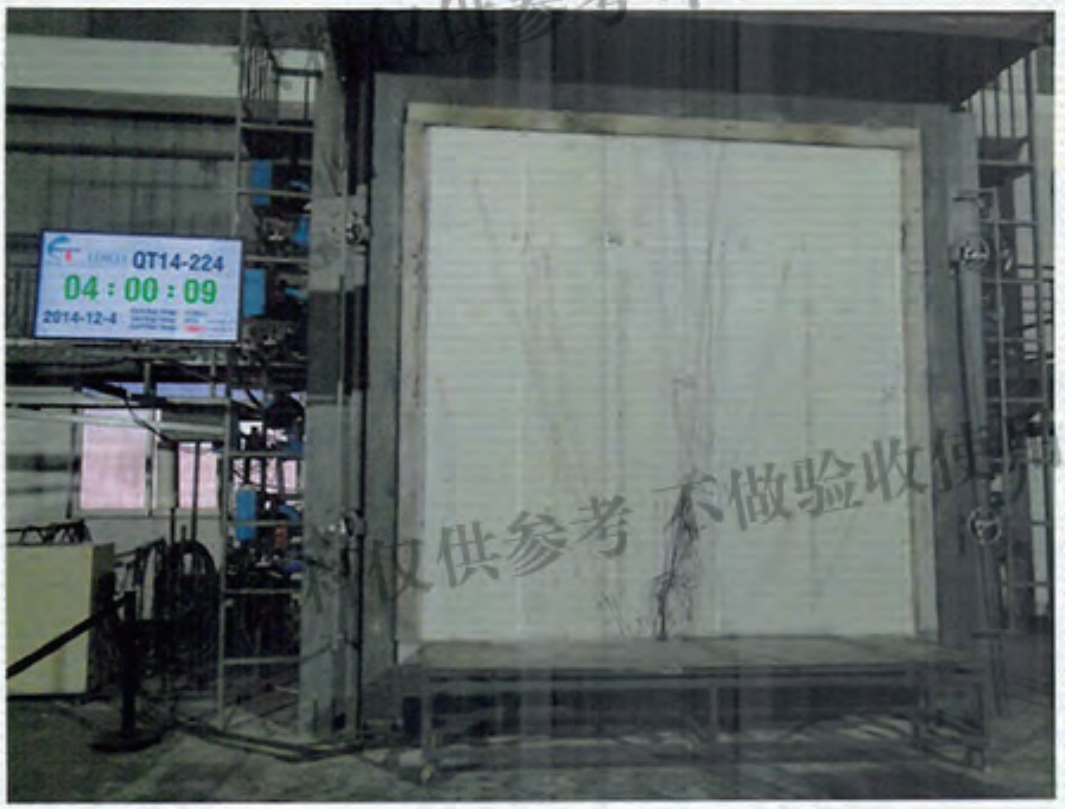


Photo 11. Unexposed surface of the specimen at 240 minute of test.

Photo 12. Unexposed surface of the specimen at the end of test.

Photo 13. Exposed surface of the specimen just after the finish of test.

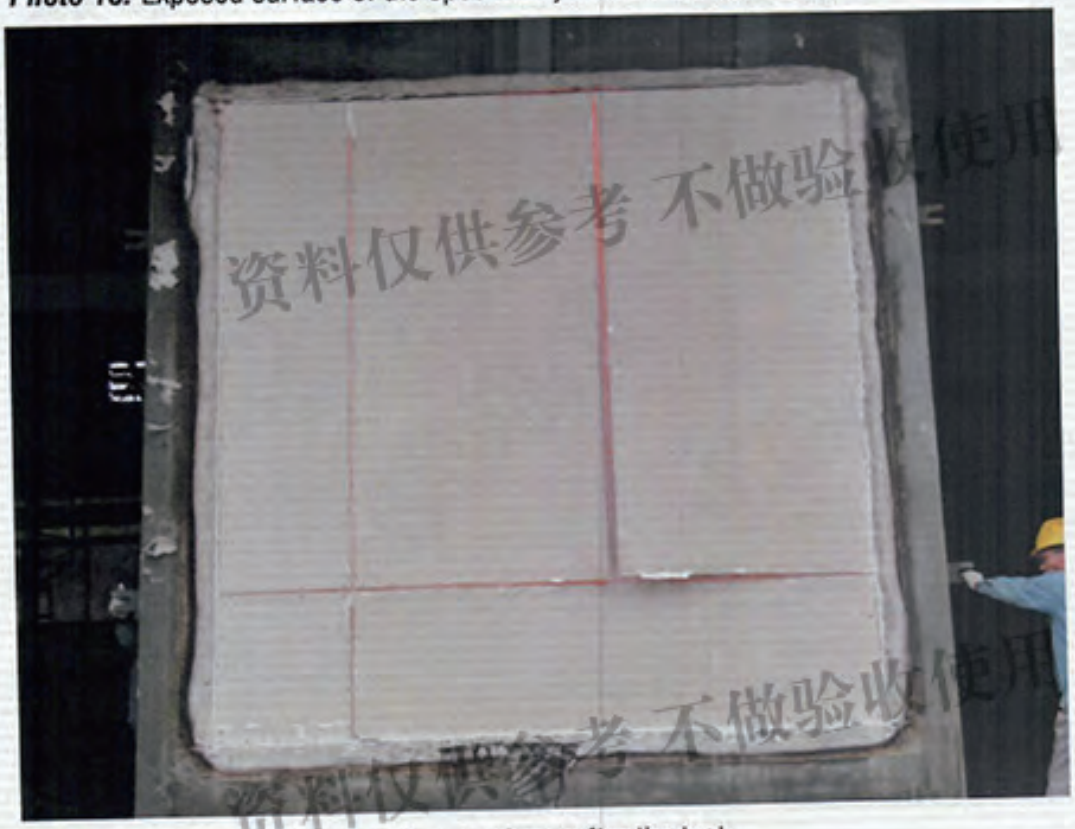


Photo 14. Exposed surface of the specimen after the test.

7. Test Results

Test was terminated after a period of 271 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			
Integrity (E)			
Criteria of Failure		Description	Elapsed Time before Failure Occurrence
Sustained Flaming		Continuous flaming for a period of time greater than 10 seconds on unexposed surface	271 minutes (No Failure)
Gap Gauge	Ø6 mm	Penetration of the gauge into the furnace through the specimens and movable along a 150 mm gap	271 minutes (No Failure)
	Ø25 mm	Penetration of the gauge into the furnace through the specimens	
Cotton Pad		Ignition of the cotton pad	271 minutes (No Failure)

Performance Criteria		
Insulation (I)		
Criteria of Failure	Description	Elapsed Time before Failure Occurrence
Integrity Failure	The performance criterion "insulation" shall automatically be assumed not to be satisfied when the "integrity" criterion ceases to be satisfied	271 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	271 minutes (No Failure)
Maximum Temperature Rise	An increase of temperature at any other point of the specimens above the initial average temperature by more than 180 °C	271 minutes (No Failure)

8. Limitations

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

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

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9. Field of Direct 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.

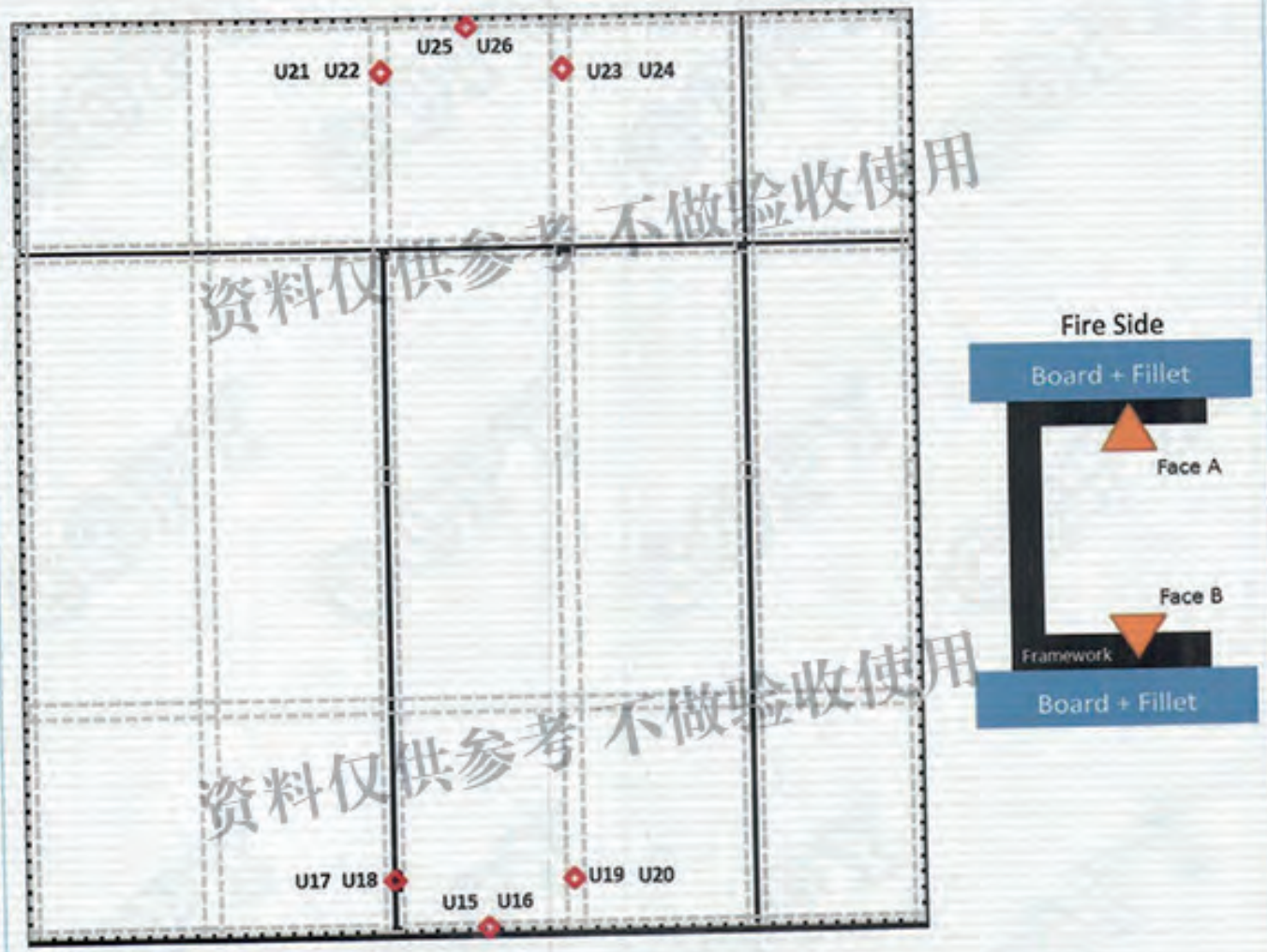
The series of rules and guidelines are defined in *Clause 13 "Field of direct application of test results", BS EN 1364-1: 1999* and relevant clauses and annexes.

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.

