

FIRE RESISTANCE TEST FACILITY

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CLIENT

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TEST REPORT

Test date: 17 October 2024
Test Number: IT 24-10-00063
Place of test: Cape Town
Test Description: Reaction to fire tests
Type: XPS Board
Standards: Reaction to fire classification (SANS 53501-1)

REPORT COMPILATION

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FIRE REACTION TEST CONFIRMATION				
Client	Isofoam SA (Pty) Ltd			
Test sample type	Insulation Material			
Description	XPS Boards			
Test report no	IT 24-10-00063			
Test facility	Ignis Test Laboratory Cape Town			
Code Applied	SANS 53501-1			
Class approved	Class B			
Tests available	SANS 1743, SANS 53823, SANS 11925-2, SANS 11820			
Density	N/A			
CRITERIA				
	STANDARD			
Product	80 mm IsoBoard			
Materials	Extruded Polystyrene, Glue			
Tests performed	SANS 53823, SANS 11925-2			
Classification	B – s1,d0			
Ignitability (SANS 11925)	Fs <150 mm	t = 60 seconds	Pass B	
Single Burn Item (SANS 53823)	FIGRA < 120W/s	LFS<Edge of specimen	THR _{600s} < 7 MJ	Pass B
AUTHORISATION				
Date Authorised	10-12-2024			
Authorised by	DJ Streicher (Pr Eng 880107) MSc. (Civ)Eng (UCT)			
Authors	C Kuhn (BEng Chem)			
Supervisor	PJ Grabe (Pr Tech Mech Eng)			
Conditional recommendation	None			
Report authenticity period	5 years			




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A: SANS 53501 Classification Criteria

1. INTRODUCTION

The client (Isofoam SA (Pty) Ltd) approached Ignis testing to determine the SANS 53501-1 reaction to fire classification of the material. The material tested is 80mm IsoBoard extruded polystyrene boards used as insulation. The tests to evaluate the performance of the product are the Ignitability (EN 11925/SANS 11925), and the Single Burning Item test (EN 13823/SANS 53823). These tests cover the range of classification based on criteria set out by SANS 53501-1.

2. MATERIAL DATA

Table 1 below is the information provided by Isofoam SA (Pty) Ltd for the SANS 53501-1 classification.

Table 1: Material Data sheet for product classified

MATERIAL DATA SHEET	
NAME	<i>IsoBoard</i>
TYPE	<i>XPS board</i>
DENSITY	<i>32-36 kg/m³</i>
THICKNESS	<i>80 mm</i>
GLUE USED	<i>Yes*</i>
FIRE RETARDANTS USED	<i>N/A</i>

**Material specifications and gsm remain confidential and kept on record*

3. TEST DESCRIPTION

For all tests, refer to Appendix A to see the required criteria for each classification of the SANS 53501-1 code.

3.1 SANS 11925-2 Single Flame ignitability test:

Ignitability of products subjected to direct impingement of flame.

This test method was developed to define and investigate the reaction to fire performance of materials. The ignitability of products is determined by directing a small-flame impingement using a vertically oriented test specimen. This test measures the flame spread up the vertical surface of the test specimen after the application of a small 20 mm flame to the middle edge of the test surface for 30 seconds. Flaming droplets generated from the specimen are evaluated based on whether the droplets result in the ignition of a filter paper placed below the specimen. Furthermore, the duration of the self-sufficient flame is also measured which also influences the outcome of the test.

3.2 SANS 53823 Single Burning Item:

Fire growth rate, smoke growth rate and flame spread.

The Single Burning Item (SBI) consists of a frame with a sliding trolley. A hood with specified ducting as specified by both SANS 53823 and EN 13823 is utilized to analyse any smoke production. Commercial propane of a minimum purity of 95% is used for the two sandbox burners. Two specimen planes are fixed perpendicularly, having dimensions of 1000 mm x 1500 mm for one panel and 500mm x 1500 mm for the other. The Test sample is exposed to the burner, evaluating the fire growth rate (FIRGA), Heat Release Rate (HRR), smoke growth rate index (SMOGRA), total heat release (THR), flame spread and the formation of flaming droplets during the test.

