

## TEST REPORT

**Customer:** Endutex – Revestimentos Têxteis, S.A

**Address:** Rua da Baiona, 22  
4795-784 Vilarinho  
Santo Tirso

**Request:** Tests according standard NP EN 13501-1: 2007

**Material Reference:** Terra Opak 300 FR

**Request Reference:** Email

**Request Date:** 2016-12-21

**Reception Date:** 2016-12-19

**Test Date:** 2017-01-09 to 2017-01-16

**Report N.** 48/LFF/16i

### Determination of Fire Reaction Classification

#### 1 - Scope

The tests reported concern the determination of the fire reaction class for a two side coated fabric with reference **Terra Opak 300 FR** to be used on billboards.

## 2 - Methodology

The tests were performed as indicated in the standard EN ISO 11925-2 issued of 2010 and standard EN 13823:2010+A1 issued of 2014. The classification method was applied according the standard NP EN 13051-1:2007+A1 issued of 2013.

## 3 - Specimens

### 3.1 - Dimension and conditioning

The specimens were prepared by the costumer and had the following dimensions:

Specimens	Lenght (mm)	Width (mm)	Thickness (mm)	Mass (g)
48/LFF/16i/01	1500	1002	0.3	506.9
48/LFF/16i/01	1500	500	0.3	260.9
48/LFF/16i/02	1502	1004	0.3	501.6
48/LFF/16i/02	1500	503	0.3	253.4
48/LFF/16i/03	1501	1001	0.3	500.3
48/LFF/16i/03	1500	501	0.3	250.6
48/LFF/16i/04	251	91	0.3	7.7
48/LFF/16i/05	251	90	0.3	7.7
48/LFF/16i/06	251	90	0.3	7.8
48/LFF/16i/07	249	90	0.3	7.6
48/LFF/16i/08	250	90	0.3	7.6
48/LFF/16i/09	249	90	0.3	7.5
48/LFF/16i/10	250	90	0.3	7.5
48/LFF/16i/11	251	89	0.3	7.7
48/LFF/16i/12	251	90	0.3	7.7
48/LFF/16i/13	250	90	0.3	7.9
48/LFF/16i/14	250	90	0.3	7.8
48/LFF/16i/15	250	90	0.3	7.8

Before being tested the specimens were conditioned for a minimum period of 500 hours at  $23 \pm 2$  °C and  $50 \pm 5$  % relative humidity

### 3.2 – Mounting of specimens

Boards are tested free standing (paragraph 5.2.2.a. of EN 13823 standard).

## 4 - Results

### 4.1 – Ignitability test (EN ISO 11925-2)

Position of flame application	Edge
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Specimens	48/LFF/16i/0 4	48/LFF/16i/0 5	48/LFF/16i/0 6	48/LFF/16i/0 7	48/LFF/16i/0 8	48/LFF/16i/0 9
Flame application time (s)	30	30	30	30	30	30
Ignition (s)	2	1	1	1	1	1
F <sub>s</sub> (mm)	Not reached	Not reached	Not reached	Not reached	Not reached	Not reached
Droplets/Particles	No	No	No	No	No	No
Ignition of the filter paper	No	No	No	No	No	No

F<sub>s</sub>: Vertical Flame Spread



Position of flame application	Surface
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Specimens	48/LFF/16i/1 0	48/LFF/16i/1 1	48/LFF/16i/1 2	48/LFF/16i/1 3	48/LFF/16i/1 4	48/LFF/16i/1 5
Flame application time (s)	30	30	30	30	30	30
Ignition (s)	3	2	3	4	2	3
F <sub>s</sub> (mm)	Not reached	Not reached	Not reached	Not reached	Not reached	Not reached
Droplets/Particles	No	No	No	No	No	No
Ignition of the filter paper	No	No	No	No	No	No

F<sub>s</sub>: Vertical Flame Spread

#### 4.2 – Single burning item test (EN 13823)

Specimens	48/LFF/16i/01	48/LFF/16i/02	48/LFF/16i/03	AVERAGE
FIGRA <sub>0,2 MJ</sub> (W/s)	Threshold not reached	Threshold not reached	Threshold not reached	Threshold not reached
THR <sub>600s</sub> (MJ)	0.2	0.5	0.1	0.3
LFS (m)	No	No	No	No
FIRE BEHAVIOUR	A2/B	A2/B	A2/B	A2/B
SMOGR <sub>A</sub> (m <sup>2</sup> /s <sup>2</sup> )	45.0	69.9	35.0	50.0
TSP <sub>600s</sub> (m <sup>2</sup> )	37.7	102.1	45.9	61.9
SMOKE PRODUCTION	s2	s2	s2	s2
FLAMING DROPLETS/PARTICLES	No	No	No	No
FLAMING DROPLETS	d0	d0	d0	d0

FIGRA: Fire growth rate THR: Total heat release LFS: Lateral flame spread

SMOGR<sub>A</sub>: Smoke growth rate TSP: Total smoke production

## 5 – Conclusion

Considering all the results and according the EN 13501-1 standard, it can be concluded that the material should be included in the following classification:

Fire behaviour		Smoke Production			Flaming droplets	
<b>B</b>	-	<b>s</b>	<b>2</b>	,	<b>d</b>	<b>0</b>

This classification is valid if material is applied free standing.

Porto, January 17, 2017

Technical Manager



João Rodrigues

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 be the sole criterion for assessing the potential fire hazard of the product in use.

