LGAI

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Bellaterra: 10th July, 2018

File number: **18/16667-1119 Part 1**

Petitioner's reference: **SAYAHFAR&KHANDADASH FZC COMPANY**
Flexi Office, RAKEZ Bussines
POX 327078, Zone-FZ RAS AL KHAIMAH
United Arab Emirates

TEST REPORT

Date at which samples were received: 29-05-2018

1.- OBJECT OF THE TEST

Fire tests of construction products in compliance with the following standards:

- UNE-EN-ISO 1716:2011: "Reaction to fire tests for products - Determination of the gross heat of combustion".

-UNE-EN 13823:2012+A1:2016: "Reaction to fire tests for building products - Building products excluding floorings exposed to the thermal attack by a single burning item".

2. – PRODUCT CHARACTERISTICS

The description of the specimen given below has been prepared from information provided by the sponsor:

Product Description		Two aluminium sheets sandwiching a corrugated aluminium core	
Product Reference		Premium Bond 3D Corrugated Core Aluminium Panel	
Fire side		Coated Side	
Total thickness		4.2 mm (measured)	
Total Area Density		3.5 kg/m^2 (stated)	
Product details	1st Layer Coating (Fire Side)	Material	Polyvinylidene fluoride (PVDF) Coating
		Application method	Spray and oven baked
		Number of coats	2
		Area Density	0.05 kg/m^2
	2nd Layer Coating	Material	Aluminium
		Thickness	0.5 mm
		Area Density	1.3 kg/m^2
	3rd Layer Coating	Material	Adhesive film
		Thickness	0.100 mm
		Area Density	90 g/m^2
	4th Layer Coating	Material	Corrugated aluminium
		Thickness	3 mm
		Area Density	0.8 kg/m^2
	5th Layer Coating	Material	Adhesive film
		Thickness	0.100 mm
		Area Density	90 g/m^2
	6th Layer Coating	Material	Aluminium
		Thickness	0.5 mm
		Area Density	1.3 kg/m^2
	7th Layer Coating	Material	Paint
		Area Density	0.018 kg/m^2

Fixing system: The sample was fixed to the standard substrate (Calcium silicate according to UNE-EN 13238:2011) with screws.

Manufacturer: PREMIUM BOND. Address: Sanat sq, Shiraz Special Economic Zone, Shiraz, Iran.

3. – SPECIFICATIONS ABOUT MAINTENANCE

Not applied.

4. – DESCRIPTION OF THE FINAL USE CONDITIONS

Façade, wall decoration.

5. - CONDITIONING

The product conditioning was conducted in compliance with Standard UNE-EN 13238:2011: "Reaction to fire tests for building products - Conditioning procedures and general rules for selection of substrates".
The samples were stored in a conditioning chamber at 23 ºC±2 ºC, and at 50%±5% relative humidity, until a constant weight was reached.

6. – TESTS

6.1.- Determination of the Combustion Heat – UNE-EN-ISO 1716:2011

Date at which test was performed: Start: 19-06-2018
End: 6-07-2018

During the tests, the environmental conditions of the laboratory were maintained at a temperature of (23 ± 5) ºC, and relative humidity of (50 ± 20) %.

6.1.1- Procedure for homogeneous products

Substantial Component
Aluminium, identified as M_1
Corrugated aluminium, identified as M_2

Non-substantial external components
PVDF Coating, identified as M_3
Paint (back face), identified as M_4

Non-substantial internal components
Adhesive film, identified as M_5

Aluminium (M_1)

Metallic components do not need to be tested, and their higher calorific potential used to calculate the total PCS will be 0 (point 8.4.1. of the Standard)

Corrugated aluminium (M_2)

Metallic components do not need to be tested, and their higher calorific potential used to calculate the total PCS will be 0 (point 8.4.1. of the Standard)

PVDF Coating (M_3)

Preparation of the Samples

Starting from a minimum mass of 10 g, it was obtained, through the grating and sieving method, enough fine powder for performing a minimum of 3 determinations.
The quantity of the product used in every determination was of 0.5 g of product

Method

Determinations were performed according to the crucible method described in section 7.9 of the test standard.

Equivalent Energy Value (MJ/kg) = 2402.3040

Samples	1	2	3	Average
Higher Heating Value (in MJ/kg)	13.07	13.07	12.67	**12.94**
Higher Heating Value (in MJ/m^2)	0.65	0.65	0.63	**0.65**

Criteria for acceptance or rejection (according to section 11 of the test standard):
Max - Min of the 3 reproduced tests must be **≤ 0.1 MJ/m^2**

Uncertainty associated with the measure: ± 0.15 MJ/kg

Paint (Back face) (M_4)

Preparation of the Samples

Starting from a minimum mass of 10 g, it was obtained, through the grating and sieving method, enough fine powder for performing a minimum of 3 determinations.
The quantity of the product used in every determination was of 0.5 g of product

Method

Determinations were performed according to the crucible method described in section 7.9 of the test standard.

