

## FIRE RESISTANCE TEST FACILITY



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## CLIENT



Technopol  
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## TEST REPORT

Test date: 04 August 2023  
Test Number: 2023-08-04 Technopol  
Place of test: Cape Town  
Test Description: Reaction to fire tests  
Type: Expanded Polystyrene  
Standards: Reaction to fire classification (SANS 53501-1)

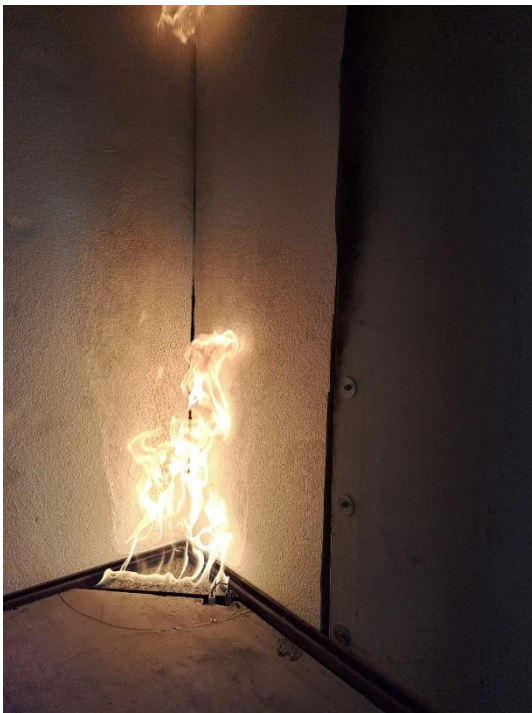
## REPORT COMPILATION

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FIRE REACTION TEST CONFIRMATION	
Client	Technopol
Test sample type	Expanded Polystyrene
Test report no	2023-08-17 Technopol
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	$\pm 18.37 \text{ kg/m}^3$
Sheet Thickness	60 mm
<b>CRITERIA</b>	
<b>STANDARD</b>	
Product	Insulation Material
Materials	Expanded Polystyrene
Tests performed	SANS 53823, SANS 11925-2
<b>Classification</b>	<b>B - s1,d0</b>
<b>Single Burn Item</b>	<b>FIGRA &lt; 120 W/s    LFS &lt; Edge of specimen    THR<sub>600s</sub> &lt; 15MJ    Pass B</b>
<b>Ignitability</b>	<b>Fs &lt; 150 mm within 60s    Pass B</b>
<b>AUTHORISATION</b>	
Date Authorised	17-08-2023
Authorised by	DJ Streicher (Pr Eng 880107) MSc. (Civ)Eng (UCT)
Authors	C Kuhn (BEng Chem)
Assistants	PJ Grabe (Pr Tech Mech Eng)
Conditional recommendation	None
Report authenticity period	5 years



*DJ Streicher*



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## 1. INTRODUCTION

The client (Technopol) approached Ignis testing to determine the SANS 53501-1 reaction to fire classification of the material. The material tested is expanded polystyrene and is intended to be used as insulation material. The tests to evaluate the performance of the product are the Single Burning Item test (EN 13823/SANS 53823) and Ignitability test (EN 11925/ SANS 11925-2). These tests cover the range of classification based on criteria set out by SANS 53501-1.

## 2. TEST DESCRIPTION

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

### 2.1 SANS 11925-2 Single-flame source 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.

### 2.2 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.

### 3. PROCEDURES

#### Test procedure:

##### 3.1 Single flame source test (ISO 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 it would 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.

##### 3.2 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.
- Weigh the specimen after cooling it to ambient temperature.
- Six repeatable tests must be performed for a sample.