## ANNEX 1

### Photographs of the mounting specimens



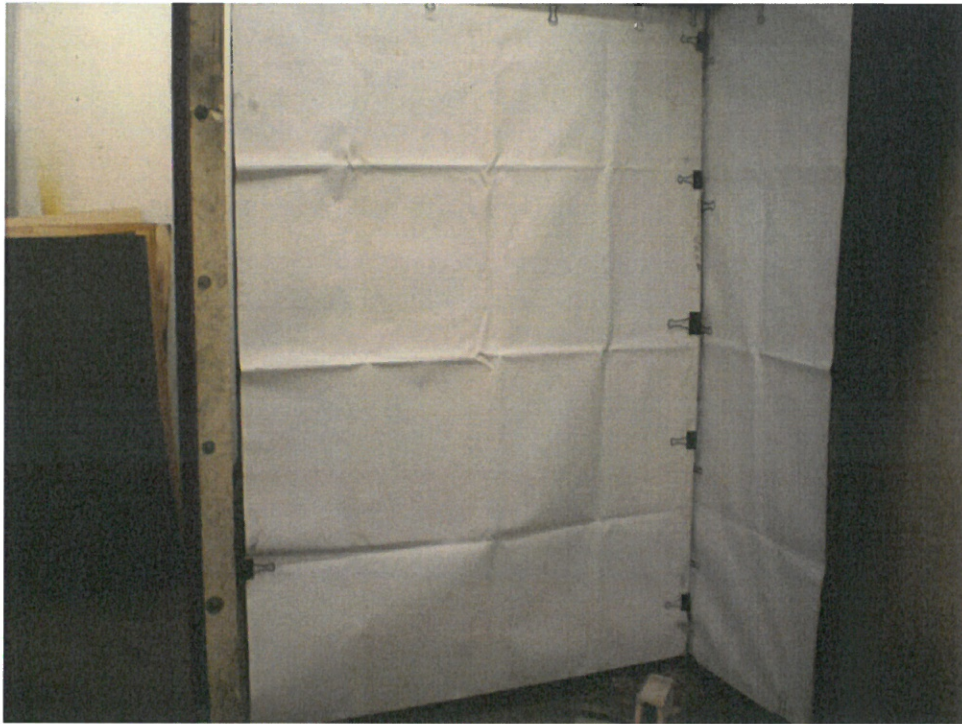


Figure 1 – View of mounting.



Figure 2 – The SBI test.





Figure 3 – The SBI test.

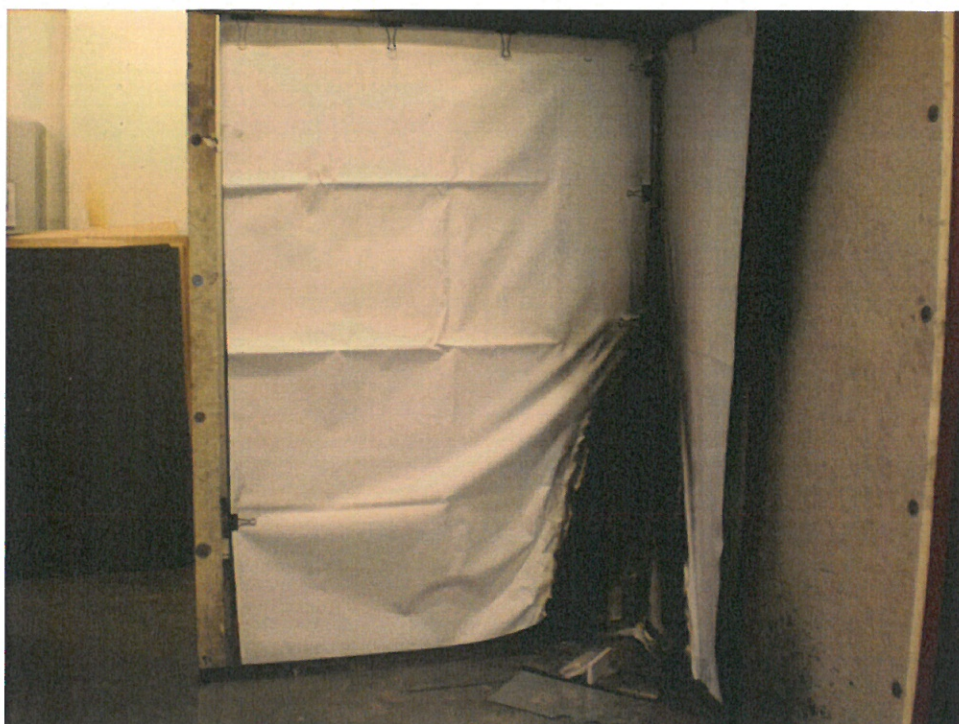


Figure 4 – Specimens following testing in the SBI.



## ANNEX 2

### SBI Test Reports

# SBI Test Report

Laboratory name LFF  
 Operator João Rodrigues  
 Filename C:\SBICALC\DATA\17010001.RW1  
 Report identification 48/LFF/16/01  
 Product identification Terra Opak 300 FR

Test	Pre-test conditions	Specimen conditioning
Standard used EN 13823:2010	Baseline duct temperature 295.44 K	Method Constant mass
Date of test 13/01/2017	Ambient temperature 295.67 K	Time interval 578 hours
Date of report 13/01/2017	Ambient pressure 101.735 kPa	Mass 1 507 g
E' 17.2 MJ/m <sup>3</sup>	Relative humidity 40%	Mass 2 261 g
		Temperature 23°C
		RH 50%
Apparatus specifications	Baseline conditions	
kt 0.892	Baseline ambient oxygen 20.728%	
kp 1.08	Baseline oxygen 20.951%	
Duct diameter 0.315 m	Baseline carbon dioxide 0.0807%	
O2 calibration delay time 15 s	Baseline smoke 100.12%	
CO2 calibration delay time 11 s		

## Specimen information

Thickness 0.3 mm	Mounting method 5.2.2a) in EN 13823:2002
Density	Joints none
Surface mass/area 0.34 kg/m <sup>2</sup>	Fixed to substrate? No
Specimen number	Fixing method N/A
Date of arrival 19/12/2016	Substrate none
	Manufacturer Endutex - Revestimentos Têxteis, SA
	Sponsor

## Test validity criteria

### Test drifts

	Initial	Final	Change
Oxygen	20.951%	20.946%	0.005%
CO2	0.081%	0.077%	0.003%
Smoke	100.12%	99.29%	0.008

Exposure time 1254 s

### Synchronisation details

Duct temp. dropped by 2.5 K from baseline of 318.15 K at 303 s  
 Oxygen rose by 0.05% from baseline of 20.676% at 303 s  
 CO2 dropped by 0.02% from baseline of 0.297% at 300 s

### Burner details

Burner HRR	29.956 kW
Burner HRR std. dev.	0.642 kW
Burner CO2/O2 ratio	0.785
Burner SPR	0.031 m <sup>2</sup> /s
Burner SPR std. dev.	0.005 m <sup>2</sup> /s
Burner response time (s)	24 s

### Other checks

Minimum duct flow	0.569 m <sup>3</sup> /s
Maximum duct flow	0.667 m <sup>3</sup> /s
Possible T/C1 & T/C3 failure	

## Classification results

FIGRA(0.2)	threshold not reached
FIGRA(0.4)	threshold not reached
THR(600)	0.2 MJ
SMOGRA	45.0 cm <sup>2</sup> /s <sup>2</sup> at 336 s
TSP(600)	37.7 m <sup>2</sup>

## Classification observations

LFS to edge?	No
FDP flaming <= 10s?	No
FDP flaming > 10s?	No

## Potential classification

Class	A2/B
Smoke production	s2
Flaming droplets/particles	d0

## Recorded events

Surface flashes? No; Falling specimen parts? No; Smoke not entering hood? No  
 Mutual fixing of backing board failed? No; Distortion/collapse of specimen? No