Equivalent Energy Value (MJ/kg) = 2402.3040

Samples	1	2	3	Average
Higher Heating Value (in MJ/kg)	8.67	8.43	10.48	**9.19**
Higher Heating Value (in MJ/m^2)	0.16	0.15	0.19	**0.17**

Criteria for acceptance or rejection (according to section 11 of the test standard):
Max - Min of the 3 reproduced tests must be **≤ 0.1 MJ/m^2**

Uncertainty associated with the measure: ± 0.15 MJ/kg

Adhesive film (M_5)

Preparation of the Samples

Starting from a minimum mass of 10 g, it was obtained, through the grating and sieving method, enough fine powder for performing a minimum of 3 determinations.
The quantity of the product used in every determination was of 0.5 g of product

Method

Determinations were performed according to the crucible method described in section 7.9 of the test standard.

Equivalent Energy Value (MJ/kg) = 2402.3040

Samples	1	2	3	Average
Higher Heating Value (in MJ/kg)	44.30	44.05	44.15	**44.17**
Higher Heating Value (in MJ/m^2)	3.99	3.96	3.97	**3.98**

Criteria for acceptance or rejection (according to section 11 of the test standard):
Max - Min of the 3 reproduced tests must be **≤ 0.1 MJ/m^2**

Uncertainty associated with the measure: ± 0.15 MJ/kg

6.1.2. - Results

Determination of the superficial density

From the data provided by the petitioner, was done the calculation of the superficial density for each component of the product.

Components	Thickness	Superficial Density
PVDF (M_3)	-	0.05 kg/m^2
Aluminium (M_1)	0.5 mm	1.3 kg/m^2
Adhesive film (M_5)	0.100 mm	0.09 kg/m^2
Corrugated aluminium (M_2)	3.0 mm	0.8 kg/m^2
Paint (back face) (M_4)	-	0.018 kg/m^2
Product as a whole	-	3.648 kg/m^2

In this heterogeneous product there are different components:

2 external non-substantial components: PVDF (M_3) and paint (back face) (M_5)
1 internal non-substantial component: adhesive film (M_5)
2 substantial components: Aluminium (M_1) and corrugated aluminium (M_2)

Components	M_3	M_1	M_5	M_2	M_5	M_1	M_4	PRODUCT
PCS (en MJ/m^2)	**0.65**	0.00	**3.98**	0.00	**3.98**	0.00	**0.17**	8.76
PCS (en MJ/kg)	12.94	**0.00**	44.17	**0.00**	44.17	**0.00**	9.19	**2.40**

6.2. – SBI Test based on Standard UNE-EN 13823:2012+A1:2016

Date at which test was performed: Start: 14-06-2018
End: 15-06-2018

During the tests, the environmental conditions of the laboratory were maintained at a temperature of 20±10ºC.

6.2.1.- General principles of testing

Determine the fire reaction behaviour of construction products when these are exposed to the thermal attack of a single burning object.

The product is tested while installed on a sample support positioned at an angle. Each sample consists of two wings: one 1.500 mm x 495 mm-short wing, and one 1.500 mm x 1.000 mm-long wing, by the thickness of the product.

The assembly and installation of the product on the support must be representative of the final use condition of such product.

A minimum of three samples are tested for each condition of use. The product is exposed to the flames for approximately 21 minutes. The relevant measurements are continuously recorded every three seconds.

The sample is exposed to the flame of a propane burner with a nominal power of (30.7±2.0) kW. The burner is located on the base of the angle formed by the corner, at a distance of 40 mm from the surface of the product.

6.2.2. – Expression of the results

The test makes it possible to assess how much heat and smoke are released by the products subject to the thermal attack. These measurements are the basis to determine the following indexes:

6.2.2.1.-

FIGRA $_{0.2MJ}$ and FIGRA $_{0.4MJ}$ (in W/s)
These are defined as the maximum value of the quotient HRR_{av} (t) / (t-300), multiplied by 1,000. The quotient is only calculated for that part of the exposure time during which the levels of the thresholds for HRR_{av} and THR were exceeded.
If one of the two threshold values of a FIGRA index is not topped during the period of exposure, this FIGRA index equals zero. Two different TRH threshold values are used, which result in $FIGRA_{0.2MJ}$ and $FIGRA_{0.4MJ}$.
THR_{600} (in MJ)
This is the total heat released by the sample during the first 600 s (10 minutes) from the beginning of the exposure to the main burner.
HRR (in kW)
This is the velocity of the heat released.

6.2.2.2.-

SMOGRA (in m^2/sec^2)
This is defined as the maximum value of the quotient SPR_{av} (t) / (t-300), multiplied by 10,000. The quotient is only calculated for the part of the time of exposure during which the levels of the thresholds for SPR_{av} and TSP were exceeded.
If one or the two threshold values are not exceeded during the period of exposure, the SMOGRA value equals zero.

TSP_{600} (in m^2)
This is the total amount of smoke released by the sample during the first 600 s (10 minutes) from the beginning of the exposure to the main burner.

SPR (in m^2/sec):
This is the smoke production velocity.

6.2.3. – Assembly specifications

Each test set consists of two items:
1 part measuring 1.500 x 495 mm, which is representative of the short wing, and
1 part measuring 1.500 x 1.000 mm, representative of the long wing, in accordance with the specifications contained in paragraph 5.1.1.