4. PROCEDURES

Test procedure:

4.1 Single Burning Item (SANS 53823):

- Prepare the sample panes to the according sizes.
- Fix the panes to the apparatus frame.
- Install calcium silicate backboards behind the sample panes.
- Add any additional required brackets as needed to represent the intended installation.
- Mark horizontal lines on the back pane at a height of 500 mm and 1000 mm.
- Zero all the gas analysers.
- Commence the start-up of the auxiliary burner
- Switch over to the primary burner after the baseline has been established.
- Observe flame spread and any droplets forming during the test.

4.2 Single flame source test (SANS 11925-2):

- Prepare a specimen of 250 mm $\pm$ 2 long by 90 mm $\pm$ 2 wide.
- Test the flame reaction and time to calibrate with no specimen.
- Adjust the flame height to 20 mm in a controlled environment with no samples present.
- Switch off the flame after adjustments.
- Fix the specimen within the holding bracket inside the test container.
- Bring the burner close enough to the sample to ensure contact is made with the bottom centre edge.
- Position a piece of filter paper in an aluminium tray directly below the specimen.
- Light the burner and start the timer simultaneously.
- Observe the forming of any flaming droplets and whether they result in the ignition of the filter paper in the tray below the sample.
- After 30 seconds extinguish the flame and observe whether the specimen continues to flame.
- Measure the flame spread after waiting for all flames to self-extinguish.

5. RESULTS AND DISCUSSIONS

5.1 IGNITABILITY SANS 11925-2

Six samples were tested in the ignitability setup (SANS 11925-2), with all six samples having a flame spread of less than 150 mm within 60 seconds. See Table 2 below.

Table 2: Single Flame Ignitability Results

Sample ID	t	Fs	Burning Droplets	Ignition of Filter Paper
1	60 s	<150 mm	No	No
2	60 s	<150 mm	No	No
3	60 s	<150 mm	No	No
4	60 s	<150 mm	No	No
5	60 s	<150 mm	No	No
6	60 s	<150 mm	No	No

5.2 SINGLE BURNING ITEM SANS 53823

Three samples of XPS boards were tested. The results are listed in Table 3 in below, with all of the three samples exhibiting a fire growth rate (FIGRA) of **less than 120 W/s**. Additionally, the lateral flame spread (LFS) did not reach the furthest edge of the long wing sample for all three tests. One of the three tests exhibited combustion, with a THR₆₀₀ exceeding 7.5 MJ. Burning particles formed for the one test that exhibited combustion but did not exhibit flaming of longer than 10 seconds on the particles/droplets, with the other two tests showing no droplets spreading further than the burner area, resulting in a **d0** burning droplet classification. Smoke produced was less than 30m²/s² for two of the three tests, which would result in a **s1** smoke classification.

According to Appendix A, this meets the criteria for an D classification for the SANS 53823 part of the classification.

Table 3: SBI results for each sample

CRITERIA	SAMPLE 1	SAMPLE 2	SAMPLE 3
FIGRA (W/s)	112	16	37
LFS (Edge)	No	No	No
THR ₆₀₀ (MJ)	13.8	0.4	0.1
SMOGRA (m ² /s ²)	46.2	5.7	4.3
Droplets/Particles	Yes	No	No
Droplet flaming (s)	> 10	< 10	< 10

Figures 1 to 3 give the heat release rate over the time of the test.