## Pre-test comments

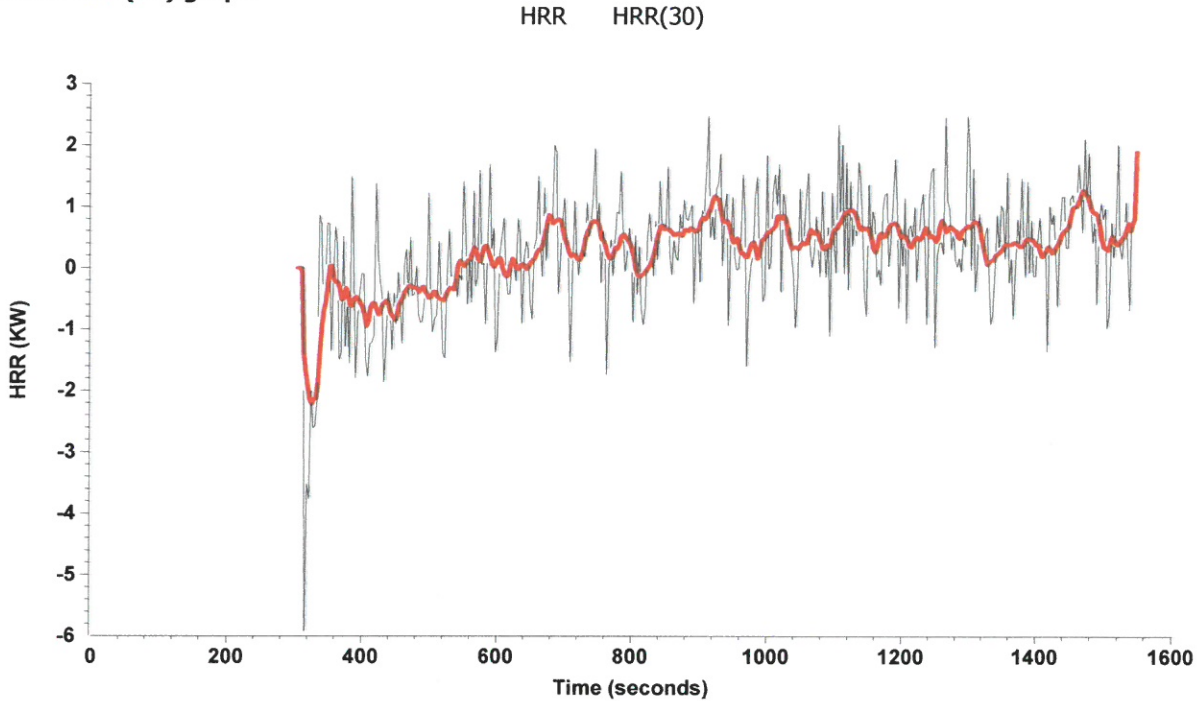
## After-test comments



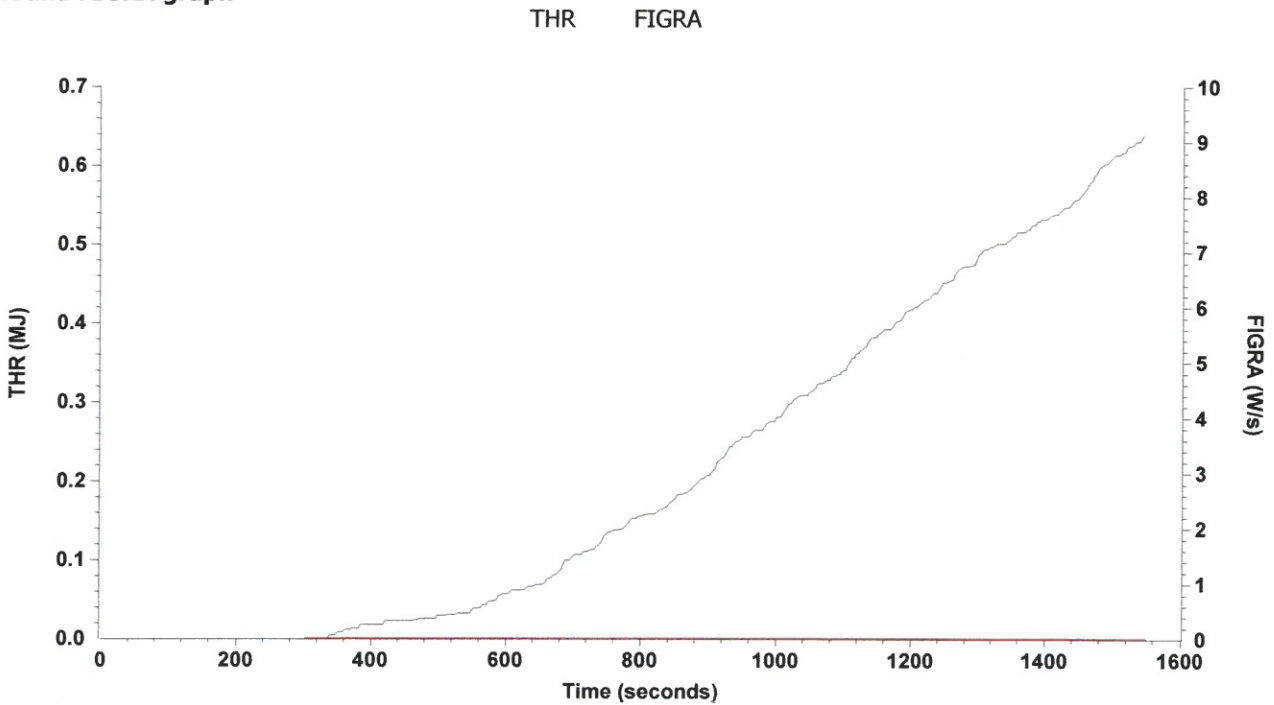
# SBI Test Report

Laboratory name LFF  
Operator João Rodrigues  
Filename C:\SBICALC\DATA\17010001.RW1  
Report identification 48/LFF/16/01  
Product identification Terra Opak 300 FR