Appendix A

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

A.2 Additional Thermocouples – Detailed Temperature Records

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

Temperature outputs from unexposed surface temperature U15 to U20

Time (min)	U15	U16	U17	U18	U19	U20
0	10.4	10.2	10.7	11.4	10.9	11.6
20	94.6	100.1	94.9	97.9	94.9	96.7
40	91.6	136.3	89.3	184.8	89.6	175.7
60	90.5	311.5	94.9	496.9	91.4	456.3
80	93.1	507.7	128.4	795.5	125.4	720.7
100	97.9	628.6	195.8	839.2	196.3	828.8
110	104.5	638.9	222.6	864.4	224.3	848.5
120	121.6	635.1	244.9	892.3	248.9	864.9
130	127.5	626.2	268.2	912.5	272.2	877.7
140	132.8	629.7	290.4	926.8	294.6	888.9
150	137.4	639.1	309.9	941.4	314.9	899.4
160	143.3	651.9	327.3	951.3	334.1	904.0
170	149.6	663.6	342.3	959.8	351.9	904.3
180	156.3	673.8	355.1	827.5	368.2	899.3
190	163.0	683.4	366.0	965.5	383.2	886.6
200	169.7	692.3	375.9	973.9	396.8	868.2
210	176.7	703.0	384.8	982.5	410.1	856.6
220	184.3	714.7	393.5	1200.9	423.5	845.2
230	192.2	726.8	401.6	1128.1	437.7	825.3
240	199.9	738.4	409.4	1085.5	454.3	801.9
250	207.5	749.6	417.8	1096.9	466.9	764.8
260	215.1	761.7	428.1	1093.8	480.0	721.3
265	219.2	768.5	432.8	1022.9	486.8	710.6
266	220.0	770.0	433.9	1019.1	488.2	709.5
267	220.6	771.4	434.9	1019.7	489.8	707.9
268	221.4	772.8	435.8	1017.2	491.2	695.8
269	222.3	774.4	437.0	1014.9	492.8	703.2
270	223.3	775.9	438.0	1014.0	494.3	692.2
271	224.1	777.2	439.0	1012.4	495.7	717.2

Temperature outputs from unexposed surface temperature U21 to U26

Time (min)	U21	U22	U23	U24	U25	U26
0	11.8	11.2	9.9	9.9	11.0	11.4
20	103.6	97.6	96.1	98.5	94.7	96.3
40	97.0	203.8	88.2	171.4	91.9	214.3
60	95.6	415.0	87.3	406.0	100.3	583.4
80	123.2	665.7	132.4	660.2	150.1	711.7
100	156.2	779.7	186.5	829.2	203.1	799.1
110	171.2	797.1	204.8	849.8	227.7	822.8
120	185.8	808.8	219.4	848.0	251.1	843.8
130	200.2	814.3	233.7	839.0	273.1	861.6
140	213.5	816.6	247.5	830.5	294.9	874.7
150	226.0	817.7	260.3	827.7	316.9	879.6
160	238.0	819.8	272.2	828.8	338.8	828.1
170	249.3	824.2	282.7	829.4	359.1	747.1
180	259.6	830.2	291.8	830.7	376.3	744.6
190	268.6	836.5	301.8	832.9	391.7	744.7
200	277.5	848.0	311.4	842.3	407.4	748.4
210	286.3	858.3	322.0	850.7	424.2	752.0
220	295.8	866.2	332.7	859.1	442.0	754.7
230	305.2	873.1	343.5	856.7	460.4	753.4
240	314.8	881.0	355.0	859.9	482.3	759.0
250	324.8	890.7	367.7	847.6	509.1	759.3
260	335.3	914.8	381.3	846.4	538.4	760.3
265	340.8	912.8	388.0	857.0	553.3	762.8
266	342.1	913.3	389.5	844.4	556.1	763.1
267	343.1	914.2	390.9	844.0	559.1	763.6
268	344.2	915.6	392.2	845.6	562.2	764.6
269	345.6	916.8	394.0	843.3	565.3	765.1
270	346.7	921.3	395.3	844.4	568.4	766.0
271	347.8	926.3	396.8	846.7	571.2	766.3

END OF REPORT

TEST REPORT

Your Ref: Email dated 28 Jun 2006 | Date: 04 Jul 2006

Our Ref: 54S063476/2A/LGJ | Page: 1 of 3

DID: 68653783 | Fax: 68621433

NOTE: This report is issued subject to PSB Corporation's "Terms and Conditions Governing Technical Services". The terms and conditions governing the issue of this report are set out as attached within this report.

SUBJECT:

Non-combustibility test on "Hawk" Calcium Silicate Board material submitted by Kingtec (Hong Kong) Building Materials Industiral Co., Ltd. on 30 May 2006.

TESTED FOR:

Jinte Constructional Material Industrial Limited Company
368 Ping An Road, Yichun City
Jiangxi Province
People's Republic of China

Attn: Mr Shi Po De

DATE OF TEST:

27 Jun 2006 and 28 Jun 2006

PURPOSE OF TEST:

To determine whether the material is non-combustible when it is exposed to the conditions of the test specified in British Standard 476: Part 4: 1970 "Fire Test on Building Materials and Structures - Non-combustibility Test for Materials".
The test was conducted at PSB Corporation fire test laboratory located at No. 10 Tuas Avenue 10, Singapore 639134.
fire propagation for products".

54S063476/2A/LGJ

PSB

DESCRIPTION OF SAMPLES:

42 pieces of sample, said to be "Hawk" (1244kg/m^3) Calcium Silicate Board material, each of nominal size of 40mm x 40mm x 8mm thickness were received. 6 blocks of specimen, each of nominal test size of 40mm x 40mm x 50mm thickness were prepared.

TEST PROCEDURE:

Specimens were exposed to the specified heating conditions (750 ± 10°C) in a furnace conforming to Clause 6 and illustrated in Figure 1, 2 and 3 of the Standard. The furnace was heated and its temperature stabilized at 750 ± 10°C for more than 10 minutes. One specimen was then inserted in the furnace, the whole operation was performed in less than 5 seconds. The temperature of the specimens and the furnace were measured by two separate Chromel/Alumel thermocouples continuously for 20 minutes on the chart of a recorder. The flaming time of the specimen was determined by a stop watch. The procedure was repeated twice for two other specimens, one at each time.

RESULTS:

Description	Specimen 1	Specimen 2	Specimen 3	Requirements
Time of continuous flaming (sec.)	0	0	0	<10
Temperature rise of furnace (°C)	0	17	15	<50
Temperature rise of sample (°C)	0	0	0	<50
Classification	Non-combustible	Non-combustible	Non-combustible	-

CONCLUSION:

A non-combustibility test for materials in accordance with British Standard 476 Part 4 : 1970 has been performed on the material as described in this report and the classification of the sample is non-combustible.

Mah Poh Huat
Associate Engineer

Chan Lung Toa
Product Manager
(Fire Safety & Security Products)
Mechanical

This Report is issued under the following conditions:

1. Results of the testing/calibration in the form of a report will be issued immediately after the service has been completed or terminated.

2. Unless otherwise requested, a report shall contain only technical results. Analysis and interpretation of the results and professional opinion and recommendations expressed thereupon, if required, shall be clearly indicated and additional fee paid for, by the Client.

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TEST REPORT

Your Ref Email dated 28 Jun 2006 | Date. 04 Jul 2006

Our Ref 54S063476/1A/OKH | Page 1 of 6

DID 68653783 | Fax 68621433

NOTE: This report is issued subject to PSB Corporation's "Terms and Conditions Governing Technical Services". The terms and conditions governing the issue of this report are set out as attached within this report.

SUBJECT:

Fire propagation test on "Hawk" Calcium Silicate Board material submitted by Kingtec (Hong Kong) Building Materials Industrial Co., Ltd. on 30 May 2006.

TESTED FOR:

Jinte Constructional Material Industrial Limited Company
368 Ping An Road, Yichun City
Jiangxi Province
People's Republic of China

Attn: Mr Shi Po De

DATE OF TEST:

16 Jun 2006

PURPOSE OF TEST:

To determine the Index of Performance of the material when it is exposed to the conditions of the test specified in British Standard 476 : Part 6 : 1989 "Method of test for fire propagation for products".
The test was conducted at PSB Corporation fire test laboratory located at No. 10 Tuas Avenue 10, Singapore 639134.

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LA-2001-0212-A
LA-2001-0213-F
LA-2001-0214-E
LA-2001-0215-B
LA-2001-0216-G
LA-2001-0217-G

The results reported herein have been performed in accordance with the laboratory's terms of accreditation under the Singapore Accreditation Council - Singapore Laboratory Accreditation Scheme. Tests marked "Not SAC-SINGLAS Accredited" in this Report are not included in the SAC-SINGLAS Accreditation Schedule for our laboratory.

DESCRIPTION OF SAMPLES:

6 pieces of sample, said to be "Hawk" (1244kg/m^3) Calcium Silicate Board material, each of nominal size of 225mm x 225mm x 8mm thickness were received.

TEST PROCEDURE:

Three specimens were tested with either face exposed to the specified heating conditions, in an apparatus conforming to paragraph 5 and illustrated in Figures 1 to 3 of the Standard.

The calibration and test procedures were as defined in paragraphs 8 and 9 respectively, of the specification. The apparatus was calibrated prior to test and the actual calibration curve obtained is shown in Figure 1 of this report.

RESULTS OF TEST:

The mean temperature rise above ambient obtained from three specimens is also shown in Figure 1 (i.e. with the actual calibration curve). The mean temperature readings for the material and the calibration curve were obtained at the following intervals from the start of the test: at 1/2 minute intervals up to 3 minutes, at 1 minute intervals from 4 to 10 minutes, and at 2 minutes intervals from 12 to 20 minutes.

资料仅供参考 不作验收使用
资料仅供参考 不作验收使用

RESULTS OF TEST: (Cont'd)

From these readings, the index of performance for the material was determined as follows:

$$s_1 = \sum_{t=0.5}^{t=3} \frac{\Theta_s - \Theta_c}{10t} \qquad s_2 = \sum_{t=4}^{t=10} \frac{\Theta_s - \Theta_c}{10t}$$

and $$s_3 = \sum_{t=12}^{t=20} \frac{\Theta_s - \Theta_c}{10t}$$

$$S = s_1 + s_2 + s_3$$

where S = Index of performance for each of the specimens tested and s_1, s_2 and s_3 are sub-indices

t = Time in minutes from the origin at which readings are taken.

Θ_s = Temperature rise in deg. C for the specimen at time, t

Θ_c = Temperature rise in deg. C for the calibration sheet at time, t

In computations only the positive value of $\frac{\Theta_s - \Theta_c}{10t}$ was used.

RESULTS OF TEST: (Cont'd)

The following test results were obtained for each specimen tested:

Specimen	Sub-Indices			Index of Performance
	s_1	s_2	s_3	S
A	0.0	0.0	0.0	0.0
B	0.0	0.0	0.0	0.0
C	0.0	0.0	0.0	0.0

CONCLUSION:

The test results obtained for the sample tested are as follows:

Index of overall performance, I = 0.0
(Fire propagation index)

Sub-index, i_1 = 0.0

Sub-index, i_2 = 0.0

Sub-index, i_3 = 0.0

REMARKS:

1. The test results relate only to the behaviour of the test specimens of the product under the particular conditions of test; they are not intended to be the sole criterion for assessing the potential fire hazard of the product in use.
2. The sample was tested with either exposed to the heat and backed with calcium silicate board.

Mah Poh Huat
Associate Engineer

Chan Lung Tca
Product Manager
(Fire Safety & Security Products)
Mechanical

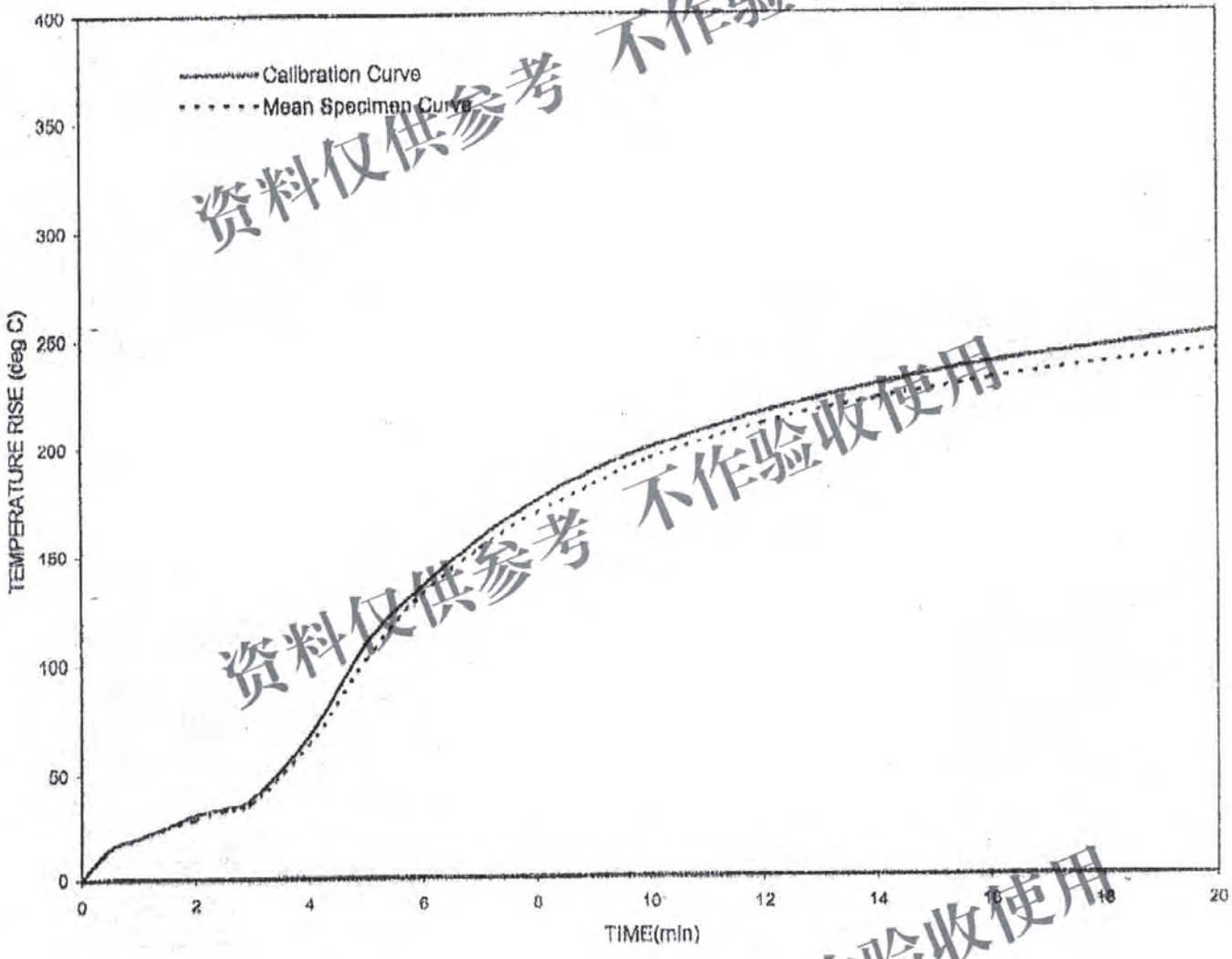

FIGURE 1 : COMPARISON OF MEAN SPECIMEN AND CALIBRATION CURVES

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10. Unless otherwise stated, the tests are carried out in PSB Corporation Pte Ltd, No 1 Science Park Drive Singapore 118221.