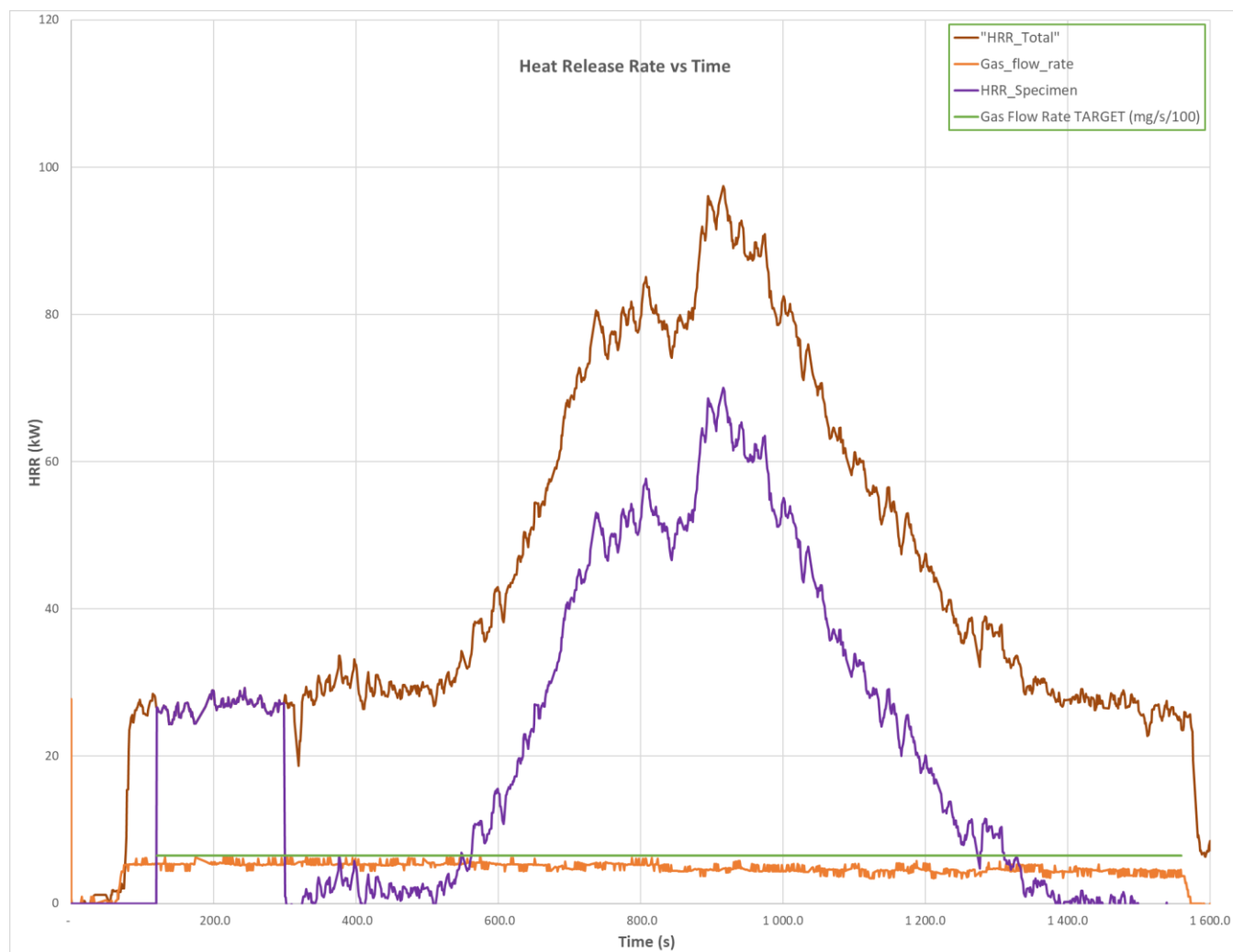


Figure 1: Heat Release rate over time for the first sample in the SBI.

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Figure 2: Heat Release rate over time for the second sample in the SBI

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Figure 3: Heat Release rate over time for the third sample in the SBI

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Image 1: Sample installed for a Single Burning Item test.