## 4. RESULTS AND DISCUSSIONS

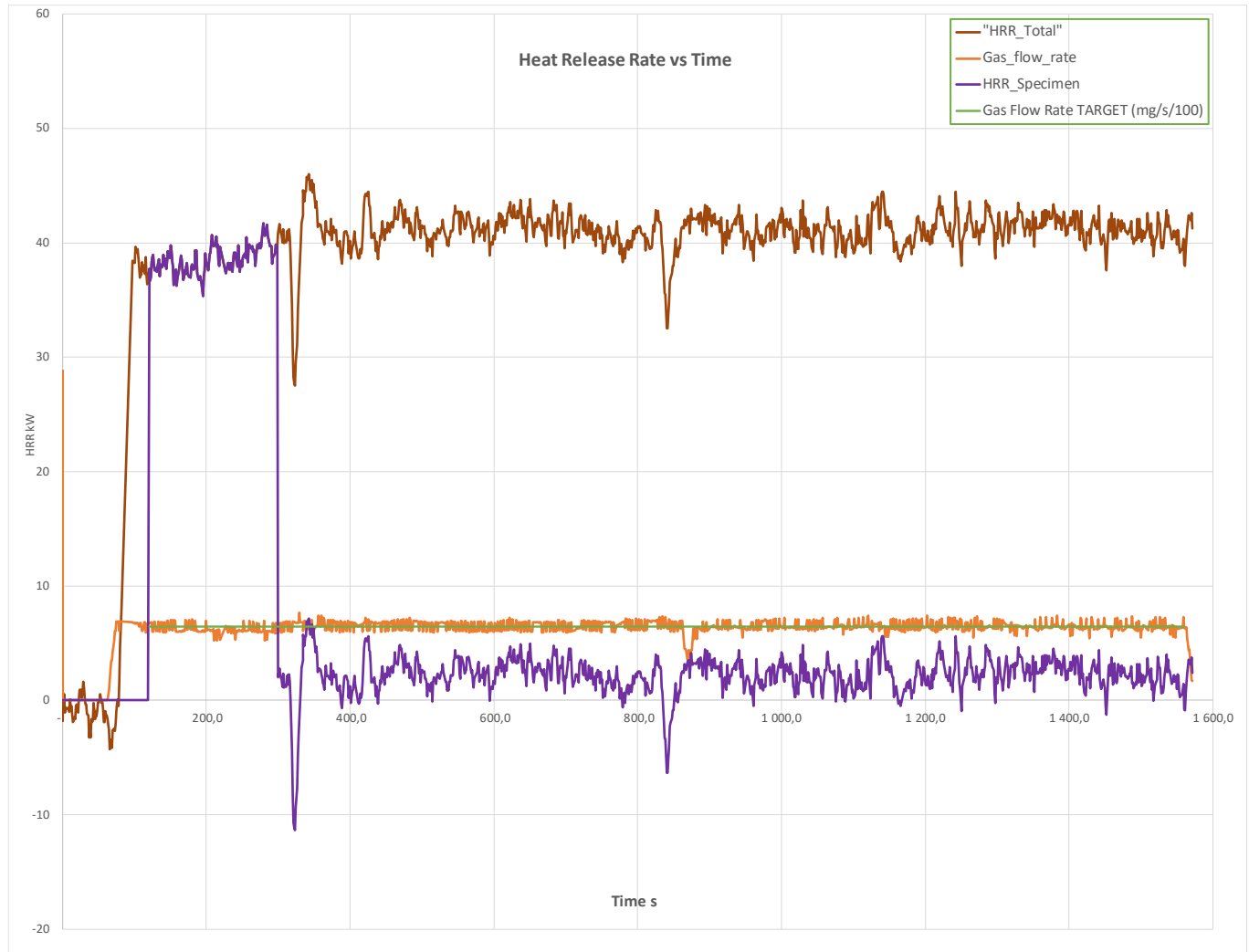
### 4.1 SINGLE BURNING ITEM SANS 53823

Three samples of the expanded polystyrene that were provided by Technopol were tested with results listed in Table 1. In all the tests conducted the fire growth rate (FIGRA) was lower than 120 W/s and a total heat release (THR) of well below 7.5 MJ. It should further be noted that the product did not combust, nor did it have any sustained flaming. The polystyrene melted away from flame contact, vacating the exposed area and thus leading to no combustion. Minimal to no smoke was produced during the tests, with few droplets formed during the 600 seconds during the test, but all particles being non-flaming. No particles fell further than the marked circular line around the flaming point.