June 2006

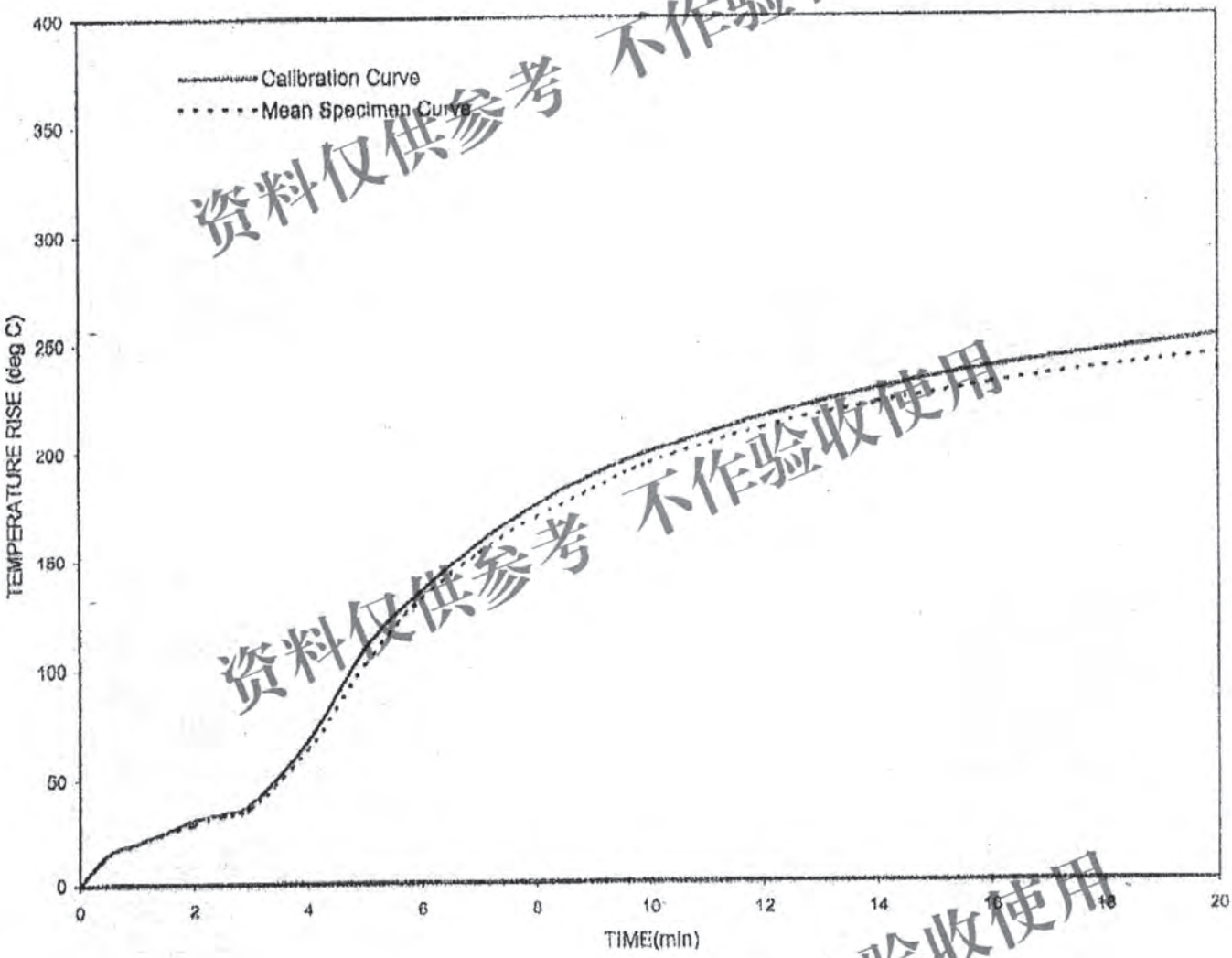

FIGURE 1 : COMPARISON OF MEAN SPECIMEN AND CALIBRATION CURVES

TEST REPORT

PSB
Corporation

Your Ref: Email 26 Oct 05 | Date: 28 Oct 2005

Our Ref: 64S055811/OKH | Page: 1 of 6

DID: 68653783 | Fax: 68621433

NOTE: This report is issued subject to PSB Corporation's "Terms and Conditions Governing Technical Services". The terms and conditions governing the issue of this report are set out as attached within this report.

SUBJECT:

Large scale surface spread of flame test on "Hawk" Calcium Silicate Board material submitted by Kingtec Building Materials Industrial Co., Ltd. on 28 Sep 2005.

TESTED FOR:

Jinte Constructional Material Industrial Limited Company
368 Ping An Road, Yichun City
Jiangxi Province
People's Republic of China

Attn: Mr Shi Zi De

DATE OF TEST:

06 Oct 2005

PURPOSE OF TEST:

To determine the tendency of the surface of a material or a combination of materials to support the spread of flame across its surface and to classify the surface according to the test given in British Standard 476: Part 7: 1997.
The test was conducted at PSB Corporation fire test laboratory located at No. 10 Tuas Avenue 10, Singapore 639134.

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Reg. No. – Regional Offices: Bangkok • Guangzhou • Jakarta • Kuala Lumpur • Qingdao • Shanghai • Tianjin

香 港 認 可 處
Hong Kong Accreditation Service
創新科技署 Innovation and Technology Commission

RQA 1/003/25
Tel No. 2829 4870

12 December 2005

Mr. SZE Po Tak,
Director,
Kingtec (Hong Kong) Building Materials Industrial Co. Ltd,
Shop D, G/F, Lucky House Industrial Building,
64, Tong Mi Road,
Mongkok,
Kowloon

Dear Mr. SZE,

Mutual Recognition Agreement (MRA) Between HKAS and SAC-SINGLAS

I refer to your letter dated 6 December 2005 and the attached SAC-SINGLAS endorsed test reports dated 28 October 2005 and Ref No. 68653783 (Total 5 pages).

HKAS of Hong Kong and SAC-SINGLAS of Singapore are both signatories of the Asia Pacific Laboratory Accreditation Co-operation (APLAC) and the International Laboratory Accreditation Co-operation (ILAC) Multilateral Arrangements (MLA). Under the MLA, signatories accept laboratory accreditation granted by each other as equivalent and undertake to promote the acceptance of test reports endorsed by any signatories to the arrangements. This means that we will regard test report to BS 476:Part 7:1997 standard endorsed by SAC-SINGLAS as equivalent to test reports to the same respective test standards endorsed by HKAS under the Hong Kong Laboratory Accreditation Scheme (HOKLAS).

I hope the above information will be useful to you. If you have any further questions, please do not hesitate to contact the undersigned.

Yours sincerely,

(C K Cheung)
for Executive Administrator

香港灣仔告士打道七號入境事務大樓三十六樓 36/F, Immigration Tower, 7 Gloucester Road, Wan Chai, Hong Kong
電話 Tel: 2829 4837 傳真 Fax: 2824 1302 電郵 E-mail: hkas@itc.gov.hk 網址 Website: http://www.itc.gov.hk/hkas/

54S055811/OKH

PSBCorporation

DESCRIPTION OF SAMPLES:

9 pieces of sample, said to be "Hawk" Calcium Silicate Board material, each of nominal size of 885mm x 270mm x 8mm thickness were received. The bulk density of the sample was found to be about 1244kg/m^3.

TEST PROCEDURE:

Prior to test, the specimens were prepared and conditioned in accordance with paragraphs 5.3 to 5.6 of the standard and secured to a specimen holder as described in paragraph 6.3.

Six specimens were tested with either face exposed to the specified thermal radiation from the apparatus described in paragraph 6.1 of the standard. The intensity of the radiated heat incident on the specimen varies with distance from the hotter end, so that when the specified calibration panel is mounted in the place to be occupied by the specimen, the irradiance of the radiometer is as given in Table 1. The test was terminated when the flame front reached the 825mm reference line, or after 10 minutes has elapsed, whichever is the shorter.

Table 1 : Irradiance Along Horizontal Reference Line on the Calibration Board

Distance along reference line from inside edge of specimen holder	Irradiance kW/m^2		
mm	specified	min.	max.
75	32.5	32.0	33.0
225	21.0	20.5	21.5
375	14.5	14.0	15.0
525	10.0	9.5	10.5
675	7.0	6.5	7.5
825	5.0	4.5	5.5

RESULTS OF TEST:

Specimen No.	1	2	3	4	5	6
Spread of flame at first 1½ minutes (mm)	0	0	0	0	0	0
Distance (mm)	Time of spread of flame to indicated distance (minutes + seconds)					
Start of flaming	nil	nil	nil	nil	nil	nil
75	-	-	-	-	-	-
165	-	-	-	-	-	-
190						
215						
240						
265						
290						
375						
455						
500						
525						
600						
675						
710						
750						
785						
825						
865						
Time of maximum spread of flame (minutes + seconds)	-	-	-	-	-	-
Distance of maximum spread of flame (mm)	0	0	0	0	0	0
Comments	None					

54S055811/OKH

PSB Corporation

Classification of Surface Spread of Flame

Classification	Spread of flame at 1.5 min.		Final spread of flame	
	Limit (mm)	Limit for one specimen in sample (mm)	Limit (mm)	Limit for one specimen in sample (mm)
Class 1	165	165 + 25	165	165 + 25
Class 2	215	215 + 25	455	455 + 45
Class 3	265	265 + 25	710	710 + 75
Class 4	Exceeding the limits for class 3			

CONCLUSION:

In accordance with the class definitions specified in the Standard, the test results show that the sample tested has a Class One Surface Spread of Flame.

REMARKS:

1. The test results relate only to the behaviour of the test specimens of the product under the particular conditions of test; they are not intended to be the sole criterion for assessing the potential fire hazard of the product in use.
2. The sample was tested with either face exposed to the heat and backed with calcium silicate board.

Mah Poh Huat
Associate Engineer

Chan Eang Tee
Product Manager
(Fire Safety & Security Products)
Mechanical

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May 2006

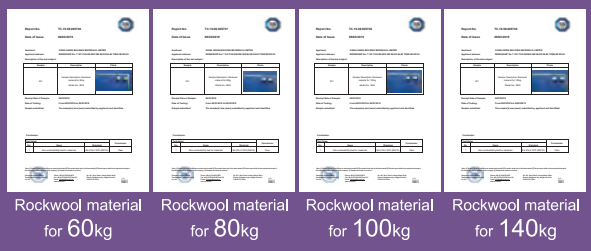
ROCK MINERAL WOOL

BNS mineral rockwool uses selected basalt as the base material and is a heat preservating material made through the processes of being melted at a high temperature, fiber forming through high speed centrifugation and fiber laying through oscillating beltVertically pressed and molded. BNS mineral rockwool is ideal for thermal insulation and sound absorption.It has a stable chemical Properties as well as fireproof and corrosion resistant.It can be made into different forms of boards, felt and pipe shell according to it's different purposes, They are widely applied for exterior walls, roofs, equipments and piping, drywalls help with acoustic corrections & heat preservation as well.

ROCK MINERAL WOOL

Fire Performance Certificate:

BS 476-4:1970, BS 476-6:1970, BS 476-7:1970


Rockwool material for 60kg | Rockwool material for 80kg | Rockwool material for 100kg | Rockwool material for 140kg


Rockwool material for 60kg | Rockwool material for 80kg | Rockwool material for 100kg | Rockwool material for 140kg


Rockwool material for 60kg | Rockwool material for 80kg | Rockwool material for 100kg | Rockwool material for 140kg

Fire prevention

Thermal insulation

moisture proof

Green material

Withstand voltage

Sound absorption

Description

BNS rockwool boards are supplied in 1200 x 600mm format with a density of 60- 140 kg/cu.m. The standard product is bare, but could be manufactured with a factory applied foil or tissue facing if required.