The samples were assembled by staff of Laboratory and in accordance with the specifications provided by the petitioner.

Fixing system: The sample was fixed to the standard substrate (Calcium silicate according to UNE-EN 13238:2011) with screws.

The test was carried out removing the lateral bottom plates of the test wagon, according to section 5.2.2 a) of the test standard and with a separation of 40 mm between the rear part of the sample and the support plate.
The assembly was performed with joints. A horizontal joint at 500 mm from the bottom of the sample, and a vertical joint at 200 mm from inside corner fulfilling criteria described on section 5.2.2.e) of the test standard.

6.2.4. – Test results

6.2.4.1. – Sample nº1

Environmental conditions at the beginning of the test:

Temperature: **24 ºC** HR: **46 %** Pressure: **99579 Pa**

Level of exposure of the burner (kW): **30.04**

INDEXES

FIGRA $_{0.2\ MJ}$ (W/s)	0.00
FIGRA $_{0.4\ MJ}$ (W/s)	0.00
LFS	< to edge
THR$_{600S}$ (MJ)	0.27
SMOGRA (m^2/s^2)	0.00
TSP$_{600S}$ (m^2)	34.22
Release of inflamed material in 600 s	NO

Conditions at the end of the test:

Temperature: **25 ºC** HR:**46 %** Pressure: **99526 Pa**

Light transmission (%): **99.78 %** O_2 Concentration (%): **20.94 %**

CO_2 Concentration (%): **0.01 %**

6.2.4.2. - Sample nº 2

Environmental conditions at the beginning of the test:

Temperature: **25 ºC** HR: **53 %** Pressure: **99490 Pa**

Level of exposure of the burner (kW): **29.22**

INDEXES

FIGRA $_{0.2\ MJ}$ (W/s)	0.00
FIGRA $_{0.4\ MJ}$ (W/s)	0.00
LFS	< to edge
THR$_{600S}$ (MJ)	0.40
SMOGRA (m^2/s^2)	0.00
TSP$_{600S}$ (m^2)	29.22
Release of inflamed material in 600 s	NO

Conditions at the end of the test:

Temperature: **26 ºC** HR: **53 %** Pressure: **99465 Pa**

Light transmission (%): **99.81 %** O_2 Concentration (%): **20.94 %**

CO_2 Concentration (%): **0.01 %**

6.2.4.3. - Sample nº3

Environmental conditions at the beginning of the test:

Temperature: **26 ºC** HR: **52 %** Pressure: **99410 Pa**

Level of exposure of the burner (kW): **30.09**

INDEXES

FIGRA $_{0.2\ MJ}$ (W/s)	52.64
FIGRA $_{0.4\ MJ}$ (W/s)	19.16
LFS	< to edge
THR$_{600S}$ (MJ)	1.19
SMOGRA (m^2/s^2)	0.00
TSP$_{600S}$ (m^2)	35.06
Release of inflamed material in 600 s	NO

Conditions at the end of the test:

Temperature: **26 ºC** HR: **50 %** Pressure: **99414 Pa**

Light transmission (%): **98.79 %** O_2 Concentration (%): **20.95 %**

CO_2 Concentration (%): **0.01 %**

6.2.5.- Visual observations

The observation of released material or inflamed particles during the first 10 minutes of test lead to the attribution of the identification sub-index "d" to the material, so that:

d0: No release of inflamed material is observed.

d1: release of inflamed material with a flame persistence < 10 s.

d2: Release of inflamed material with a flame persistence > 10 s.

No lateral flame spread over the long wing, or release of inflamed material is observed in any of the three tested samples.

6.2.6.- Uncertainty associated to the measurement equipment

Set of thermocouples of the extraction pipe	±2ºC
Pressure transmitter of the pipe	±2 Pa
Smoke measuring device	±5%
Ambient pressure measuring equipment	±5%
Ambient humidity measuring device	±5%
Ambient temperature measuring device	±2ºC

6.3. – Results

6.3.1. - UNE-EN ISO 1716:2011

Testing method	UNE-EN ISO 1716:2011
Values obtained	$PCS^{(A)}$ = **0.00 MJ/kg** $PCS^{(B)}$ = **0.00 MJ/m²** $PCS^{(C)}$ = **0.65 MJ/m²** $PCS^{(D)}$ = **0.17 MJ/m²** $PCS^{(E)}$ = **3.98 MJ/m²** $PCS^{(F)}$ = **2.40 MJ/kg**

(A) Substantial component (aluminium)
(B) Substantial component (corrugated aluminium)
(C) External non-substantial component (PVDF)
(D) External non-substantial component (paint-back face)
(E) Internal non-substantial component (adhesive film)
(F) Product as a whole

6.3.2. - UNE-EN 13823:2012+A1:2016

Samples	I	II	III	Average
FIGRA $_{0.2\ MJ}$ (W/s)	0.00	0.00	52.64	**17.55**
FIGRA $_{0.4\ MJ}$ (W/s)	0.00	0.00	19.16	**6.39**
LFS	< to edge	< to edge	< to edge	**< to edge**
THR$_{600S}$ (MJ)	0.27	0.40	1.19	**0.62**
SMOGRA (m^2/s^2)	0.00	0.00	0.00	**0.00**
TSP$_{600S}$ (m^2)	34.22	29.22	35.06	**32.83**
Release of inflamed material in 600 s	NO	NO	NO	**NO**

The test results correspond to the behaviour of test samples of a product under the testing conditions themselves. They do not intend to be the only evaluation criterion to assess the potential fire hazard involved in the use of the product.