**Table 1: SBI results for each sample**

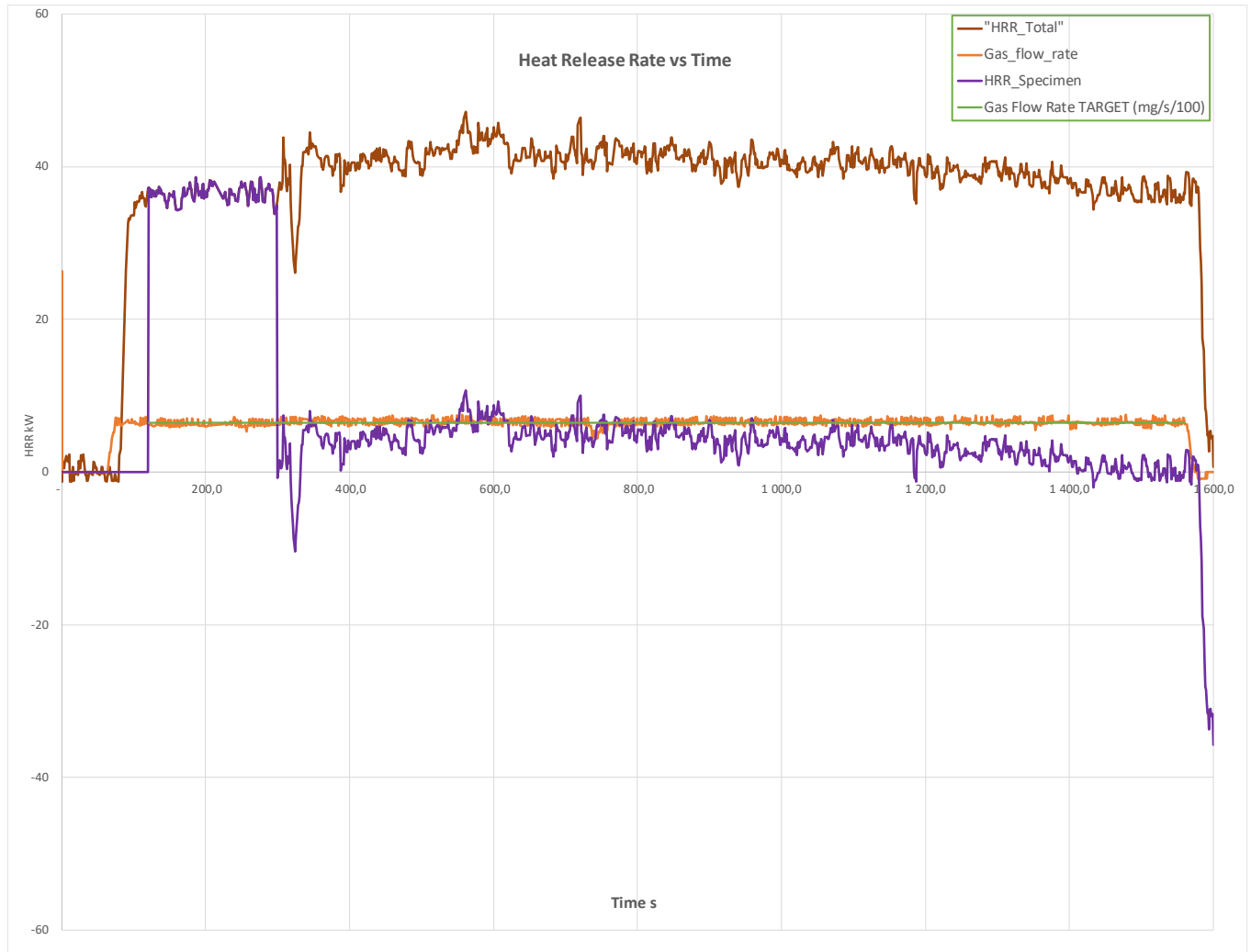
CRITERIA	SAMPLE 1	SAMPLE 2	SAMPLE 3
FIGRA (W/s)	2.7	7.2	6.8
LFS (Edge)	No	No	No
THR <sub>600</sub> (MJ)	1.3	2.9	2.4
SMOGRA (m <sup>2</sup> /s <sup>2</sup> )	0.0	0.0	0.0
Droplets/Particles	Yes – Non-Flaming	Yes – Non-Flaming	Yes – Non-Flaming

Figures 1 to 3 give the heat release rate over the time of the test. In all three cases, the observed heat release rate delivered by the specimen is almost negligible, supporting the conclusion that the product would not combust under the testing conditions and passes the highest classification requirements for the single-burning item tests. It should be noted that although the results from the SBI classifies for an A2 result, the results of the non-combustibility tests excludes it from any A classifications.