Distributed by:

CHINA UNION BUILDING MATERIALS

E-mail: Chinaunion2office@gmail.com

Tel: 5596 7709

Due to it's superior acoustic performances and the speed of installation of drywalls, lightweight steel-framed partitions are becoming more popularly used in commercial use buildings such as hospitals, cinemas studios and offices.

Below are some suggested specifications of BNS drywalls

ROCK MINERAL WOOL

Fire Performance

BNS rockwool is classified as non-combustible to BS476: Part 4.

Thermal performance

The thermal conductivity of BNS rockwool varies from 0.035 to 0.043 w/mk.

Durability

BNS rockwool is odorless, non-hygroscopic, rot proof, not sustain vermin and does not promote mildew, fungi, or bacteria.

1 Standard metal stud partitions

In all, inside BNS (steel stud) partitions, install acoustic insulation of BNS Rockwool (Unfaced), (50-200mm thick).

Secure BNS Rockwool (Unfaced) at roof of partition using timber batten or light steel angle.

Insulation to fit snugly between studs and at bottom of the structure to ensure that there are no gaps.

Seal partition at sides and all service penetration with acoustic sealant

2 Staggered stud partitions

In all, BNS (steel stud) partitions, install acoustic insulation of BNS Rockwool (Unfaced). (50-200mm thick)

Once the BNS studs have been positioned and boarded on one side, wound the insulation through the studs horizontally. Ensure there are no gaps at abutments or between adjacent lengths of the insulation.

Seal partition at sides and all service penetrations with acoustic sealant.

3 High performance twin frame

In all BNS (twin frame) partitions, install acoustic insulation of BNS Rockwool, (50-200mm thick).

Once the BNS studs have been positioned and boarded on one side, the insulation layer should be inserted between the studs horizontally.

Ensure there are no gaps at abutments or between adjacent lengths of the insulation.

Seal partition at side and all service penetrations with acoustic sealant.

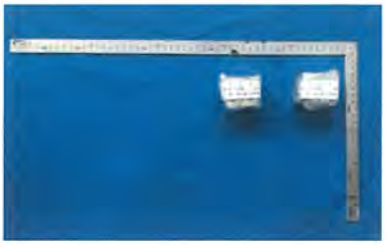
Report No. TC.19.08.005739

Date of Issue 09/03/2019

Applicant: CHINA UNION BUILDING MATERIALS LIMITED

Applicant address: WORKSHOP No.7 13/F FUK KEUNG IND BLDG 66-68 TONG MI RD KL

Description of the test subject:

Sample	Description	Photo
001	Sample Description: Rockwool material for 140kg Model No.: BNS	

Receipt Date of Sample: 08/23/2019

Date of Testing: From 08/23/2019 to 09/03/2019

Sample submitted: The sample(s) was (were) submitted by applicant and identified.

Conclusion:

Test Items			Conclusion
No.	Items	Standard	
1	Non-combustibility test for materials	BS 476-4:1970 (R2012)	Pass

Changzhou Jinbiao Railway Transportation Technical Service Co.,Ltd.

Phone: +86/ (0) 519-8123-9872
Fax: +86/ (0) 519-8123-9872 ext.123
E-mail: hui.shen@tuv-sud.cn
www.tuv-sud.cn

No. 164, Wuyi Road ,Lucheng Street, Wujin District, Changzhou city, Jiangsu Province, 213015 P.R. China

Report No. TC.19.08.005739

Date of Issue 09/03/2019

Test Results

1. BS 476-4:1970 (R2012) Fire tests on building materials and structures. Non-combustibility test for materials

1.1 Sample describe

Specimen size	40mm x 40mm
Height	50mm

conditioning	temperature	relative humidity	Period
	60±5°C	desiccative	24h

1.2 Test result

Specimen	1	2	3	Average
Furnace temperature (initial) (°C)	746	749	750	748
Duration of sustained flaming inside the furnace (s)	--	--	--	--
Highest temperature of the centre of specimen Tc(max) (°C)	779	773	772	775
Final temperature of the centre of specimen Tc(final °C)	764	759	762	762
Highest temperature of furnace inside TF(max) (°C)	764	762	763	763
Final temperature of furnace inside TF(final °C)	747	743	744	745
The centre of specimen temperature rise △TC(°C)	15	14	10	13
Furnace inside temperature rise △TF(°C)	18	13	13	15

Requirement:
The material shall be deemed non-combustible if, during the test, none of the three specimens either
1) Causes the temperature reading from either of the two thermocouples to rise by 50 deg C or more above the initial furnace temperature (the stabilized temperature is 750°C), or
2) Is observed to flame continuously for 10 s or more inside the furnace. Otherwise, the material shall be deemed combustible.

Conclusion: According to the test results, the sample **complies** with the requirement of BS 476-4:1970 (R2012).

Statement: The test results relate to the behaviour of the test specimens of a product under the particular conditions of the test; they are not intended to the sole criterion for assessing the potential smoke and toxicity hazard of the product in use.

Changzhou Jinbiao Railway Transportation Technical Service Co.,Ltd.
Phone: +86/ (0) 519-8123-9872
Fax: +86/ (0) 519-8123-9872 ext.123
E-mail: hui.shen@tuv-sud.cn
www.tuv-sud.cn
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Report No. TC.19.08.005739

Date of Issue 09/03/2019

Changzhou Jinbiao Railway Transportation Technical Service Co., Ltd.

Drafted by:

Lynn liu

Approved by:

Shen hui

-End of Report-

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Report No. TC.20.07.003403

Date of Issue 08/04/2020

Applicant: CHINA UNION BUILDING MATERIALS LIMITED

Applicant address: WORKSHOP No.7 13/F FUK KEUNG IND BLDG 66-68 TONG MI RD KL

Description of the test subject:

Sample	Description	Photo
001	Sample Description: Rockwool material for 140kg Style No.: BNS	

Receipt Date of Sample: 07/27/2020

Date of Testing: From 07/27/2020 to 08/04/2020

Sample submitted: The sample(s) was (were) submitted by applicant and identified.

Conclusion:

Test Items			Conclusion
No.	Items	Standard	
1	Fire tests on building materials and structures —Part 6: Method of test for fire propagation for products	BS 476-6:1989+A1:2009	See test results

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Fax: +86/ (0) 519-8123-9872 ext.123
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www.tuv-sud.cn

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Report No. TC.20.07.003403

Date of Issue 08/04/2020

Test Results

1. BS476-6:1989+A1:2009 Fire tests on building materials and structures —Part 6: Method of test for fire propagation for products

1.1 Sample details

Size of specimen	225mm×225mm
Thickness	About 50.0 mm

Precondition	Temperature	Relative humidity	Duration
	23±2°C	50±5%R.H.	48h

1.2 Test result

Specimens	Index of performance of specimens			The index of performance
	S_1	S_2	S_3	S
A	0.95	0	0	0.95
B	0.91	0	0	0.91
C	0.98	0	0	0.98

Sample quantity	i_1	i_2	i_3	Fire propagation index I
3	0.95	0	0	0.95

Note: S, S1, S2 and S3 are given by the following expressions.

$$S_1 = \sum_{t=0.5}^{t=3} \frac{\theta_s - \theta_c}{10t} \quad ; \quad S_2 = \sum_{t=4}^{t=10} \frac{\theta_s - \theta_c}{10t} \quad ; \quad S_3 = \sum_{t=12}^{t=20} \frac{\theta_s - \theta_c}{10t}$$

$$S = S_1 + S_2 + S_3$$

Fire propagation index:

$$i_1 = \frac{1}{3}\left[(S_1)_A + (S_1)_B + (S_1)_C\right] \quad ; \quad i_2 = \frac{1}{3}\left[(S_2)_A + (S_2)_B + (S_2)_C\right]$$

$$i_3 = \frac{1}{3}\left[(S_3)_A + (S_3)_B + (S_3)_C\right] \quad ; \quad I = i_1 + i_2 + i_3$$

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Report No. TC.20.07.003403

Date of Issue 08/04/2020

Remark:

θ_S the temperature rise for the flue gases, °C

θ_C the actual temperature rise to the nearest, °C

Statement: The test results relate to the behaviour of the test specimens of a product under the particular conditions of the test; they are not intended to the sole criterion for assessing the potential smoke and toxicity hazard of the product in use. Test results are just for internal reference.

Changzhou Jinbiao Railway Transportation Technical Service Co., Ltd.

Drafted by: Wayne Wang

Approved by: Shen hui

-End of Report-

Changzhou Jinbiao Railway Transportation Technical Service Co.,Ltd.

Phone: +86/ (0) 519-8123-9872
Fax: +86/ (0) 519-8123-9872 ext.123
E-mail: hui.shen@tuv-sud.cn
www.tuv-sud.cn

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Test Report

Report No. TC.21.03.000701

Date of Issue 03/17/2021

Applicant: CHINA UNION BUILDING MATERIALS LIMITED

Applicant address: G/F 619 RECLAMATION STREET MONG KOK KL

Description of the test subject:

Sample	Description	Photo
001	Sample Description: Rock Wool material for 140kg Style No.: BNS	

Receipt Date of Sample: 03/09/2021

Date of Testing: From 03/09/2021 to 03/17/2021

Sample submitted: The sample(s) was (were) submitted by applicant and identified.

Conclusion:

Test Items			Result
No.	Items	Standard	
1	Fire tests on building materials and structures Part 7. Method of test to determine the classification of the surface spread of flame of products	BS 476-7:1997(R2016)	See test result

Laboratory:
TÜV SÜD SW Rail Transportation Technology (Jiangsu) Co., Ltd.

Phone: +86/ (0) 519- 8123-9872
Fax: +86/ (0) 519- 8123-9872 ext.123
E-mail: Haixin.Zhao @tuvsud.com
www.tuvsud.com

Regd. Office:
Innovative Industry Park, No. 377 Wuyinan Road, National High and New Technology & Industry Development Zone, Wujin, 213015 P.R. China

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Test Report

Report No. TC.21.03.000701

Date of Issue 03/17/2021

Test Results

1. BS 476-7:1997(R2016) Fire tests on building materials and structures Part 7. Method of test to determine the classification of the surface spread of flame of products

1.1 Sample details:

Specimen size	885mm×270mm
Thickness	About 50.0 mm
Conditioning	Constant mass at a temperature of 23±2°Cand a relative humidity of 50±10%

1.2 Test results:

Distance (mm)	Time to travel to indicated distance (second)					
	1	2	3	4	5	6
165	NR	NR	NR	NR	NR	NR
455	NR	NR	NR	NR	NR	NR
710	NR	NR	NR	NR	NR	NR
825	NR	NR	NR	NR	NR	NR
Maximum distance traveled at 1.5 minutes (mm)	0	0	0	0	0	0
Maximum distance traveled during the whole test (mm)	0	0	0	0	0	0
Time to reach maximum distance traveled(second)	--	--	--	--	--	--
Observations	--					

Remark:

1.Six specimens are usually tested. If the test on any specimen is deemed to be invalid, as defined in the standard, it is permissible for up to a maximum of nine specimens to be tested in order to obtain the six valid test results.

2. NR=Not reached

Classification:

In accordance with the tested results and the classifications defined in BS 476-7:1997(R2016), the submitted sample is classified as **Class 1**

Laboratory:
TÜV SÜD SW Rail Transportation Technology (Jiangsu) Co., Ltd.

Phone: +86/ (0) 519- 8123-9872
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Test Report

Report No. TC.21.03.000701

Date of Issue 03/17/2021

Classification requirements:

Classification	Spread of flame at 1.5 min		Final spread of flame	
	Limit (mm)	Limit for one specimen in sample(mm)	Limit (mm)	Limit for one specimen in sample(mm)
Class 1	165	165+25	165	165+25
Class 2	215	215+25	455	455+45
Class 3	265	265+25	710	710+75
Class 4	Exceeding the limits for class 3			

Statement: The test results relate to the behaviour of the test specimens of a product under the particular conditions of the test; they are not intended to the sole criterion for assessing the potential smoke and toxicity hazard of the product in use. Test results are just for internal reference.

TÜV SÜD SW Rail Transportation Technology (Jiangsu) Co., Ltd.

Drafted by: Qin Jianzhong

Jianzhong Qin

Approved by: wayne

Wayne Wang

-End of Report-

Laboratory:
TÜV SÜD SW Rail Transportation Technology (Jiangsu) Co., Ltd.

Phone: +86/ (0) 519- 8123-9872
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E-mail: Haixin.Zhao @tuvsud.com
www.tuvsud.com

Regd. Office:
Innovative Industry Park, No. 377 Wuyinan Road,
National High and New Technology & Industry
Development Zone, Wujin, 213015 P.R. China

REPORT TO: Kingtec Building Materials (HK & Macau) Ltd.