The Euro class to which the tested product belongs is defined in Part 2 of the Classification Report.

Digitally signed by Jordi Mirabent Junyent

Responsible of the fire laboratory
LGAI Technological Center S.A. (APPLUS)

Digitally signed by Salvador Suñol Gálvez

Responsible of Reaction to fire
LGAI Technological Center S.A. (APPLUS)

The results refer exclusively to the samples tested at the time and under the conditions indicated.

The uncertainties expressed in this document pertain to the expanded uncertainty, which has been obtained by multiplying the typical measurement uncertainty by the coverage factor k=2 which, for a regular distribution, corresponds to a coverage probability of approximately 95%.

Applus+ guarantees that this task has been carried out in compliance with the requirements of our Quality and Sustainability System, and furthermore, that the contractual terms and legal regulations have been complied with. In the framework of our improvement programme, we would appreciate any comments you may deem appropriate. These should be addressed to the manager who signs this document, or to the Quality Director of Applus+, at the following address: satisfaccion.cliente@appluscorp.com

ANNEXES

7. - PHOTOGRAPHS

8. - CHARTS

7. - PHOTOGRAPHS

Photo nº1: Detail of the corner assembly, upper view.

Photo nº2: Detail of the vertical side edge of the long wing, some 500 mm from the bottom of the support.

Photo nº3: View of the corner and anchoring system.

PHOTO nº4: View of the product prior to starting the test.

PHOTO nº5: Sample 1 – Flame attack approx. 10 minutes after the start of the test.

PHOTO nº6: Sample 1 – State of the product upon completion of the test.

PHOTO nº7: Sample 2 – Flame attack approx. 10 minutes after the start of the test.

PHOTO nº8: Sample 2 – State of the product upon completion of the test.

PHOTO nº9: Sample 3 – Flame attack approx. 10 minutes after the start of the test.

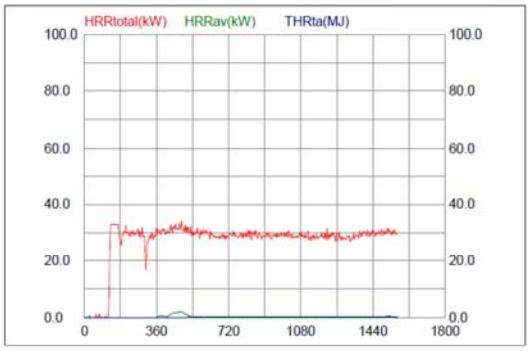
PHOTO nº10: Sample 3 – State of the product upon completion of the test.

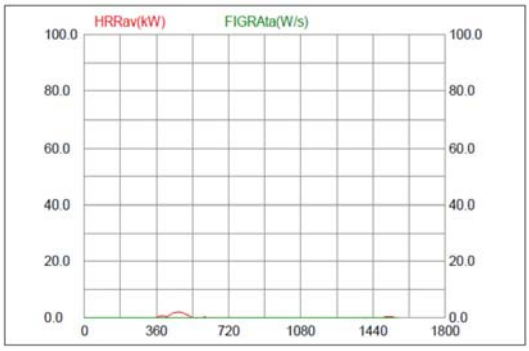
8.- CHARTS

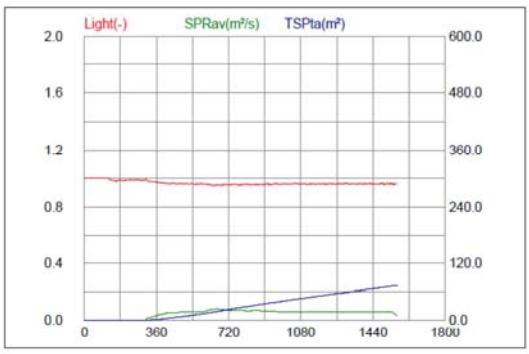
Sample nº1 – Ratios related to the release of heat and smoke.

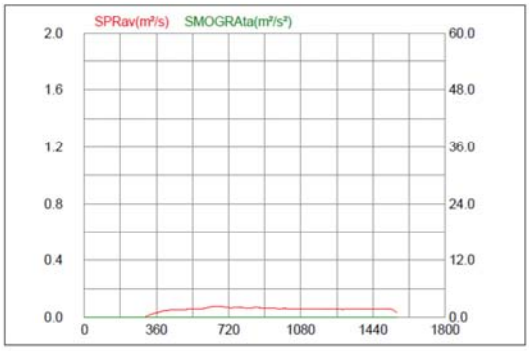
Sample nº2 – Ratios related to the release of heat and smoke.

Sample nº3 – Ratios related to the release of heat and smoke.