## HRR and HRR(30) graph



## THR and FIGRA graph

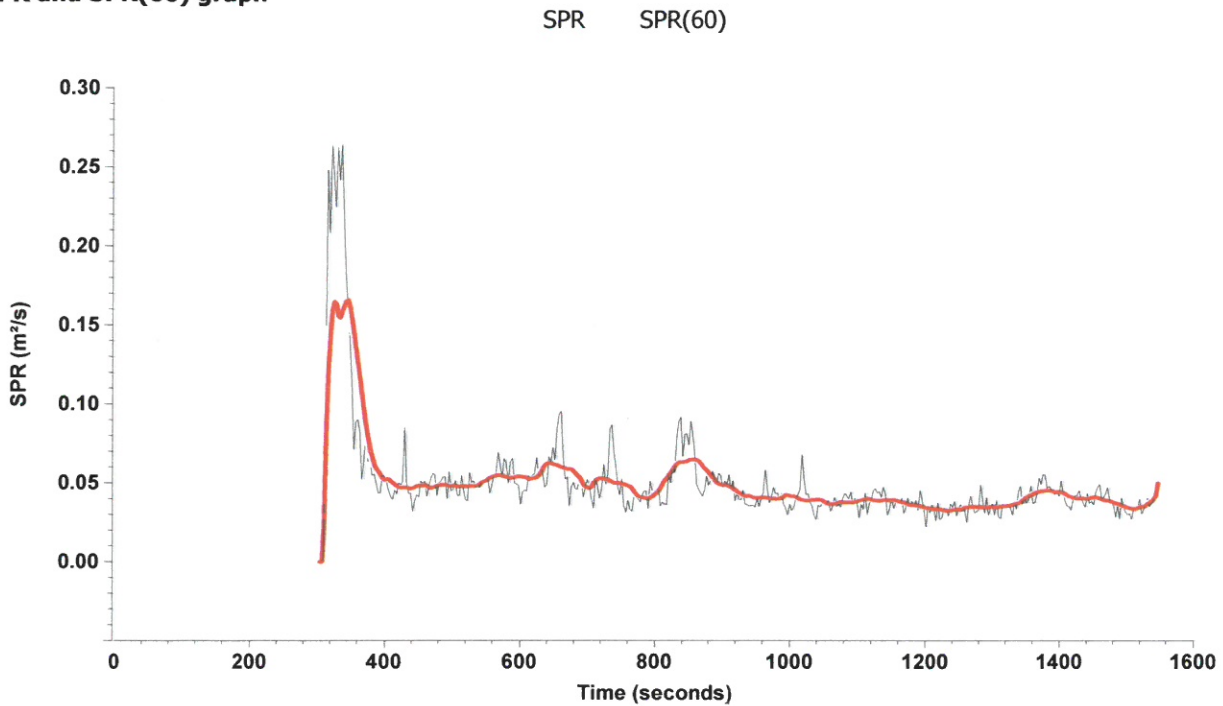


The test results relate to the behaviour of the test specimens of a product under the particular conditions of the test; they are not intended to be the sole criterion for assessing the potential fire hazard of the product in use.

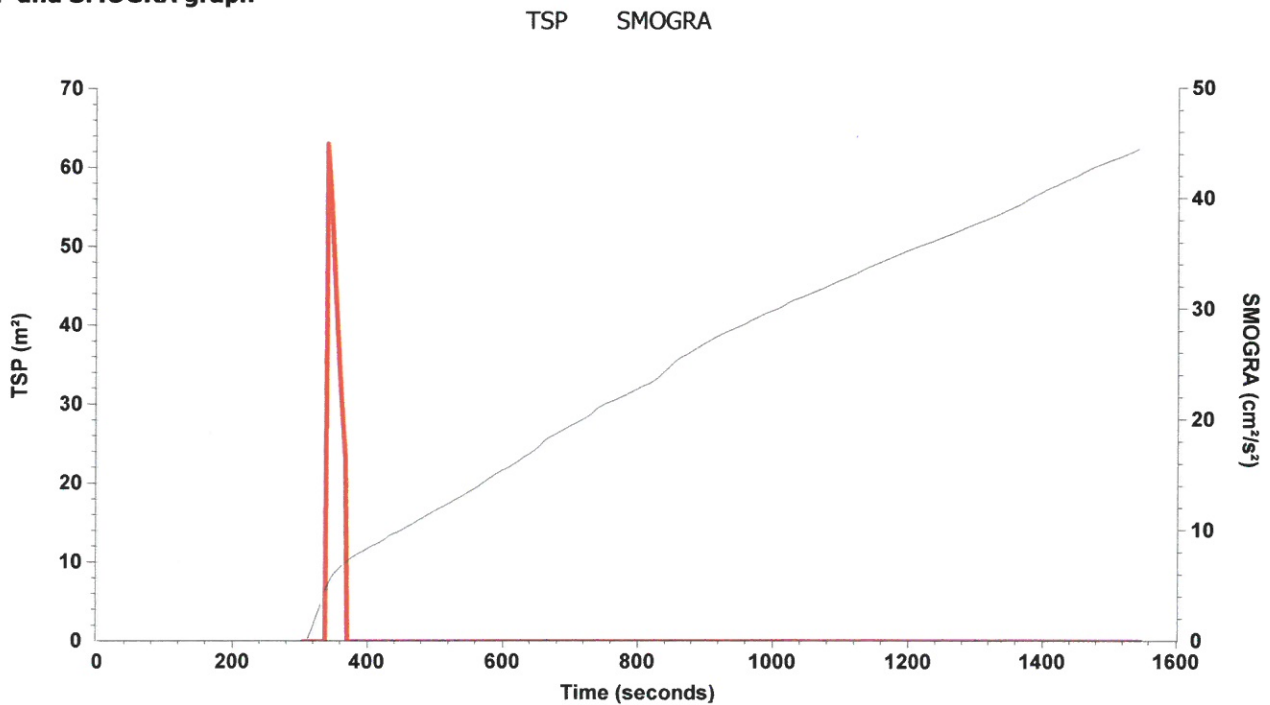
# SBI Test Report

Laboratory name LFF  
Operator João Rodrigues  
Filename C:\SBICALC\DATA\17010001.RW1  
Report identification 48/LFF/16/01  
Product identification Terra Opak 300 FR

## SPR and SPR(60) graph



## TSP and SMOGRA graph



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 be the sole criterion for assessing the potential fire hazard of the product in use.