ADDRESS: Unit 1, 3/F, Block B, Shatin Ind. Ctr.
5-7 Yuen Shun Circuit,
Shatin, N.T., Hong Kong

ATTN.: Ms. Lilian Tse / Mr. Sammy Chan

REPORT NO.: APJ15-070-RP002(Rw)

ISSUE DATE: 20 August 2015

HOKLAS Accredited Laboratory Laboratory Sound Reduction Index Measurement Test Report for 90mm Kingtec Hawk Pan Fire-rated Partition System

for Kingtec Building Materials (HK & Macau) Ltd.

(PROJECT NO.: APJ15-070)

Prepared by:

Tang Cheuk Hang
Quality Manager
WN / MT / NS

Endorsed by:

Ng Yan Wa
Laboratory Manager
(Approved Signatory)

HKAS has accredited this Laboratory (Reg. No. 122-TEST) under HOKLAS for specific laboratory activities as listed in the HOKLAS directory of accredited laboratories.

Room 422, Leader Industrial Centre, 57-59 Au Pui Wan Street, Fo Tan, Shatin, N.T., Hong Kong
Tel: (852) 2668 3423 Fax: (852) 2668 6946
Homepage: http://www.aa-lab.com E-mail: inquiry@aa-lab.com

1. Method of Measurement

1.1 The measurements were carried out in accordance with ISO 140-3:1995 (E) "Acoustics – Measurement of airborne sound insulation in buildings and of building elements - Part 3 Laboratory measurements of airborne sound insulation of building elements" (equivalent to BS 2750 Part 3: 1995) in the reverberation chamber of Acoustics and Air Testing Laboratory Co. Ltd. And the single-figure quantity for airborne sound insulation rating was evaluated in accordance with BS EN ISO 717-1:1997.

2. Details of Measurement

2.1 Principle of Measurement

The expression "sound transmission loss" (TL) is also equivalent to "sound reduction index" (R).

The sound reduction index of a partition is usually measured in a laboratory by placing the element in an opening between two adjacent reverberant rooms designed for such tests. Noise is introduced into one of the rooms, referred to as the source room, and part of the sound energy is transmitted through the test element into the second room, referred to as the receiving room. The resulting mean space-average sound pressure levels in the source room and receiving room is L_1 and L_2, respectively.

The sound reduction index is given by

$$TL = L_1 - L_2 + 10 \log(S/A)$$

Where

S is the area of the test specimen, in square metres.

A is the equivalent absorption area in the receiving room, in square metres, which may preferably be evaluated from the reverberation time measured according to ISO 354: 1985 and evaluated using Sabine's formula

$$A = 0.16\,V/T$$

Where

V is the receiving room volume, in cubic metres;

T is the reverberation time, in seconds, which was obtained by reading and averaging the measured value in receiving room.

The Weighted Sound Reduction Index (Rw) in decibels (dB) is calculated by comparing the sixteen values of Sound Transmission Loss from 100 Hz to 3150 Hz with a defined reference curve which is incremented until the requirements of BS EN ISO 717-1: 1997 are met. Spectrum adaptation terms C and C_{tr} are also calculated.

Room 422, Leader Industrial Centre, 57-59 Au Pui Wan Street, Fo Tan, Shatin, N.T., Hong Kong
Tel: (852) 2668 3423 Fax: (852) 2668 6946
Homepage: http://www.aa-lab.com E-mail: inquiry@aa-lab.com

2.2 Laboratory Location

Acoustics and Air Testing Laboratory Company Limited
Room 422, Leader Industrial Centre, 57-59 Au Pui Wan Street,
Fo Tan, Shatin, N.T., Hong Kong.

2.3 Test Condition

Conditions	Source room	Receiving room
Volume	84m^3	203m^3
Air Temperature	25.8°C	25.1°C
Relative Humidity	66.0%	66.7%

2.4 Test Date

Date of receipt of test item: 17 August 2015

Date test commencement and completion
Commencing date: 18 August 2015
Completion date 18 August 2015

2.5 Instrumentation

2.5.1 For sound production

Type	Serial No.
One Real Time Frequency Analyzer – LAN-XI 3160A	3160-100361
One Equalizer – Marantz EQ20D	56E040097
One Amplifier – B&K 2716 Power Amplifier	2571771
One OmniPower Sound Source – Bruel & Kjaer 4296	2128136
One Loudspeaker – JBL EON 515 Loudspeaker	VTP0890-14112

2.5.2 For sound measurement

One Real Time Frequency Analyzer – LAN-XI 3160A	3160-100361
Two Free-field ½" Microphone – Bruel & Kjaer 4190	2731708 & 2731709
Two ½" Microphone Preamplifier – Bruel & Kjaer 2669	2081972 & 2081971
One Sound Level Calibrator – Bruel & Kjaer 4231	1914426

2.5.3 For reverberation time measurement

One Real Time Frequency Analyzer – LAN-XI 3160A	3160-100361
One Free-field ½" Microphone – Bruel & Kjaer 4190	2731708
One ½" Microphone Preamplifier – Bruel & Kjaer 2669	2081972

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3. Results Application

3.1 The results obtained can be used to design building elements with appropriate acoustic properties, to compare the sound insulation properties of building elements and to classify such elements according to their sound insulation capabilities.

3.2 The measurements are performed in laboratory test facilities in which transmission of sound on flanking paths is suppressed. Results of measurements shall not be applied directly in the field without accounting for other factors affecting sound insulation, especially flanking transmission and loss factor.

3.3 The test results obtained relate only to the specimen tested.

4. Description of the Test Construction

4.1 Specimen description: The test specimen composed of totally two layers of 9mm thick Kingtec Hawk Pan calcium silicate board with nominal density of 1000kg/m^3, two calcium silicate fillets (50mm x 9mm), 50mm thick steel stud (at 600mm o.c.) which containing 50mm thick rockwool insulation (density: 100kg/m^3). All gaps were fully caulked.

The 90mm thick partition system was constructed in the test opening between Receiving Room and Source Room and consisted of:

Face layer	: 9mm Kingtec Hawk Pan calcium silicate board (9kg/m^2)
Base layer	: 9mm x 50mm Kingtec Hawk Pan calcium silicate fillet (9kg/m^2)
Metal Stud	: 50mm Steel Stud
Acoustic Infill	: 50mm Rockwool (5kg/m^2)
Base layer	: 9mm x 50mm Kingtec Hawk Pan calcium silicate fillet (9kg/m^2)
Face layer	: 9mm Kingtec Hawk Pan calcium silicate board (9kg/m^2)

4.2 The partition system was essentially as detailed in the client supplied drawing reproduced as in Appendix 1.

4.3 Overall specimen size: 1200 mm (wide) X 2340 mm (high) X 90mm (approx.) thick.

4.4 The tested partition system was supplied and installed by Kingtec Building Materials (HK & Macau) Ltd. on 18 August 2015.

4.5 Photographic records showing the test specimen and measurement setup are given in Appendix 2.

Room 422, Leader Industrial Centre, 57-59 Au Pui Wan Street, Fo Tan, Shatin, N.T., Hong Kong
Tel: (852) 2668 3423 Fax: (852) 2668 6946
Homepage: http://www.aa-lab.com E-mail: inquiry@aa-lab.com

5. Measurement Results

5.1 The results of measurement for the tested specimen are given in the following table:

Frequency f, Hz	Sound reduction index R, dB	Sound reduction index R, dB	Uncertainty
100	13.7	17.8	±1.56
125	21.6		±1.63
160	32.0		±1.27
200	38.4	41.4	±1.01
250	43.2		±0.81
315	45.8		±0.66
400	50.1	51.2	±0.66
500	50.8		±0.49
630	53.3		±0.53
800	54.6	55.6	±0.43
1000	56.1		±0.85
1250	56.3		±0.51
1600	55.9	56.0	±0.43
2000	56.2		±0.35
2500	55.8		±0.32
3150	51.6	53.9	±0.36
4000	54.2		±0.31
5000	58.3		±0.37

NOTE: The 95% measurement uncertainty is calculated according to an engineering method in compliance with the "Guide to the Expression of Uncertainty in Measurement", 1995.

Room 422, Leader Industrial Centre, 57-59 Au Pui Wan Street, Fo Tan, Shatin, N.T., Hong Kong
Tel: (852) 2668 3423 Fax: (852) 2668 6946
Homepage: http://www.aa-lab.com E-mail: inquiry@aa-lab.com

5.2 The measured sound reduction index of the tested specimen against 1/3-octave band center frequencies is plotted on Figure 1.

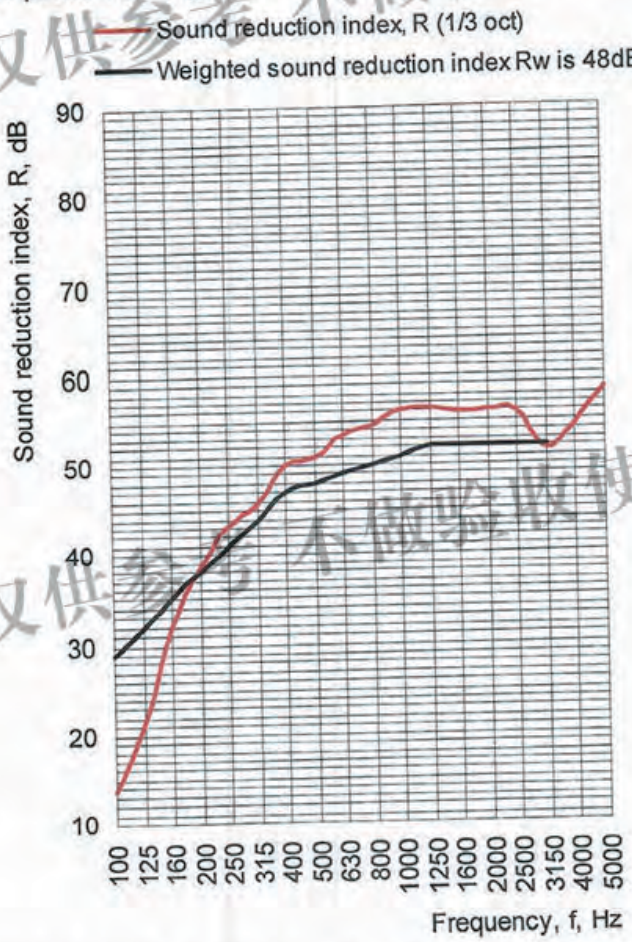

Figure 1. Sound Reduction Index against Frequency

Weighted Sound Reduction Index R'w:

Description	Weighted Sound Reduction Index Rw, dB
90mm Kingtec Hawk Pan Fire-rated Partition System	48

5.3 The rating standard, BS EN ISO 717-1:1997, identifies a number of single figure ratings for this type of test. Evaluation based on laboratory measurement results is obtained by a laboratory method. The calculated values of these rating are:

R'w (C;C_{tr}) = 58 (-7;-15) dB	$C_{100\text{-}5000}$ = -6 dB
	$C_{tr,100\text{-}5000}$ = -15 dB

- END -

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Homepage: http://www.aa-lab.com E-mail: inquiry@aa-lab.com

Appendix List

Room 422, Leader Industrial Centre, 57-59 Au Pui Wan Street, Fo Tan, Shatin, N.T., Hong Kong
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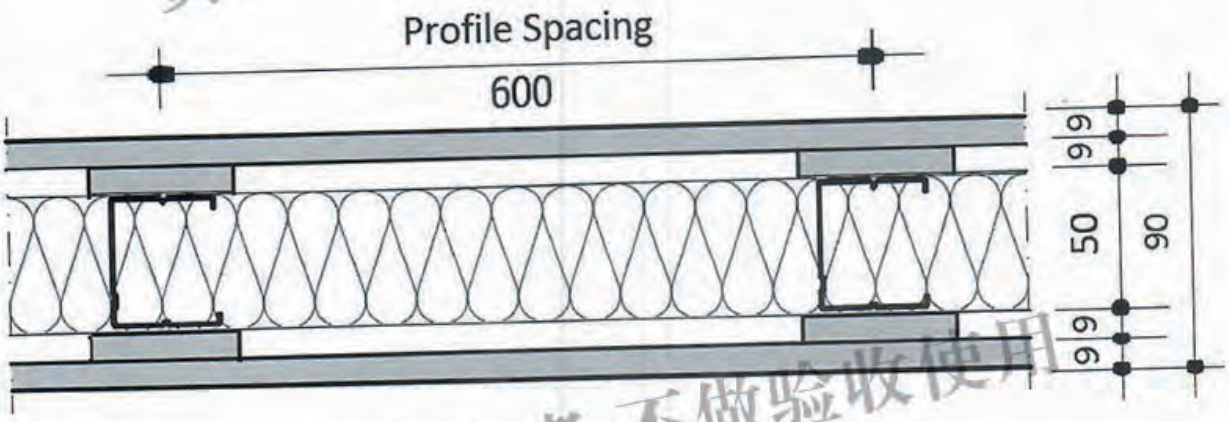
Appendix 1

Details of Test Specimen



Fire-rated Partition System:

The partition system was constructed in the test opening between Receiving Room and Source Room and consisted of:

Face layer	: 9mm Kingtec Hawk Pan calcium silicate board (9kg/m^2)
Base layer	: 9mm x 50mm Kingtec Hawk Pan calcium silicate fillet (9kg/m^2)
Metal Stud	: 50mm Steel Stud
Acoustic Infill	: 50mm Rockwool (5kg/m^2)
Base layer	: 9mm x 50mm Kingtec Hawk Pan calcium silicate fillet (9kg/m^2)
Face layer	: 9mm Kingtec Hawk Pan calcium silicate board (9kg/m^2)

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Homepage: http://www.aa-lab.com E-mail: inquiry@aa-lab.com

Appendix 2

Photographic Records

Measurement set-up (Source room)

Measurement set-up (Receiving room)

Room 422, Leader Industrial Centre, 57-59 Au Pui Wan Street, Fo Tan, Shatin, N.T., Hong Kong
Tel: (852) 2668 3423 Fax: (852) 2668 6946
Homepage: http://www.aa-lab.com E-mail: inquiry@aa-lab.com

REPORT TO: Kingtec Building Materials (HK & Macau) Ltd.