NORMA: UNE-EN 13823:2012 + A1:2016
STANDARD

Data del test: 15:06:18 12:38
Test date

Nom del fitxer: 1119mostra1
File name

Descripció: -
Description

Client: PREMIUM BOND
Client

Material: auminium corrugated panel
Material

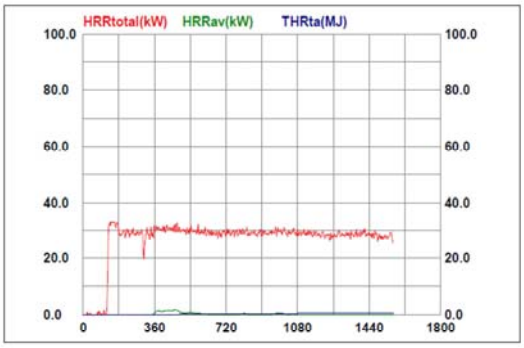
Pes (kg/m²): -
Weight(kg/m²)

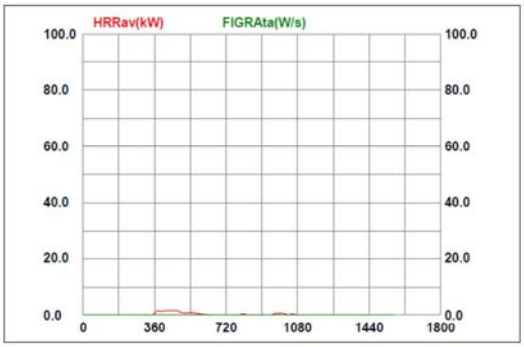
Gruix: -
Thickness

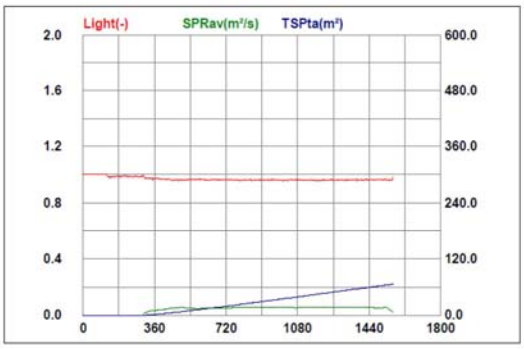
HRR av: 30.04 kW

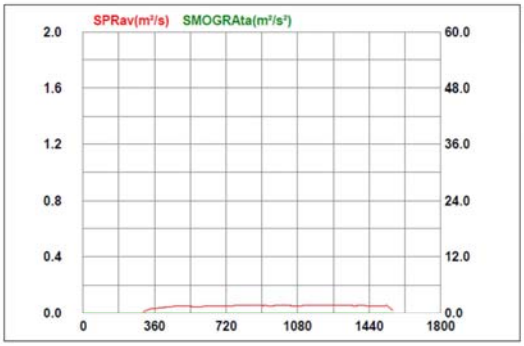
THR 600s: 0.27 MJ
FIGRA 0,2MJ: 0.00 W/s
FIGRA 0,4MJ: 0.00 W/s

TSP 600s: 34.22 m²
SMOGRA: 0.00 m²/s²









NORMA: UNE-EN 13823:2012 + A1:2016
STANDARD

Data del test: 15:06:18 13:44
Test date

Nom del fitxer: 1119mostra2
File name

Descripció: -
Description

Client: PREMIUM BOND
Client

Material: aluminium corrugated panel
Material

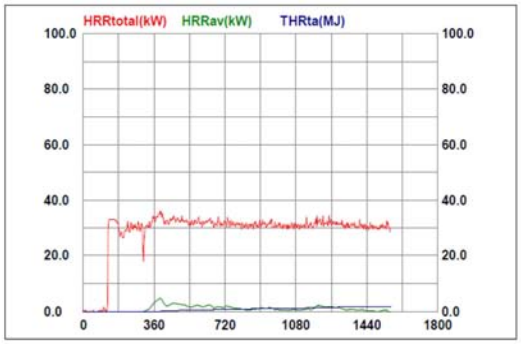
Pes (kg/m²): -
Weight(kg/m²)