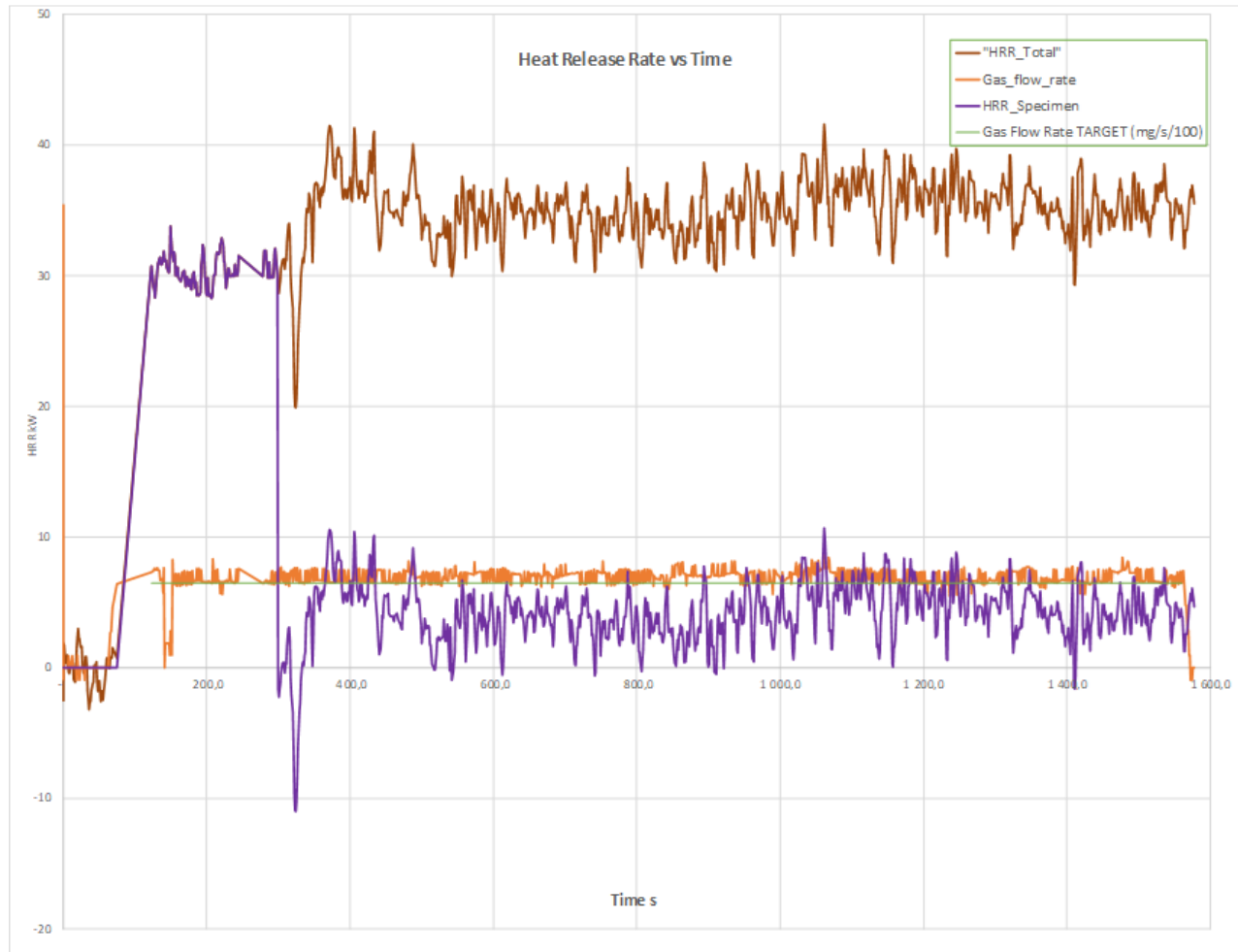
**Figure 1: Heat Release rate over time for the first sample in the SBI.**