ADDRESS: Unit 1, 3/F, Block B, Shatin Ind. Ctr.
5-7 Yuen Shun Circuit,
Shatin, N.T., Hong Kong

ATTN.: Ms. Lilian Tse / Mr. Sammy Chan

REPORT NO.: APJ15-070-RP001(STC)

ISSUE DATE: 20 August 2015

HOKLAS Accredited Laboratory
Laboratory Sound Transmission Loss Measurement
Test Report
for
140mm Kingtec Hawk Pan Fire-rated Partition System

for Kingtec Building Materials (HK & Macau) Ltd.

(PROJECT NO.: APJ15-070)

Room 422, Leader Industrial Centre, 57-59 Au Pui Wan Street, Fo Tan, Shatin, N.T., Hong Kong
Tel: (852) 2668 3423 Fax: (852) 2668 6946
http://www.aa-lab.com E-mail: inquiry@aa-lab.com

1. Method of Measurement

1.1 The measurement was carried out in accordance with ASTM E90-09 "Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions" in the reverberation room of Acoustics and Air Testing Laboratory Co. Ltd. And the single number rating of airborne sound transmission loss is given as Sound Transmission Class (STC) by evaluated in accordance with ASTM E413-10 "Classification for Rating Sound Insulation".

2. Details of Measurement

2.1 Principle of Measurement

The sound transmission loss is usually measured in a laboratory by placing the element in an opening between two adjacent reverberant rooms designed for such tests. Noise is introduced into one of the rooms, referred to as the source room, and part of the sound energy is transmitted through the test element into the second room, referred to as the receiving room. The resulting mean space-average sound pressure levels in the source and receiving rooms are denoted by L_1 and L_2 respectively.

The sound transmission loss is given by

$$TL = L_1 - L_2 + 10\log(S/A)$$

Where

L_1 is the average sound pressure level in the source room, in dB;
L_2 is the average sound pressure level in the receiving room, in dB;
S is the area of the test specimen, in m^2;
A is the equivalent absorption area in the receiving room, in meters sabins.

$$A = (0.9210Vd/c)$$

Where

V is the receiving room volume, in m^3;
d is the rate of decay of sound pressure level in receiving room, dB/s;
c is the speed of sound in the medium , m/s.

The speed of sound changes with temperature and is shall be calculated for the conditions existing at the time of test from the equation:

$$c = 20.047\sqrt{273.15 + t}$$

Where

t is the receiving room temperature, measured to nearest degree.

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Tel: (852) 2668 3423 Fax: (852) 2668 6946
E-mail: inquiry@aa-lab.com

The Sound Transmission Class (STC) of test specimen is calculated by comparing the sixteen values of Sound Transmission Loss from 125 Hz to 4000 Hz with a defined reference curve which is incremented until the requirements of ASTM E 413-10 are met.

2.2 Laboratory Location

Fo Tan Main Laboratory -
Room 422, Leader Industrial Centre, 57-59 Au Pui Wan Street,
Fo Tan, Shatin, N.T., Hong Kong.

2.3 Test Condition

Conditions	Source room	Receiving room
Volume	84m^3	203m^3
Air Temperature	26.1°C	25.1°C
Relative Humidity	69.3%	69.9%

2.4 Test Date

Date of receipt of test item: 17 August 2015

Date test commencement and completion
Commencing date: 18 August 2015
Completion date 18 August 2015

2.5 Instrumentation

2.5.1 For sound production

Type	Serial No.
One Real Time Frequency Analyzer – LAN-XI 3160A	3160-100361
One Equalizer – Marantz EQ20D	56E040097
One Amplifier – B&K 2716 Power Amplifier	2571771
One OmniPower Sound Source – Bruel & Kjaer 4296	2128136
One Loudspeaker – JBL EON 515 Loudspeaker	VTP0890-14112

2.5.2 For sound measurement

One Real Time Frequency Analyzer – LAN-XI 3160A	3160-100361
Two Free-field ½" Microphone – Bruel & Kjaer 4190	2731708 & 2731709
Two ½" Microphone Preamplifier – Bruel & Kjaer 2669	2081972 & 2081971
One Sound Level Calibrator – Bruel & Kjaer 4231	1914426

2.5.3 For reverberation time measurement

One Real Time Frequency Analyzer – LAN-XI 3160A	3160-100361
One Free-field ½" Microphone – Bruel & Kjaer 4190	2731708
One ½" Microphone Preamplifier – Bruel & Kjaer 2669	2081972

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Homepage: http://www.aa-lab.com E-mail: inquiry@aa-lab.com

3. Results Application

3.1 The results obtained can be used to design building elements with appropriate acoustic properties, to compare the sound insulation properties of building elements and to classify such elements according to their sound insulation capabilities.

3.2 The measurements are performed in laboratory test facilities in which transmission of sound on flanking paths is suppressed. Results of measurements shall not be applied directly in the field without accounting for other factors affecting sound insulation, especially flanking transmission and loss factor.

3.3 The obtained test results relate only to the tested specimen.

4. Description of the Test Construction

4.1 Specimen description: The test specimen composed of totally four layers of 9mm thick Kingtec Hawk Pan calcium silicate board with nominal density of 1000kg/m^3, 2x50mm thick steel stud (at 600mm o.c.) which containing 2x50mm thick rockwool insulation (density: 100kg/m^3). All gaps were fully caulked.

The 140mm thick partition system was constructed in the test opening between Receiving Room and Source Room and consisted of:

Face layer	: 9mm Kingtec Hawk Pan calcium silicate board (9kg/m^2)
Base layer	: 9mm Kingtec Hawk Pan calcium silicate board (9kg/m^2)
Metal Stud	: 50mm Steel Stud x 2
Acoustic Infill	: 50mm Rockwool (5kg/m^2) x 2
Base layer	: 9mm Kingtec Hawk Pan calcium silicate board (9kg/m^2)
Face layer	: 9mm Kingtec Hawk Pan calcium silicate board (9kg/m^2)

4.2 The partition system was essentially as detailed in the client supplied drawing reproduced as in Appendix 1.

4.3 Overall specimen size: 1200 mm (wide) X 2340 mm (high) X 140mm (approx.) thick.

4.4 The tested partition system was supplied and installed by Kingtec Building Materials (HK & Macau) Ltd. on 18 August 2015.

4.5 Photographic records showing the test specimen and measurement setup are given in Appendix 2.

Room 422, Leader Industrial Centre, 57-59 Au Pui Wan Street, Fo Tan, Shatin, N.T., Hong Kong
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Homepage: http://www.aa-lab.com E-mail: inquiry@aa-lab.com

5. Measurement Results

5.1 The results of measurement for the tested specimen are given in the following table:

Frequency f, Hz	Sound Transmission loss, dB	Sound Transmission loss, dB	Uncertainty, dB
100	35	36	±1.8
125	35		±1.6
160	44		±1.4
200	50	50	±1.1
250	51		±0.9
315	51		±0.8
400	53	54	±0.8
500	54		±0.6
630	56		±0.6
800	59	60	±0.6
1000	61		±1.0
1250	61		±0.6
1600	62	64	±0.5
2000	65		±0.4
2500	65		±0.4
3150	62	64	±0.4
4000	63		±0.4
5000	67		±0.5

5.2 The measured sound transmission loss of the tested specimen against 1/3-octave band center frequencies is plotted on Figure 1.

5.3 The 95% measurement uncertainty is calculated according to the method stated in the Standard ASTM E90-09 A2.

Room 422, Leader Industrial Centre, 57-59 Au Pui Wan Street, Fo Tan, Shatin, N.T., Hong Kong
Tel: (852) 2668 3423 Fax: (852) 2668 6946
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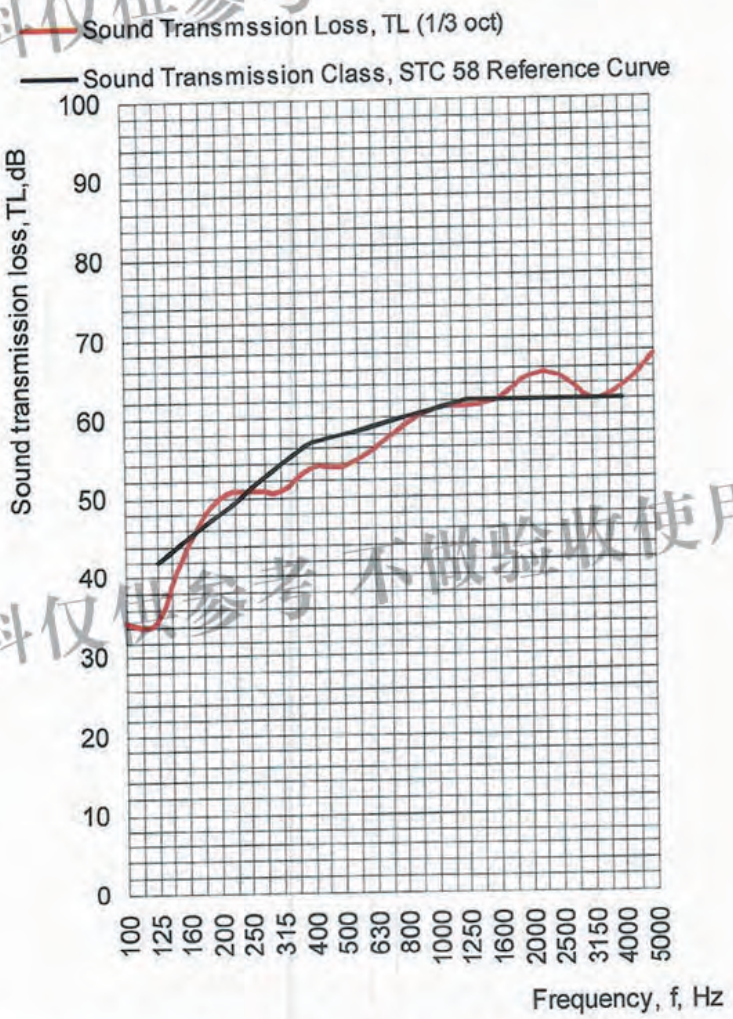

Figure 1. Sound transmission loss against Frequency

5.4 The single number rating of sound transmission class (STC) In accordance with ASTM E413-10 of the tested specimen is given below:

Description	Sound Transmission Class, STC
140mm Kingtec Hawk Pan Fire-rated Partition System	STC 58

Prepared by:

Tang Cheuk Hang
Quality Manager
WN / MT / NS

Endorsed by:

Ng Yan Wa
Laboratory Manager
(Approved Signatory)

- END -

Room 422, Leader Industrial Centre, 57-59 Au Pui Wan Street, Fo Tan, Shatin, N.T., Hong Kong
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Appendix 2	**Photographic Records**