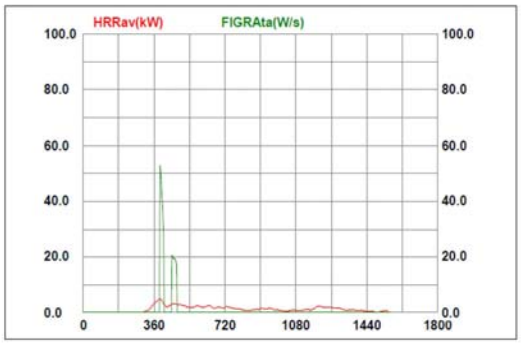
Gruix: -
Thickness

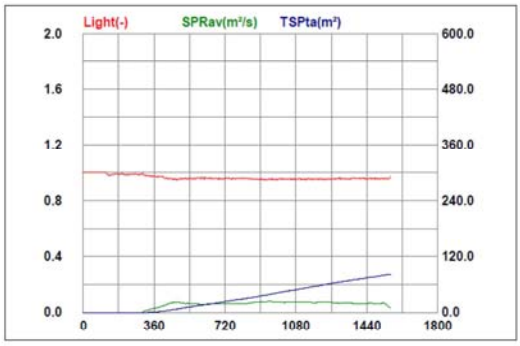
HRR av: 29.22 kW

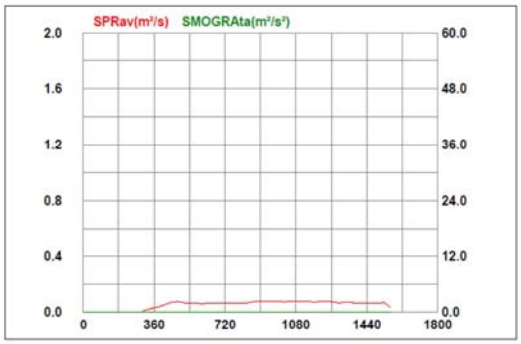
THR 600s: 0.40 MJ
FIGRA 0,2MJ: 0.00 W/s
FIGRA 0,4MJ: 0.00 W/s

TSP 600s: 29.22 m²
SMOGRA: 0.00 m²/s²









NORMA: UNE-EN 13823:2012 + A1:2016
STANDARD

Data del test: 15:06:18 15:50
Test date

Nom del fitxer: 1119mostra3
File name

Descripció: -
Description

Client: PREMIUM BOND
Client

Material: aluminium corrugated panel
Material

Pes (kg/m²): -
Weight(kg/m²)

Gruix: -
Thickness

HRR av: 30.09 kW

THR 600s: 1.19 MJ
FIGRA 0,2MJ: 52.64 W/s
FIGRA 0,4MJ: 19.16 W/s

TSP 600s: 35.06 m²
SMOGRA: 0.00 m²/s²

TEST REPORT
REACTION TO FIRE TEST

Test Sponsor:

Sayyahfar & Khandadash FZC
Flexi Office: RAKEZ Business Zone – FZ
Ras Al Khaimah, United Arab Emirates

Test Material/Assembly:

Premium Bond 3D Corrugated Core Aluminium Panel

Test Standard:

ASTM E84-18: Standard Test Method for Surface Burning Characteristics of Building Materials

THOMAS BELL-WRIGHT
INTERNATIONAL CONSULTANTS

Test Date: 3-Jun-18
Issue Date: 12-Jun-18
Test Reference No: SD144-1

PO BOX 26385, DUBAI UAE T +971 (0)4 821 5777 fire@bell-wright.com www.bell-wright.com

DUBAI ABU DHABI DOHA

Accreditation

ISO/IEC 17025: General requirements for the competence of testing and calibration laboratories with:

United Kingdom Accreditation Service (UKAS) - Testing Laboratory: **4439**
www.ukas.com

GCC Accreditation Center (GAC) – Testing Laboratory: **ATL-0017**
www.GCC-accreditation.org

Memberships

Members of European Group of Organization for Fire Testing, Inspection and Certification

www.egolf.org.uk

Member of International Trade Council

www.thetradecouncil.com

Member of Association for Specialist Fire Protection

www.asfp.org.uk

Member of Centre for Window and Cladding Technology

www.cwct.co.uk

The work which is the subject of this report falls wholly or partly under the accreditations of **ISO 17025 UKAS and ISO 17025 GAC.**

Table of Contents

1. INTRODUCTION

Determination of the flame spread index and the smoke developed index of Premium Bond 3D Corrugated Core Aluminium Panel as per ASTM E84; Standard Test Method for Surface Burning Characteristics of Building Materials.

2. SPONSOR

Name: Sayyahfar & Khandadash FZC
Address: Flexi Office: RAKEZ Business Zone – FZ
Ras Al Khaimah, United Arab Emirates

3. MANUFACTURER

Name: Premium Bond
Address: Sanat sq, Shiraz Special Economic Zone, Shiraz, Iran
Telephone: +987137175301

4. TESTING LABORATORY

Name: Thomas Bell-Wright International Consultants (TBWIC)
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5. DATE OF TEST

Sample received: 29-May-18
Test date: 3-Jun-18

The test has not been witnessed by the Sponsor.

6. SPECIMEN DESCRIPTION

The description of the specimen given below has been prepared from information provided by the Sponsor.

Product Description		Two Aluminium Sheets Sandwiching a corrugated Aluminium Core	
Product Reference		Premium Bond 3D Corrugated Core Aluminium Panel	
Fire side		Coated Side	
Total Thickness		4.2mm (measured)	
Total Area Density		3.5 kg/m^2 (stated)	
Product Details	**1st Layer Coating (Fire Side)**	Material	Polyvinylidene fluoride (PVDF) Coating
		Application method	Spray and Oven baked
		Number of coats	2
	2nd Layer	Material	Aluminium
		Thickness	0.5mm
		Area Density	1.3 kg/m^2
	3rd Layer	Material	Adhesive film
		Thickness	0.100mm
		Area Density	100 g/m^2
	4th Layer	Material	Corrugated Aluminium
		Thickness	3mm
		Area Density	0.8 kg/m^2
	5th Layer	Material	Adhesive film
		Thickness	0.100mm
		Area Density	100 g/m^2
	6th Layer	Material	Aluminium
		Thickness	0.5mm
		Area Density	1.3 kg/m^2
Dimensions per panel		800 x 600 x 4.2mm (l x w x thk.) (measured)	
No. of panel		9	
Total dimension		7200 x 600 x 4.2mm (l x w x thk.) (measured)	
Specimen placement		The nine (9) sections of Premium Bond 3D Corrugated Core Aluminium Panel were butt jointed end-to-end and were placed directly to the tunnel ledges with the exposed coated surface towards the flame source.	