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**Figure 2: Heat Release rate over time for the second sample in the SBI, end of test also displayed as the total heat release rate and gas flow returns to zero values.**

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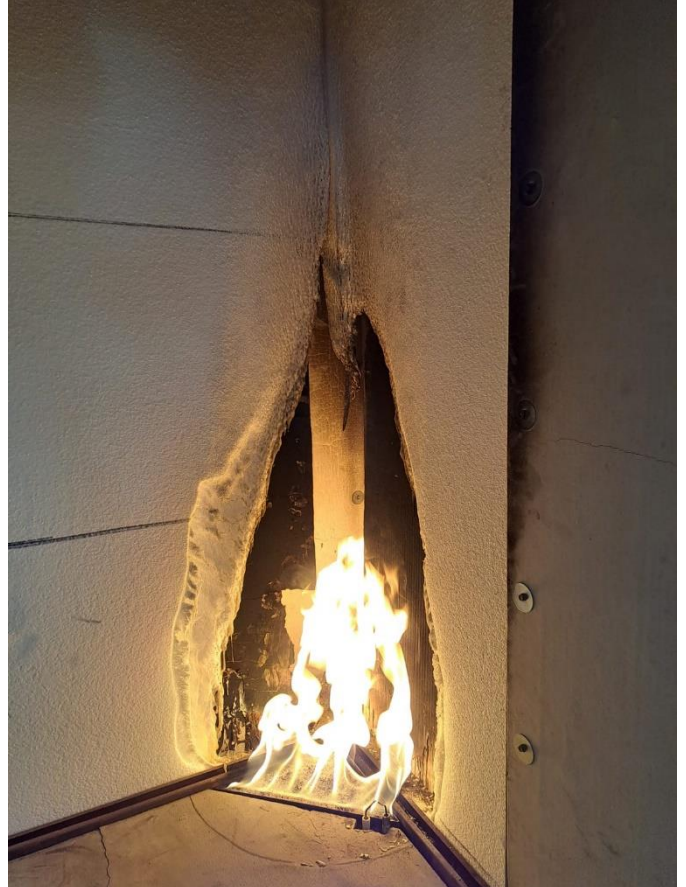


**Figure 3: Heat Release rate over time for the third sample in the SBI.**

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**Figure 4: First run Single Burning Item Test in progress**



**Figure 5: First run Single Burning Item Test in progress**

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**Figure 6: Start of Single Burning Item test**

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## 4.2 SINGLE FLAME IGNITABILITY SANS 11925-2

There were six tests conducted in total for the single flame ignitability, each having the same result, namely that there was no flame spread at all with no flaming droplets forming over a period of 60 seconds. This meets the criteria of having a flame spread ( $F_s$ ) of less than 150 mm for higher classifications as listed in Appendix A. Table 4 shows the results from the six tests conducted. The polystyrene simply melted away from flame contact, with no flaming occurring on the product self. The ignitability tests were performed on the front facing surface as well as from the centre point at the bottom of the sample. The results remain the same.

**Table 2: Single Flame Ignitability results for each sample**

SAMPLE ID	DURATION (s)	FLAME SPREAD (mm)	DROPLETS / PARTICLES FORMED?	DID DROPLETS IGNITE PAPER?
1	60	<150	No	No
2	60	<150	No	No
3	60	<150	No	No
4	60	<150	No	No
5	60	<150	No	No
6	60	<150	No	No



**Figure 7: Ignitability test sample**



**Figure 8: Ignitability test in progress**

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**Figure 13: End of ignitability test**

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## 5. ADDITIONAL INFORMATION

- 5.1 All the tests were performed according to the set standards for testing elements with measurements captured as prescribed by the listed standards.
- 5.2 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.
- 5.3 All the gas analysers were calibrated and zeroed at ambient conditions before the start of the test.
- 5.4 Three oxygen analysers are used to minimize the error between readings.
- 5.5 All weights are accurate to +/-0.02 grams margin of error.
- 5.6 Only carbon dioxide, carbon monoxide and oxygen were analysed, and no other gasses were measured.
- 5.7 No visible smoke formed during any of the tests.
- 5.8 The EPS (expanded polystyrene) melted away at the contact with flame, thus resulting in no combustion with time.
- 5.9 Gas analysers were calibrated to 18% O<sub>2</sub>, 1000 ppm CO and 2000 ppm CO<sub>2</sub> reference gasses.
- 5.10 During the ignitability testing, it should be noted that the flame spread did not exceed 150mm, but the EPS melted over the 150mm line.