# SBI Test Report

Laboratory name LFF  
 Operator João Rodrigues  
 Filename C:\SBICALC\DATA\17010002.RW1  
 Report identification 48/LFF/16/02  
 Product identification Terra Opak 300 FR

Test	Pre-test conditions	Specimen conditioning
Standard used EN 13823:2010	Baseline duct temperature 294.67 K	Method Constant mass
Date of test 16/01/2017	Ambient temperature 294.40 K	Time interval 670 hours
Date of report 16/01/2017	Ambient pressure 101.903 kPa	Mass 1 502 g
E' 17.2 MJ/m <sup>3</sup>	Relative humidity 45%	Mass 2 253 g
		Temperature 23°C
		RH 50%
Apparatus specifications	Baseline conditions	
kt 0.892	Baseline ambient oxygen 20.711%	
kp 1.08	Baseline oxygen 20.949%	
Duct diameter 0.315 m	Baseline carbon dioxide 0.0813%	
O2 calibration delay time 15 s	Baseline smoke 100.08%	
CO2 calibration delay time 11 s		

## Specimen information

Thickness	Mounting method 5.2.2a) in EN 13823:2002
Density	Joints none
Surface mass/area 0.34 kg/m <sup>2</sup>	Fixed to substrate? No
Specimen number	Fixing method N/A
Date of arrival 19/12/2016	Substrate none
	Manufacturer Endutex - Revestimentos Têxteis, SA
	Sponsor

## Test validity criteria

### Test drifts

	Initial	Final	Change
Oxygen	20.949%	20.936%	0.013%
CO2	0.081%	0.084%	0.003%
Smoke	100.08%	98.99%	0.011

Exposure time 1254 s

### Synchronisation details

Duct temp. dropped by 2.5 K from baseline of 317.51 K at 303 s  
 Oxygen rose by 0.05% from baseline of 20.673% at 303 s  
 CO2 dropped by 0.02% from baseline of 0.301% at 300 s

### Burner details

Burner HRR	29.637 kW
Burner HRR std. dev.	0.796 kW
Burner CO2/O2 ratio	0.794
Burner SPR	0.023 m <sup>2</sup> /s
Burner SPR std. dev.	0.004 m <sup>2</sup> /s
Burner response time (s)	15 s

### Other checks

Minimum duct flow	0.573 m <sup>3</sup> /s
Maximum duct flow	0.670 m <sup>3</sup> /s
No T/C failure	

## Classification results

FIGRA(0.2)	threshold not reached
FIGRA(0.4)	threshold not reached
THR(600)	0.5 MJ
SMOGRA	69.9 cm <sup>2</sup> /s <sup>2</sup> at 330 s
TSP(600)	102.1 m <sup>2</sup>

## Classification observations

LFS to edge?	No
FDP flaming <= 10s?	No
FDP flaming > 10s?	No

## Potential classification

Class	A2/B
Smoke production	s2
Flaming droplets/particles	d0

## Recorded events

Surface flashes? No; Falling specimen parts? No; Smoke not entering hood? No  
 Mutual fixing of backing board failed? No; Distortion/collapse of specimen? No