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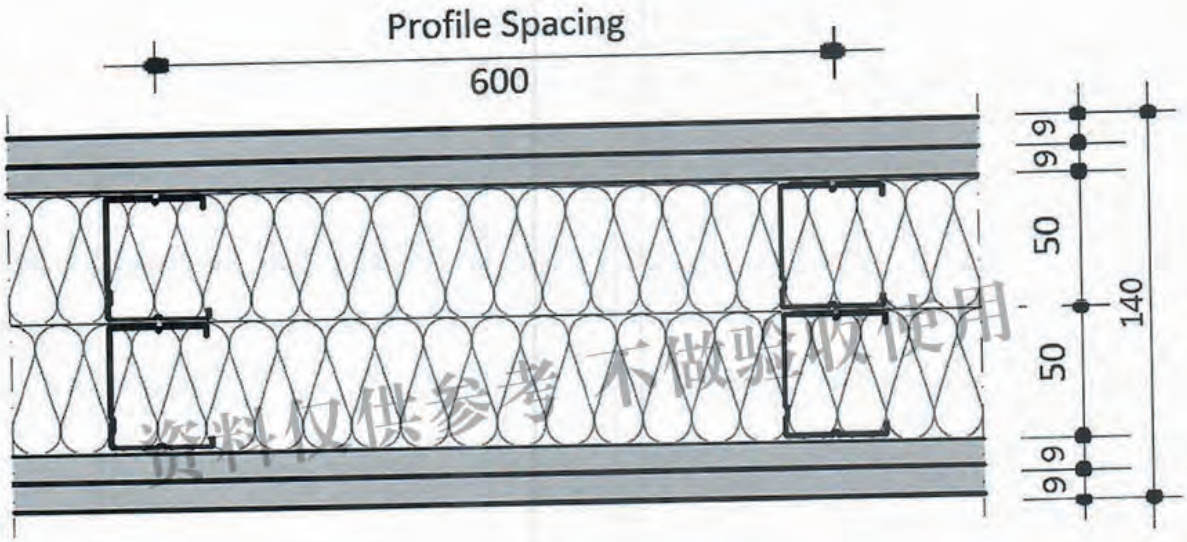
Appendix 1

Details of Test Specimen



Fire-rated Partition System:

The partition system was constructed in the test opening between Receiving Room and Source Room and consisted of:

Face layer	: 9mm Kingtec Hawk Pan calcium silicate board (9kg/m^2)
Base layer	: 9mm Kingtec Hawk Pan calcium silicate board (9kg/m^2)
Metal Stud	: 50mm Steel Stud x 2
Acoustic Infill	: 50mm Rockwool (5kg/m^2) x 2
Base layer	: 9mm Kingtec Hawk Pan calcium silicate board (9kg/m^2)
Face layer	: 9mm Kingtec Hawk Pan calcium silicate board (9kg/m^2)

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Appendix 2

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Measurement set-up (Source room)

Measurement set-up (Receiving room)

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Homepage: http://www.aa-lab.com E-mail: inquiry@aa-lab.com

REPORT TO: Kingtec Building Materials (HK & Macau) Ltd.

ADDRESS: Unit 4, 3/F, Block B, Shatin Ind. Ctr.
5-7 Yuen Shun Circuit,
Shatin, N.T., Hong Kong

ATTN.: Ms. Lilian Tse / Mr. Sammy Chan

REPORT NO.: APJ15-169-RP002

ISSUE DATE: 30 January 2016

Assessment Report for Sound Transmission Class (STC) Performance of Kingtec Hawk Pan Fire-rated Partition Systems

(3 x 9mm Kingtec Hawk Pan + 2 x 50mm Stud c/w 50mm Rockwool batt + 3 x 9mm Kingtec Hawk Pan)

(2 x 12mm Kingtec Hawk Pan + 2 x 50mm Stud c/w 50mm Rockwool batt + 2x 12mm Kingtec Hawk Pan)

(PROJECT NO.: APJ15-169)

Prepared by:

Max Tang
Quality Manager
WN / MT / NS

Endorsed by:

Wallace Ng
Laboratory Manager
(Approved Signatory)

Room 422, Leader Industrial Centre, 57-59 Au Pui Wan Street, Fo Tan, Shatin, N.T., Hong Kong
Tel: (852) 2668 3423 Fax: (852) 2668 6946
Homepage: http://www.aa-lab.com E-mail: inquiry@aa-lab.com

1. Introduction

This report presents an appraisal of the sound insulation performance for two modified fire-rated partition systems by Kingtec Building Materials (HK & Macau) Ltd., based on previously tested data and partition construction described in acoustic test report APJ15-070-RP001(STC) which was tested by Acoustics and Air Testing Laboratory Company Limited.

The fire-rated partition system, which comprised 2 x 9mm Kingtec Hawk Pan on both sides of 2 x 50mm steel stud filled with 50mm rockwool insulation, had been tested achieving acoustic rating of STC58.

The acoustic rating of modified fire-rated partition system due to the variation from 2 layers 9mm Kingtec Hawk Pan to 3 layers 9mm Kingtec Hawk Pan or 2 layers 12mm Kingtec hawk Pan will be assessed. The predicted performance of the modified partition system is checked with the requirement of ASTM E90-09 and ASTM E413-10 for STC rating.

2. Background Information

2.1 STC / R_w Rating

The sound transmission loss of a partition is a measure of the airborne sound insulation it provides. It is a measure of the ratio of the sound energy W_1 striking the partition relative to the energy W_2 which is transmitted through the partition.

This quantity is denoted by R and is expressed in decibels as follows,

$$R = 10 \lg \frac{W_1}{W_2}$$

The sound transmission loss of a partition varies with frequency, usually increasing as the frequency increases.

Although sound insulation varies with frequency and is very different for different types of partitions, it is convenient to compares the effectiveness of two partitions using a method of rating sound insulation that can be represented by a single number. In North America, the most commonly used single-number rating of sound insulation is called the "sound transmission class (STC)". In many countries other than North America, the single-number rating system used to express the overall sound insulation value of a partition is called the weighted sound reduction index R_w. The higher the R_w or STC rating, the better the sound insulation provided by a partition.

In this report, STC will be used to present the sound insulation performance of wall partition system. Values of the Sound Transmission Class, STC are determined from the measured sound reduction indices in the frequency range 125Hz to 4000Hz.

Room 422, Leader Industrial Centre, 57-59 Au Pui Wan Street, Fo Tan, Shatin, N.T., Hong Kong
Tel: (852) 2668 3423 Fax: (852) 2668 6946
http://www.aa-lab.com E-mail: inquiry@aa-lab.com

2.2 Supporting Data

"(A+A)*L Test Report No. APJ15-070-RP001(STC)"

A fire-rated partition system supplied by Kingtec Building Materials (HK & Macau) Ltd. was tested according to ASTM E90-09 and ASTM E413-10 in the reverberation chambers of Acoustics and Air Testing Laboratory in Hong Kong on 18 August 2015. The tested partition system can achieve sound insulation performance of STC58. The details of the laboratory sound transmission loss measurement for the captioned partition system are given in the Test Report APJ15-070-RP001(STC).

Specimen description: The test specimen composed of totally four layers of 9mm thick Kingtec Hawk Pan calcium silicate board with nominal density of 1000kg/m^3, 2x50mm thick steel stud (at 600mm o.c.) which containing 2x50mm thick rockwool insulation (density: 100kg/m^3). All gaps were fully caulked.

The 140mm thick partition system was constructed in the test opening between Receiving Room and Source Room and consisted of:

Face layer	: 9mm Kingtec Hawk Pan calcium silicate board (9kg/m^2)
Base layer	: 9mm Kingtec Hawk Pan calcium silicate board (9kg/m^2)
Metal Stud	: 50mm Steel Stud x 2
Acoustic Infill	: 50mm Rockwool (5kg/m^2) x 2
Base layer	: 9mm Kingtec Hawk Pan calcium silicate board (9kg/m^2)
Face layer	: 9mm Kingtec Hawk Pan calcium silicate board (9kg/m^2)

3. Required Variation and Modification to Tested Partition System

The requirements for this assessment are for the following configurations. The drawings showing the modified configurations are given in Figure 3.1 & Figure 3.2.

Type A:
The 155mm thick partition system composes of totally six layers of 9mm thick Kingtec Hawk Pan calcium silicate board with nominal density of 1000kg/m^3, 2 x 50mm thick steel stud (at 600mm o.c.) which containing 50mm thick rockwool insulation (density: 100kg/m^3). All gaps are fully caulked.

Face layer	: 9mm Kingtec Hawk Pan calcium silicate board (9kg/m^2)
Middle layer	: 9mm Kingtec Hawk Pan calcium silicate board (9kg/m^2)
Base layer	: 9mm Kingtec Hawk Pan calcium silicate board (9kg/m^2)
Metal Stud	: 2 x 50mm Steel Stud
Acoustic Infill	: 2 x 50mm Rockwool (5kg/m^2)
Base layer	: 9mm Kingtec Hawk Pan calcium silicate board (9kg/m^2)
Middle layer	: 9mm Kingtec Hawk Pan calcium silicate board (9kg/m^2)
Face layer	: 9mm Kingtec Hawk Pan calcium silicate board (9kg/m^2)

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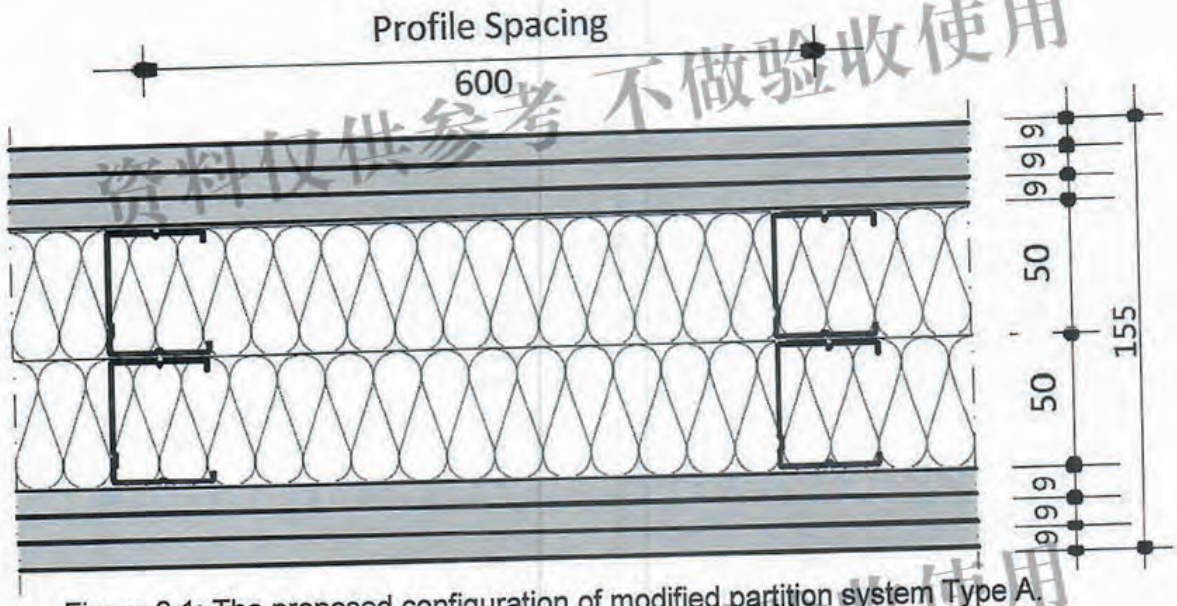

Figure 3.1: The proposed configuration of modified partition system Type A.

Type B:
The 150mm thick partition system composes of totally four layers of 12mm thick Kingtec Hawk Pan calcium silicate board with nominal density of 1000kg/m^3, 2 x 50mm thick steel stud (at 600mm o.c.) which containing 50mm thick rockwool insulation (density: 100kg/m^3). All gaps are fully caulked.

Face layer	: 12mm Kingtec Hawk Pan calcium silicate board (12kg/m^2)
Base layer	: 12mm Kingtec Hawk Pan calcium silicate board (12kg/m^2)
Metal Stud	: 2 x 50mm Steel Stud
Acoustic Infill	: 2 x 50mm Rockwool (5kg/m^2)
Base layer	: 12mm Kingtec Hawk Pan calcium silicate board (12kg/m^2)
Face layer	: 12mm Kingtec Hawk Pan calcium silicate board (12kg/m^2)

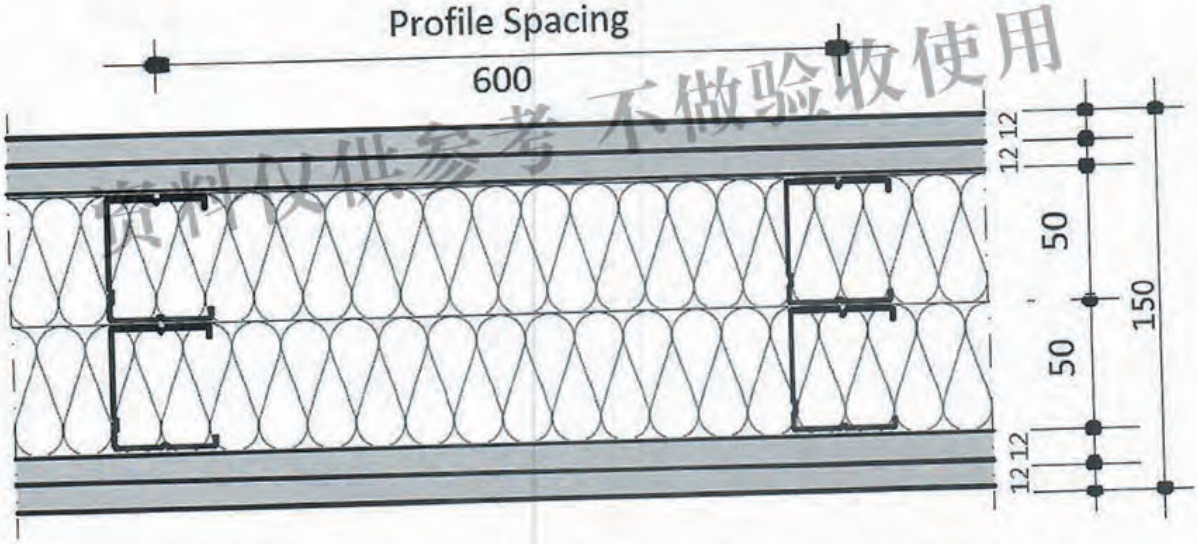

Figure 3.2: The proposed configuration of modified partition system Type B.