## 6. CONCLUSION

The results from the single burning item, SANS 53823, met the requirements of FIGRA < 120 W/s, LFS < edge of the specimen and  $THR_{600s} < 7.5$  MJ for a B classification over three separate tests. Furthermore, after the smoke was analysed and particulates were observed, additional d0 and s1 classifications could be given. Finally, six ignitability tests were performed, each having an FS < 150 mm over 60 seconds. 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 21-August-2023



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 <sup>a</sup> (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 $\text{PCS} \leq 1.4 \text{ MJ/m}^2$ <sup>d</sup> 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 $\text{PCS} \leq 4.0 \text{ MJ/m}^2$ <sup>d</sup> and $\text{PCS} \leq 3.0 \text{ MJ/kg}^e$	-
	Non-Combustibility	SANS 11820 <sup>a</sup> (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 <sup>f</sup> and flaming droplets/particles <sup>g</sup>
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 <sup>f</sup> and flaming droplets/particles <sup>g</sup>
	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 <sup>f</sup> and flaming droplets/particles <sup>g</sup>
	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 <sup>f</sup> and flaming droplets/particles <sup>g</sup>
	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 <sup>g</sup>
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:  $\text{FIGRA} \leq 20 \text{ W/s}$ ,  $\text{LFS}$  M edge of the specimen and  $\text{THR}_{600\text{s}} \leq 4.0 \text{ MJ}$  and  $s_1, d_0$ .*

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

*e – For the product as a whole.*

*f –  $s_1 = \text{SMOGRA} \leq 30\text{m}^2/\text{s}^2$  and  $\text{TSP}_{600\text{s}} \leq 50\text{m}^2$ ;*

*$s_2 = \text{SMOGRA} \leq 180\text{m}^2/\text{s}^2$  and  $\text{TSP}_{600\text{s}} \leq 200\text{m}^2$ ;*

*$s_3 = \text{not } s_1 \text{ or } s_2$ .*

*g –  $d_0 = \text{No flaming droplets/particles in SANS 53823 within 600s}$ ;*

*$d_1 = \text{No flaming droplets/particles persisting longer than 10s in SANS 53823 within 600s}$ ;*

*$d_2 = \text{not } d_0 \text{ or } d_1$ .*

*Ignition of paper in SANS 11925-2 results in a  $d_2$  classification. Pass = no ignition of paper(no classification); Fail = ignition of the paper ( $d_2$  classification).*

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**Table A2: Explanatory Terms**

<b><math>\Delta T</math></b>	<b>Temperature rise (°C)</b>
<b><math>\Delta m</math></b>	<b>Mass loss (%)</b>
<b>FIGRA</b>	<b>Fire Growth Rate</b>
<b>F<sub>s</sub></b>	<b>Flame spread (mm)</b>
<b>LFS</b>	<b>Lateral Flame Spread (mm)</b>
<b>T<sub>r</sub></b>	<b>Duration of sustained flaming (s)</b>
<b>SMOGRA</b>	<b>Smoke Growth Rate</b>
<b>TSP</b>	<b>Total Smoke Production</b>
<b>THR</b>	<b>Total Heat Release (MJ)</b>
<b>PCS</b>	<b>Gross calorific potential (MJ/kg or MJ/m<sup>2</sup>)</b>
<b>PCI</b>	<b>Net calorific potential (MJ/kg or MJ/m<sup>2</sup>)</b>

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**AMENDMENTS**

<b>DATE</b>	<b>Amendment</b>	<b>Signatory &amp; Name</b>
08/21/2023	First Edition	

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