The test specimen was submitted by the client and TBWIC has not been involved in the selection and configuration of the specimen.

7. METHOD OF TEST

7.1. Placing of test specimen

The test specimen consisted of 9 panels of Premium Bond 3D Corrugated Core Aluminium Panel. The total dimensions of the specimen were 7200 x 600mm (l x w).

Several sections of cement board butt jointed end-to-end with overall dimensions of 7350 x 600mm (l x w), were placed at the back of the sample to protect the furnace lid assembly.

7.2. Test Method

The specimen was installed horizontally in the Steiner Tunnel and supported by the ledges. The coated surface of the specimen was exposed to a flaming exposure during the 10 minute test duration.

Flame spread and density of the smoke are measured and recorded while the results are computed against the standard calibration materials (cement board and red oak flooring).

7.3. Conditioning

After delivery on 29-May-18, the specimen was stored in room temperature for 5 days prior to the test ranging from 20.2 to 25.8°C and 45 to 55% relative humidity.

8. OBSERVATION

Test Data and Observation

Observations	
Ignition Time (min:sec)	0:53
Time to maximum flame front advance (min:sec)	None
Maximum flame spread (ft)	None
Time to end of tunnel reached (min:sec)	Not Reached
Maximum temp recorded at the exposed thermocouple located near the end of the tunnel (°F / °C)	550/288
Dripping (min:sec)	None
Flaming on the floor (min:sec)	None
After flame on the top (min:sec)	None
After flame on the floor (min:sec)	None
Delamination (min:sec)	0:59
Sagging (min:sec)	None
Shrinkage (min:sec)	None
Fallout (min:sec)	None
FS*Time Area (ft*min)	0
Smoke Area (%A*min)	3.58
Red Oak Smoke Area (%A*min)	92.1

9. SUMMARY OF RESULTS

The test specimen has been evaluated in accordance with ASTM E84; Standard Test Method for Surface Burning Characteristics of Building Materials.

The test results are:

FLAME SPREAD INDEX (FSI)	**0**
SMOKE DEVELOPED INDEX (SDI)	**5**

Results are valid for the tested configuration only.

10. CLASSIFICATIONS

The following information is designed to help put these test results into context. Flame Spread Index and Smoke Developed Index results from an ASTM E84 test are often used by regulatory agencies to approve materials for various applications. For example, the International Building Code 2015, Section 803.1.1 requires that:

Interior wall and ceiling finish materials shall be classified in accordance with ASTM E84 or UL 723-10th Ed. 2008. Such interior finish materials shall be grouped in the following classes in accordance with their flame spread and smoke-developed indexes.

Class A: Flame spread index 0 - 25; smoke-developed index 0 - 450.
Class B: Flame spread index 26 - 75; smoke-developed index 0 - 450.
Class C: Flame spread index 76 - 200; smoke-developed index 0 - 450.

Note that the above example is the IBC requirement for interior wall and ceiling finishes only; your application may be different.

11. LIMITATIONS

Testing of materials that melt, drip, or delaminate to such a degree that the continuity of the flame front is destroyed, results in low flame spread indices that do not relate directly to indices obtained by the testing materials that remain in place

Thomas Bell-Wright International Consultants recommend that the relevance of test reports should be considered after a period of five years.

This test report is respectfully submitted by: Thomas Bell-Wright International Consultants