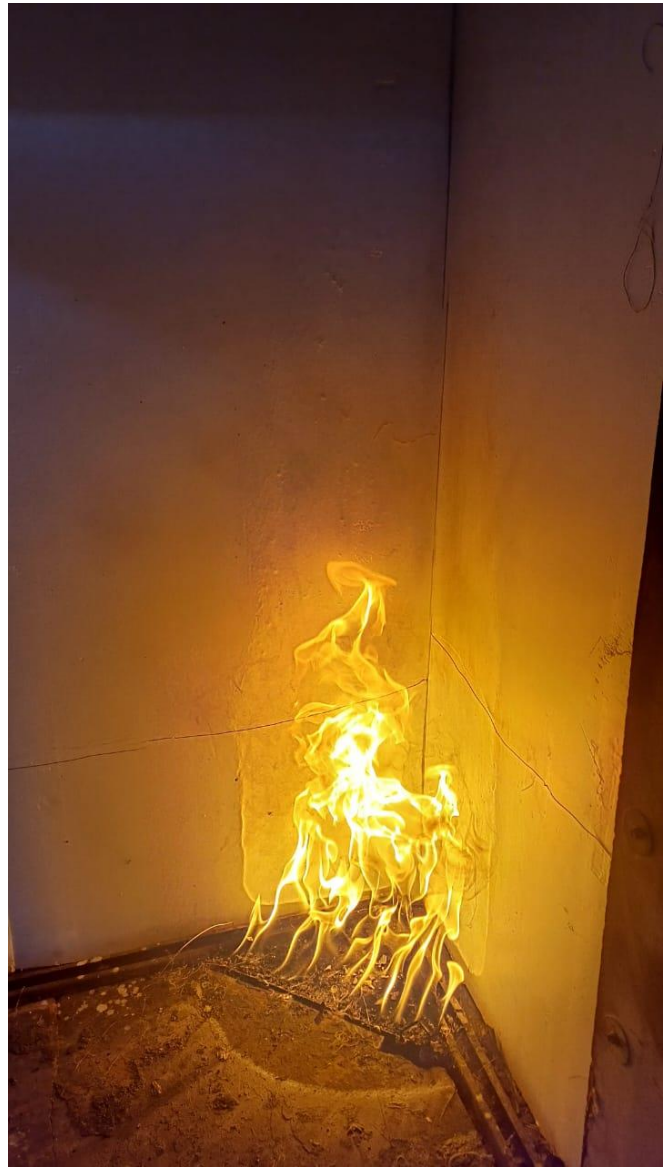


Image 2: Single Burning Item Test during the start of the testing time. View of the short wing and corner.



Image 2: Near the end of a Single Burning Item Test. No major flame spread or droplet development observed, with material mainly melting away from point of flame contact.

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6. ADDITIONAL INFORMATION

- 6.1 All the tests were performed according to the set standards for testing elements with measurements captured as prescribed by the listed standards.
- 6.2 All the thermocouples were calibrated at ambient temperature before the start of the test. All the thermocouples were within plus/minus two degrees and referenced to the calibrated test device within plus/minus 2 degrees Celsius.
- 6.3 All the gas analysers were calibrated and zeroed at ambient conditions before the start of the test.
- 6.4 Gas analysers were calibrated to 18% O₂, 1000 ppm CO and 2000 ppm CO₂ reference gasses.
- 6.5 Three oxygen analysers are used to minimize the error between readings.
- 6.6 All weights are accurate to +/-0.02 grams margin of error.
- 6.7 Only carbon dioxide, carbon monoxide and oxygen were analysed, and no other gasses were measured.
- 6.8 Sample was fixed to the back board with wires.
- 6.9 Additional images of the test will be made available on request to Ignis Testing.
- 6.10 Samples were conditioned as set out by SANS 53823 and SANS 11925-2

7. CONCLUSION

The first test that was conducted was the ignitability, SANS 11925, and the results from the tests showed that between six samples tested, no flame spread exceeded 150 mm within 60 seconds of flame contact. The results from the single burning item, SANS 53823, passed the requirements of FIGRA < 120 W/s, LFS < edge of the specimen and THR₆₀₀ < 7.5 MJ for a B classification. Furthermore, after the smoke was analysed and particulates were observed, additional d0 and s1 classifications could be given. The product can thus be classified as **B-s1,d0**.

DECLARATION

I, Dirk Johannes Streicher ID 590115 5011 087, hereby declare that I am registered with ECSA as a Professional Engineer (880107) and that I have acquainted myself with the content of the relevant codes, performed and witnessed the above test, applied my knowledge and mind to the process and that the results are accurate and true. I also declare that I have no knowledge in my capacity as a competent Professional Engineer that there is any other legal requirement w.r.t. approval of the compliance of the submitted test sample to the relevant codes.

Signed at Bellville on 10-December-2024



DJ Streicher (Pr Eng 880107)

INDEMNITY

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APPENDIX A

Table A1: Classification criteria set out by SANS 53501-1.