## Pre-test comments

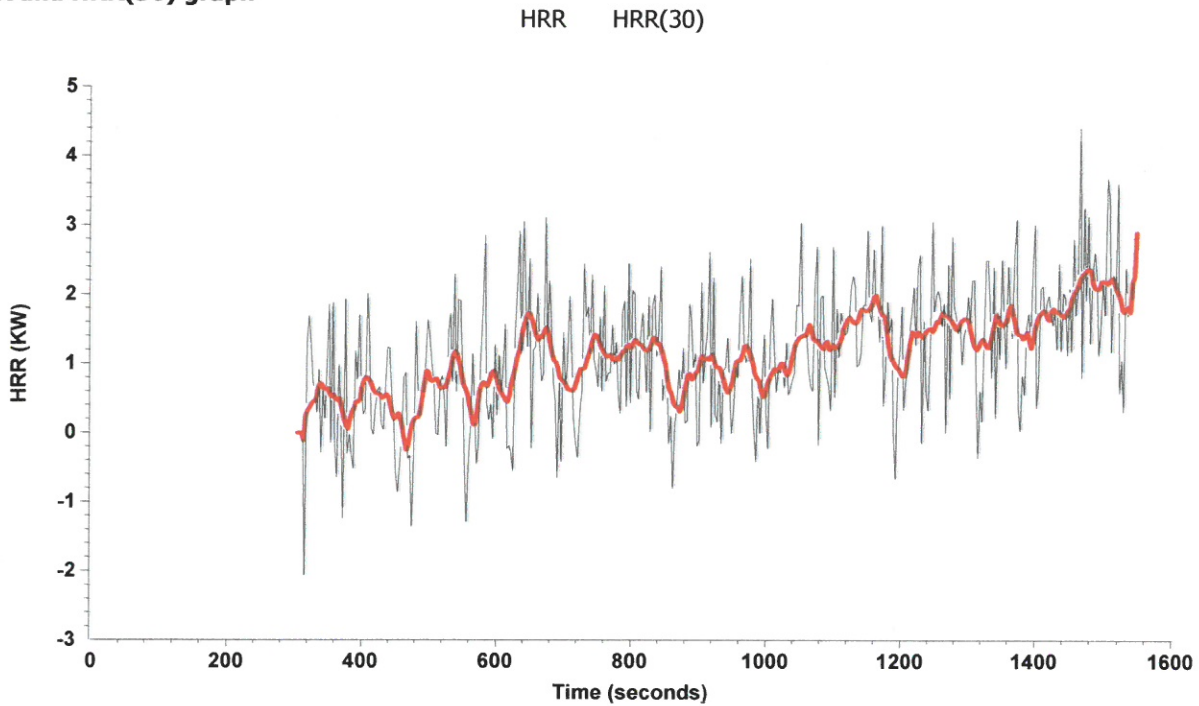
## After-test comments



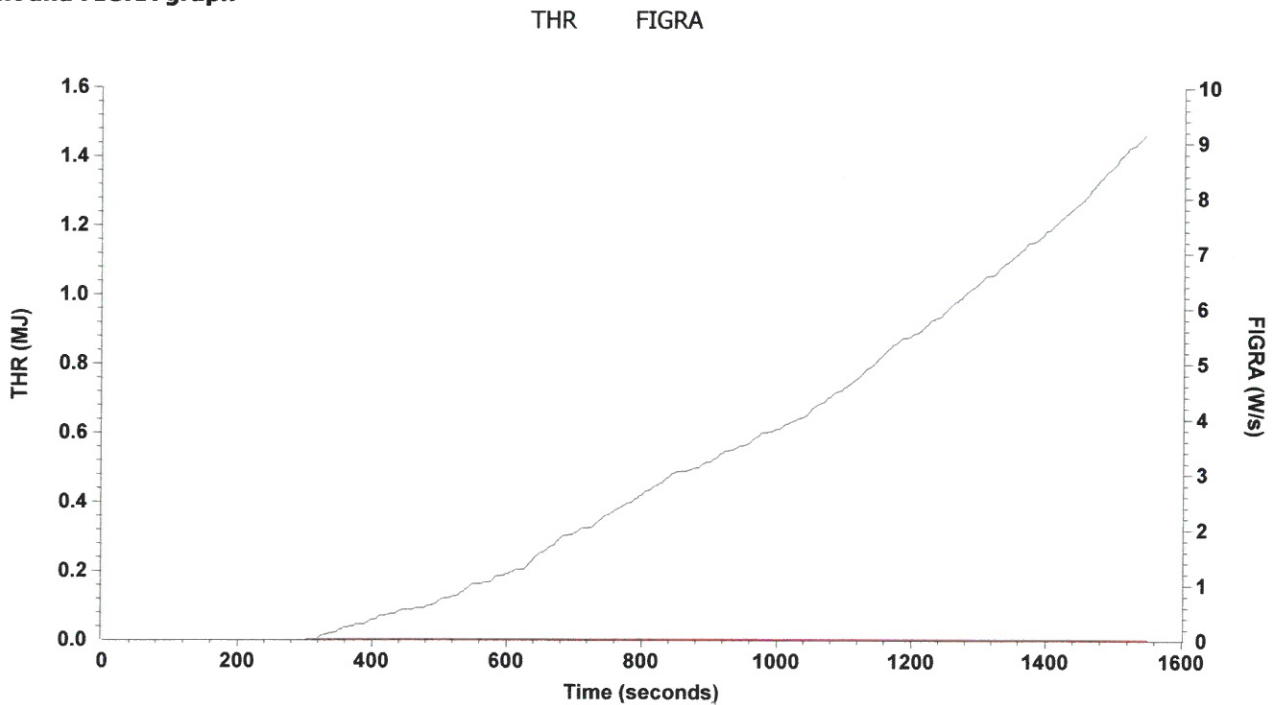
# SBI Test Report

Laboratory name LFF  
Operator João Rodrigues  
Filename C:\SBICALC\DATA\17010002.RW1  
Report identification 48/LFF/16/02  
Product identification Terra Opak 300 FR

## HRR and HRR(30) graph



## THR and FIGRA graph



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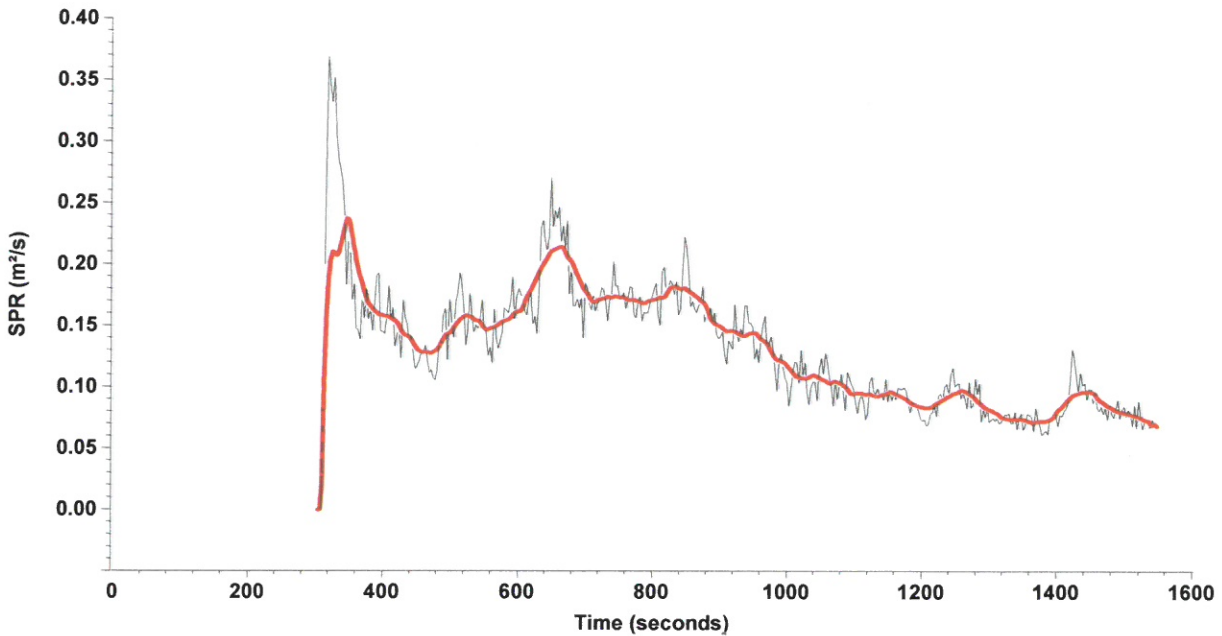


# SBI Test Report

Laboratory name LFF  
Operator João Rodrigues  
Filename C:\SBICALC\DATA\17010002.RW1  
Report identification 48/LFF/16/02  
Product identification Terra Opak 300 FR

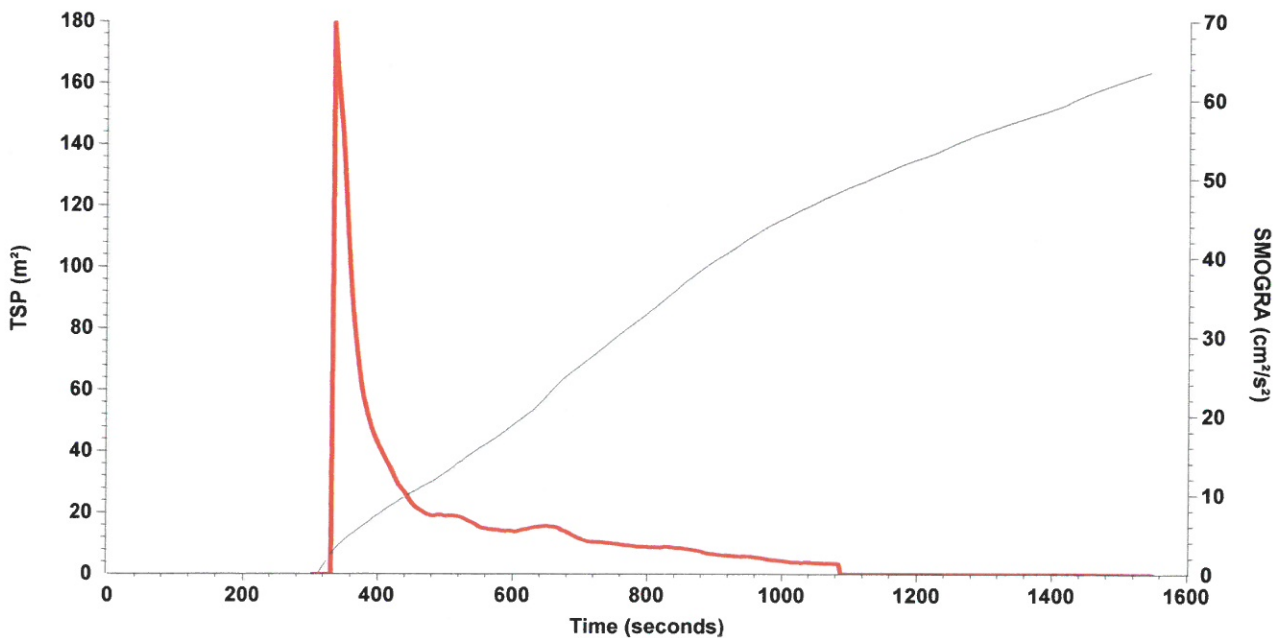
## SPR and SPR(60) graph

SPR SPR(60)