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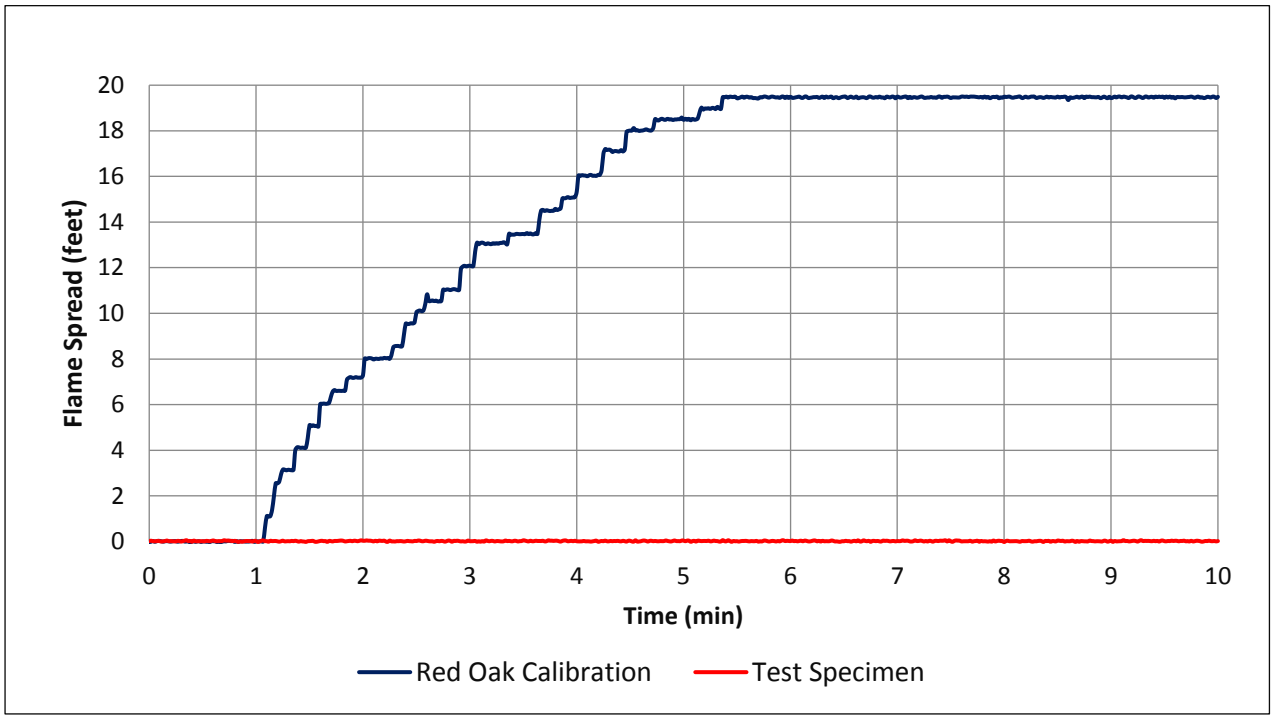
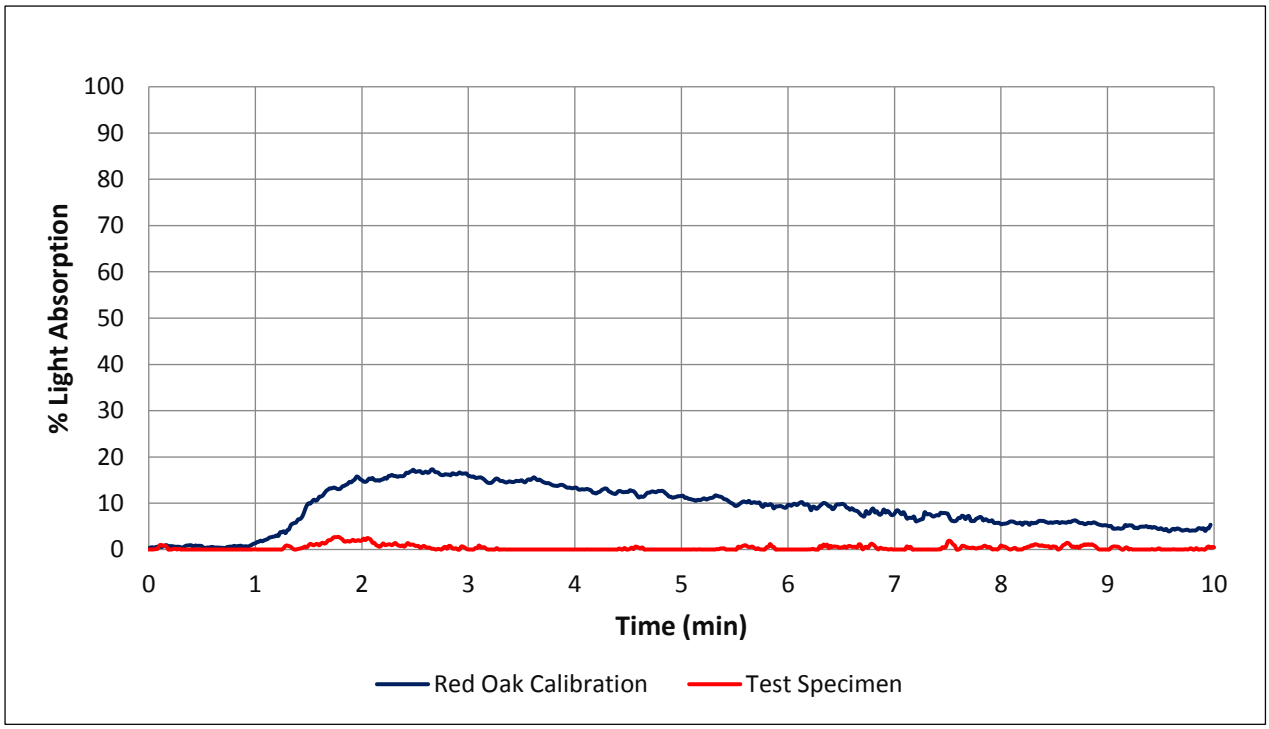
12. APPENDIX 1- GRAPHS



Graph 1: Flame Spread Index (FSI)



Graph 2: Smoke Developed Index (SDI)

13. APPENDIX 2- PICTURES

Photo 1: Specimen before the test. (Non-Fire Side)

Photo 2: Specimen before the test. (Fire Side)

Photo 3: Specimen after the test. (As seen from the fire-end)

Photo 4: Specimen after the test. (As seen from the exhaust end)

----- End of Test Report -----