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E-mail: inquiry@aa-lab.com

The modified partition system should be constructed in a similar manner from materials and components of the same manufacture and equivalent quality as tested.

4. Technical Assessment

Using the information provided, acoustic simulation was carried out by using INSUL commercial software for obtaining the airborne sound transmission loss value of partition configuration. The estimation was based on acoustic principles and relevant theory for a composite construction to a good degree of accuracy.

With the aid of the INSUL acoustic simulation software, the sound transmission loss values of Type A and Type B partition systems are calculated to be STC63 and STC59 respectively.

The graphical data of the acoustic rating of the modified partition systems are shown in Appendix 1 and 2.

5. Conclusion

An assessment had been conducted to evaluate the sound insulation performances of modified 155mm & 150mm thick Kingtec Hawk Pan fire-rated partition systems.

As a result, it is expected that the acoustic insulation rating performances of the modified 155mm thick (Type A) and 150mm thick (Type B) Kingtec Hawk Pan fire-rated partition systems will be capable of achieving STC 63 and STC 59.

This assessment is based on the test & prediction data, experience and information supplied. Any changes in the specification of the partition system will invalidate this assessment. The predicted rating is for indicative only; actual performance of the drywall partition system in accordance to ASTM E90-09 and ASTM E413-10 shall be verified by a formal laboratory test.

-END-

Room 422, Leader Industrial Centre, 57-59 Au Pui Wan Street, Fo Tan, Shatin, N.T., Hong Kong
Tel: (852) 2668 3423 Fax: (852) 2668 6946
E-mail: inquiry@aa-lab.com

Appendix List

Room 422, Leader Industrial Centre, 57-59 Au Pui Wan Street, Fo Tan, Shatin, N.T., Hong Kong
Tel: (852) 2668 3423 Fax: (852) 2668 6946
E-mail: inquiry@aa-lab.com

Appendix 1

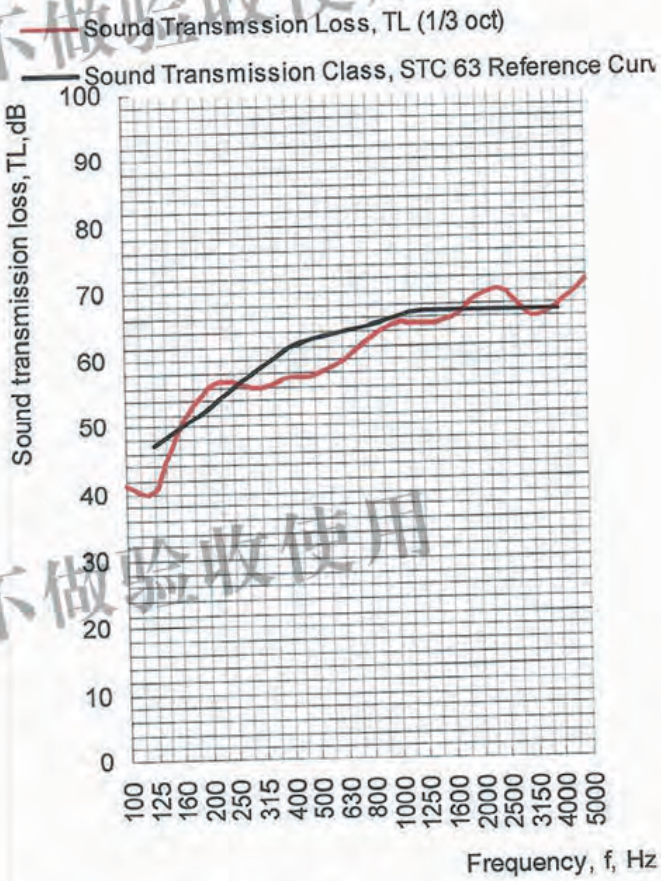
Predicted STC Rating of Modified 155mm Kingtec Hawk Pan Fire-rated Partition System

Description: The 155mm thick partition system composes of totally six layers of 9mm thick Kingtec Hawk Pan calcium silicate board with nominal density of 1000kg/m^3, 2 x 50mm thick steel stud (at 600mm o.c.) which containing 50mm thick rockwool insulation (density: 100kg/m^3). All gaps are fully caulked.

Face layer	: 9mm Kingtec Hawk Pan calcium silicate board (9kg/m^2)
Middle layer	: 9mm Kingtec Hawk Pan calcium silicate board (9kg/m^2)
Base layer	: 9mm Kingtec Hawk Pan calcium silicate board (9kg/m^2)
Metal Stud	: 2 x 50mm Steel Stud
Acoustic Infill	: 2 x 50mm Rockwool (5kg/m^2)
Base layer	: 9mm Kingtec Hawk Pan calcium silicate board (9kg/m^2)
Middle layer	: 9mm Kingtec Hawk Pan calcium silicate board (9kg/m^2)
Face layer	: 9mm Kingtec Hawk Pan calcium silicate board (9kg/m^2)

The predicted Sound Transmission Loss is given as:

Frequency f, Hz	Sound transmission loss TL, dB	Sound transmission loss TL, dB
100	42	43
125	41	
160	50	
200	56	56
250	57	
315	56	
400	57	58
500	58	
630	60	
800	63	64
1000	65	
1250	65	
1600	66	68
2000	69	
2500	70	
3150	66	68
4000	67	
5000	71	



Sound Transmission Class = STC 63

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Appendix 2

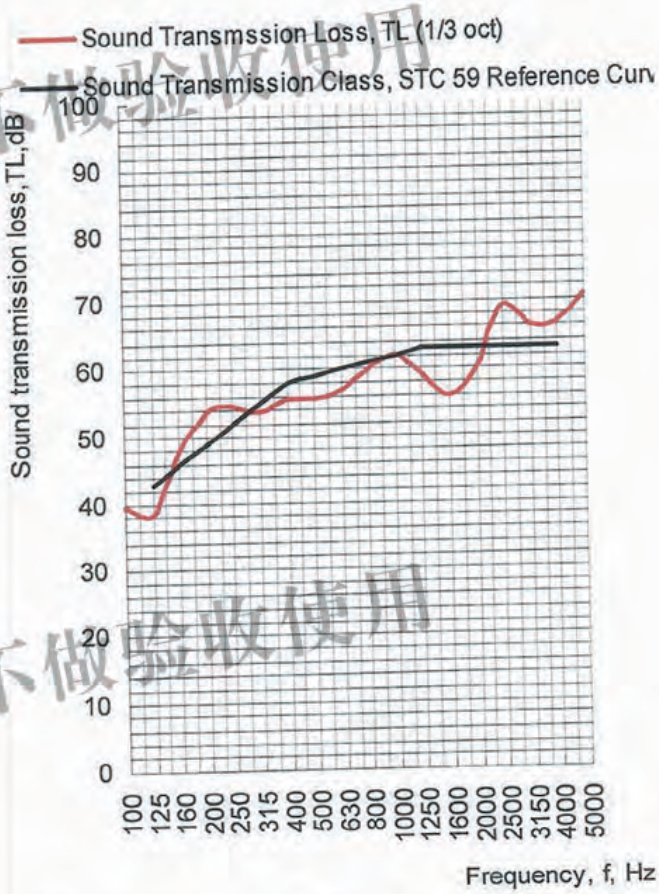
Predicted STC Rating of Modified 150mm Kingtec Hawk Pan Fire-rated Partition System

Description: The 150mm thick partition system composes of totally four layers of 12mm thick Kingtec Hawk Pan calcium silicate board with nominal density of 1000kg/m^3, 2 x 50mm thick steel stud (at 600mm o.c.) which containing 50mm thick rockwool insulation (density: 100kg/m^3). All gaps are fully caulked.

Face layer : 12mm Kingtec Hawk Pan calcium silicate board (12kg/m^2)
Base layer : 12mm Kingtec Hawk Pan calcium silicate board (12kg/m^2)
Metal Stud : 2 x 50mm Steel Stud
Acoustic Infill : 2 x 50mm Rockwool (5kg/m^2)
Base layer : 12mm Kingtec Hawk Pan calcium silicate board (12kg/m^2)
Face layer : 12mm Kingtec Hawk Pan calcium silicate board (12kg/m^2)

The predicted Sound Transmission Loss is given as:

Frequency f, Hz	Sound transmission loss TL, dB	Sound transmission loss TL, dB
100	40	41
125	39	
160	48	
200	54	54
250	55	
315	54	
400	55	56
500	56	
630	57	
800	60	60
1000	62	
1250	59	
1600	56	59
2000	60	
2500	69	
3150	66	67
4000	66	
5000	70	



Sound Transmission Class = STC 59

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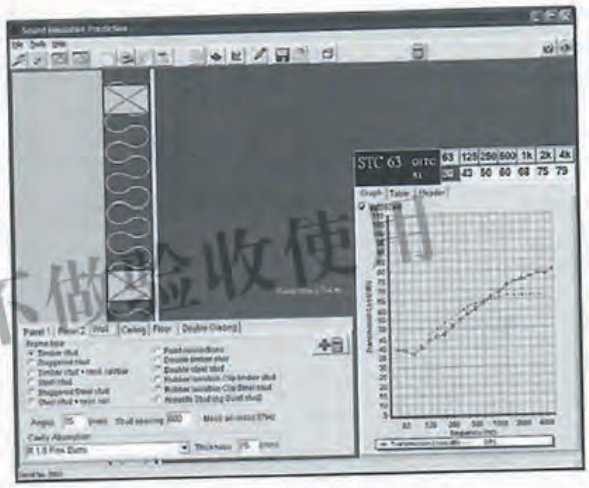
Tel: (852) 2668 3423 Fax: (852) 2668 6946
E-mail: inquiry@aa-lab.com

Appendix 3

Information about INSUL Program

INSUL is based on classical theoretical models that only require easily obtainable construction information. The program can make good estimates of the Transmission Loss (TL) in 1/3 octave bands and Weighted Sound Reduction Index (STC or Rw) for use in noise transfer calculations.

INSUL can be used to quickly evaluate new materials and systems, or to investigate the effects of changes to existing designs. It models materials using well known elastic plate theory including allowances for thick panel effects as published by Ljunggren, Rindell and others. More complex partitions are modeled using work by Sharp, Cremer and others.

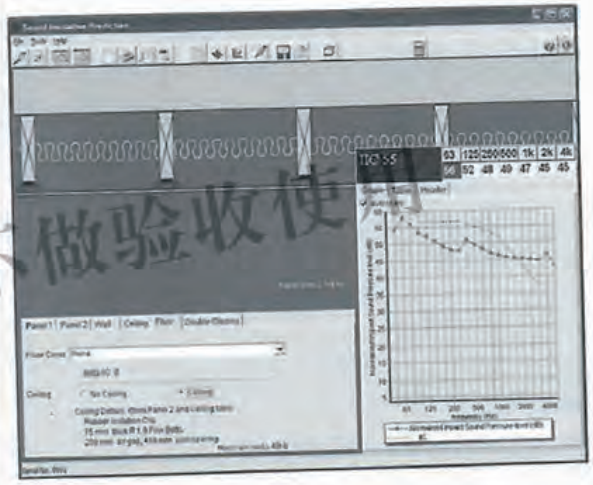


It can predict the effect of installing an acoustic blanket in the stud cavity. It has evolved over several versions into a very easy to use tool that takes advantage of the Windows environment, and has been refined by continued comparison with laboratory tests to provide acceptable accuracy for a wide range of constructions.

Test data can be entered to permit easy comparison with predictions and constructions can be saved for later recall.

INSUL takes account of finite size effects which are very important when predicting small samples such as windows and also for normal elements at low frequencies.

Like any prediction tool INSUL is not a substitute for measurement. However, comparisons with test data indicate that INSUL reliably predicts STC values to within 3dB for most constructions.



INSUL will greatly enhance the ability of acoustic consultants and product manufacturers to quickly and confidently specify constructions in order to achieve a desired airborne sound insulation.

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