CLASS	EQUIPMENT	TEST METHODS	CLASSIFICATION CRITERIA	ADDITIONAL CLASSIFICATION
A1	Non-Combustibility	SANS 11820 ^a (EN 1182)	$\Delta T \leq 30^{\circ}\text{C}$; $\Delta m \leq 50\%$ and $t_r \leq 5\text{s}$	-
	Bomb Calorimeter	SANS 1743 (EN 1716)	$\text{PCS} \leq 2.0 \text{ MJ/kg}^a$ and $\text{PCS} \leq 2.0 \text{ MJ/kg}^{b,c}$ and $\text{PCS} \leq 1.4 \text{ MJ/m}^2^d$ and $\text{PCS} \leq 2.0 \text{ MJ/kg}^e$	-
A2	Bomb Calorimeter	SANS 1743 (EN 1716)	$\text{PCS} \leq 3.0 \text{ MJ/kg}^a$ and $\text{PCS} \leq 4.0 \text{ MJ/kg}^{b,c}$ and $\text{PCS} \leq 4.0 \text{ MJ/m}^2^d$ and $\text{PCS} \leq 3.0 \text{ MJ/kg}^e$	-
	Non-Combustibility	SANS 11820 ^a (EN 1182)	$\Delta T \leq 30^{\circ}\text{C}$; $\Delta m \leq 50\%$ and $t_r \leq 5\text{s}$	-
	Single Burning Item	SANS 53823 (EN 13823)	$\text{FIGRA} \leq 120 \text{ W/s}$; $\text{LFS} < \text{edge of specimen}$; $\text{THR}_{600\text{s}} \leq 7.5 \text{ MJ}$	Smoke production ^f and flaming droplets/particles ^g
B	Single Burning Item	SANS 53823 (EN 13823)	$\text{FIGRA} \leq 120 \text{ W/s}$; $\text{LFS} < \text{edge of specimen}$; $\text{THR}_{600\text{s}} \leq 7.5 \text{ MJ}$	Smoke production ^f and flaming droplets/particles ^g
	Single Flame Ignitability	SANS 11925-2 Exposure = 30s	$F_s \leq 150 \text{ mm}$ within 60s	
C	Single Burning Item	SANS 53823 (EN 13823)	$\text{FIGRA} \leq 250 \text{ W/s}$; $\text{LFS} < \text{edge of specimen}$; $\text{THR}_{600\text{s}} \leq 15 \text{ MJ}$	Smoke production ^f and flaming droplets/particles ^g
	Single Flame Ignitability	SANS 11925-2 Exposure = 30s	$F_s \leq 150 \text{ mm}$ within 60s	
D	Single Burning Item	SANS 53823 (EN 13823)	$\text{FIGRA} \leq 750 \text{ W/s}$	Smoke production ^f and flaming droplets/particles ^g
	Single Flame Ignitability	SANS 11925-2 Exposure = 30s	$F_s \leq 150 \text{ mm}$ within 60s	
E	Single Flame Ignitability	SANS 11925-2 Exposure = 5s	$F_s \leq 150 \text{ mm}$ within 20s	Flaming droplets/particles ^g
F	No Performance determined			

a – For homogeneous products and substantial components of non-homogenous products.

b – For any external non-substantial components of non-homogenous products.

c – Alternatively, any external non-substantial component having $\text{PCS} \leq 2.0 \text{ MJ/m}^2$, provided that the product satisfies the following criteria of SANS 53823: $\text{FIGRA} \leq 20 \text{ W/s}$, LFS M edge of the specimen and $\text{THR}_{600\text{s}} \leq 4.0 \text{ MJ}$ and $s1, d0$.

d – For any internal non-substantial component of non-homogenous products.

e – For the product as a whole.

f – $s1 = \text{SMOGRA} \leq 30 \text{ m}^2/\text{s}^2$ and $\text{TSP}_{600\text{s}} \leq 50 \text{ m}^2$;

$s2 = \text{SMOGRA} \leq 180 \text{ m}^2/\text{s}^2$ and $\text{TSP}_{600\text{s}} \leq 200 \text{ m}^2$;

$s3 = \text{not } s1 \text{ or } s2$.

g – $d0 = \text{No flaming droplets/particles in SANS 53823 within 600s}$;

$d1 = \text{No flaming droplets/particles persisting longer than 10s in SANS 53823 within 600s}$;

$d2 = \text{not } d0 \text{ or } d1$.

Ignition of paper in SANS 11925-2 results in a $d2$ classification. Pass = no ignition of paper(no classification); Fail = ignition of the paper ($d2$ classification).

Table A2: Explanatory Terms

ΔT	Temperature rise (°C)
Δm	Mass loss (%)
FIGRA	Fire Growth Rate
F_s	Flame spread (mm)
LFS	Lateral Flame Spread (mm)
T_r	Duration of sustained flaming (s)
SMOGRA	Smoke Growth Rate
TSP	Total Smoke Production
THR	Total Heat Release (MJ)
PCS	Gross calorific potential (MJ/kg or MJ/m²)
PCI	Net calorific potential (MJ/kg or MJ/m²)

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AMENDMENTS

DATE	Amendment	Signatory & Name
10/12/2024	Original Version	C. Kuhn

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