## TSP and SMOGRA graph

TSP SMOGRA



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 be the sole criterion for assessing the potential fire hazard of the product in use.

# SBI Test Report

Laboratory name LFF  
 Operator João Rodrigues  
 Filename C:\SBICALC\DATA\17010003.RW1  
 Report identification 48/LFF/16/03  
 Product identification Terra Opak 300 FR

Test	Pre-test conditions	Specimen conditioning
Standard used EN 13823:2010	Baseline duct temperature 294.86 K	Method Constant mass
Date of test 16/01/2017	Ambient temperature 294.77 K	Time interval 674 hours
Date of report 16/01/2017	Ambient pressure 101.564 kPa	Mass 1 500 g
E' 17.2 MJ/m <sup>3</sup>	Relative humidity 44%	Mass 2 251 g
		Temperature 23°C
		RH 50%
Apparatus specifications	Baseline conditions	
kt 0.892	Baseline ambient oxygen 20.716%	
kp 1.08	Baseline oxygen 20.952%	
Duct diameter 0.315 m	Baseline carbon dioxide 0.0768%	
O2 calibration delay time 15 s	Baseline smoke 99.93%	
CO2 calibration delay time 11 s		

## Specimen information

Thickness	Mounting method 5.2.2a) in EN 13823:2002
Density	Joints none
Surface mass/area 0.34 kg/m <sup>2</sup>	Fixed to substrate? No
Specimen number	Fixing method N/A
Date of arrival 19/12/2016	Substrate none
	Manufacturer Endutex - Revestimentos Têxteis, SA
	Sponsor

## Test validity criteria

### Test drifts

	Initial	Final	Change
Oxygen	20.952%	20.943%	0.010%
CO2	0.077%	0.079%	0.002%
Smoke	99.93%	98.38%	0.016

Exposure time 1254 s

### Synchronisation details

Duct temp. dropped by 2.5 K from baseline of 317.58 K at 303 s  
 Oxygen rose by 0.05% from baseline of 20.676% at 303 s  
 CO2 dropped by 0.02% from baseline of 0.296% at 300 s

### Burner details

Burner HRR	29.836 kW
Burner HRR std. dev.	0.757 kW
Burner CO2/O2 ratio	0.794
Burner SPR	0.033 m <sup>2</sup> /s
Burner SPR std. dev.	0.004 m <sup>2</sup> /s
Burner response time (s)	24 s

### Other checks

Minimum duct flow	0.575 m <sup>3</sup> /s
Maximum duct flow	0.683 m <sup>3</sup> /s
Possible T/C1 & T/C3 failure	

## Classification results

FIGRA(0.2)	threshold not reached
FIGRA(0.4)	threshold not reached
THR(600)	0.1 MJ
SMOGRA	35.0 cm <sup>2</sup> /s <sup>2</sup> at 345 s
TSP(600)	45.9 m <sup>2</sup>

## Classification observations

LFS to edge?	No
FDP flaming <= 10s?	No
FDP flaming > 10s?	No

## Potential classification

Class	A2/B
Smoke production	s2
Flaming droplets/particles	d0

## Recorded events

Surface flashes? No; Falling specimen parts? No; Smoke not entering hood? No  
 Mutual fixing of backing board failed? No; Distortion/collapse of specimen? No

## Pre-test comments

## After-test comments

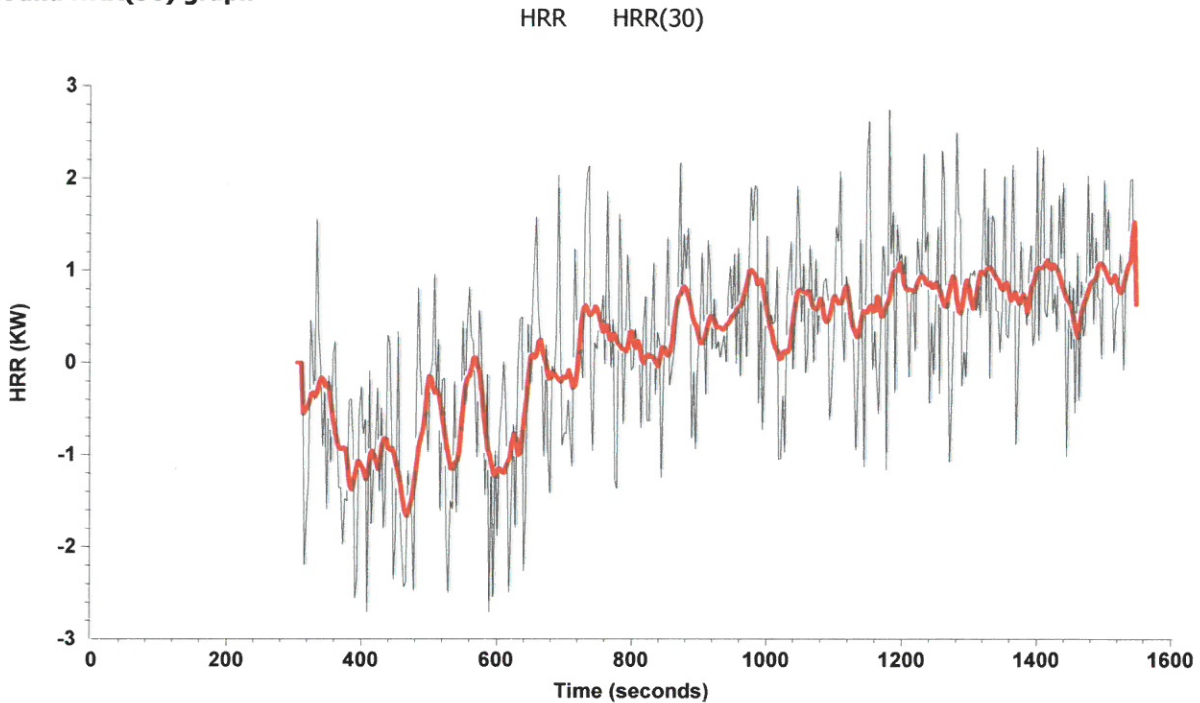




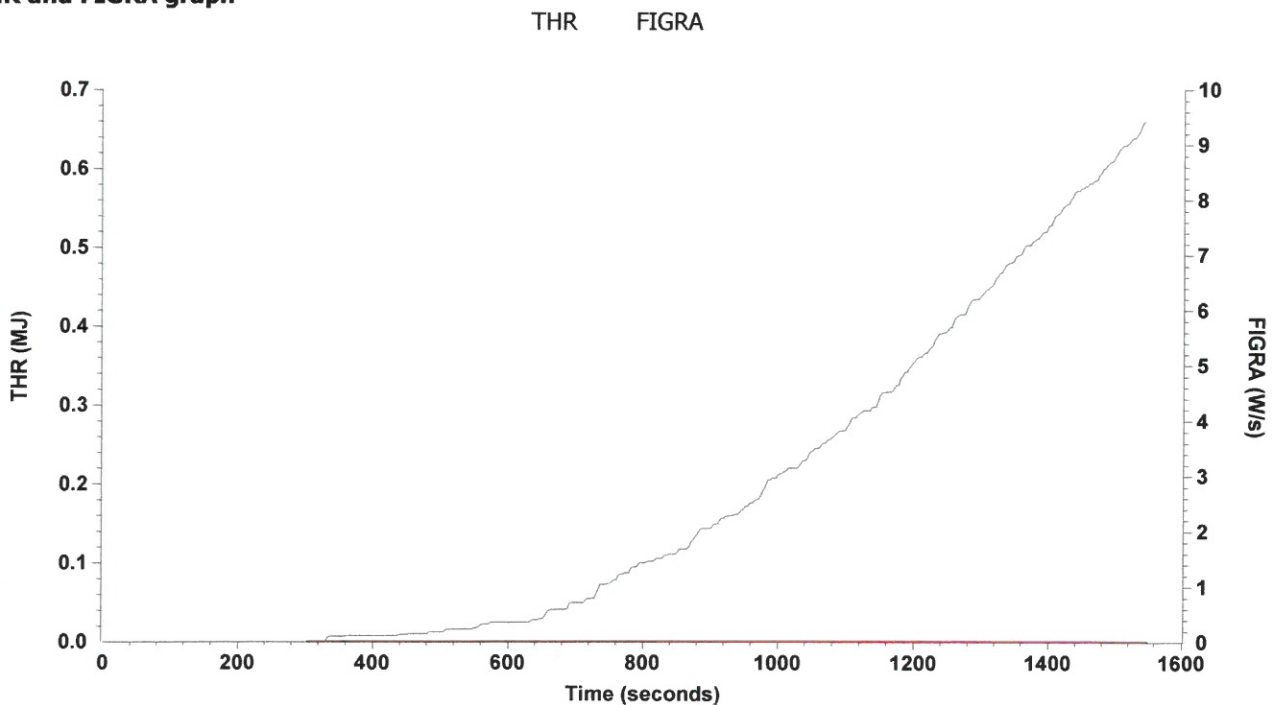
# SBI Test Report

Laboratory name LFF  
Operator João Rodrigues  
Filename C:\SBICALC\DATA\17010003.RW1  
Report identification 48/LFF/16/03  
Product identification Terra Opak 300 FR

## HRR and HRR(30) graph



## THR and FIGRA graph

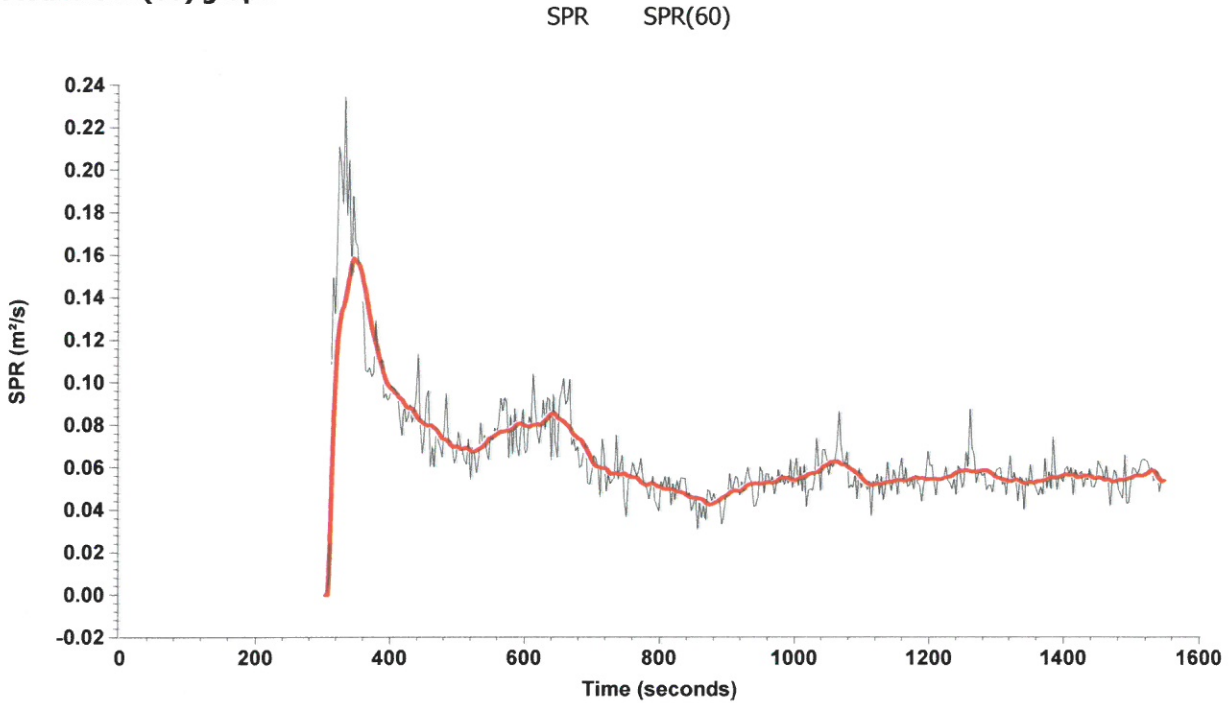


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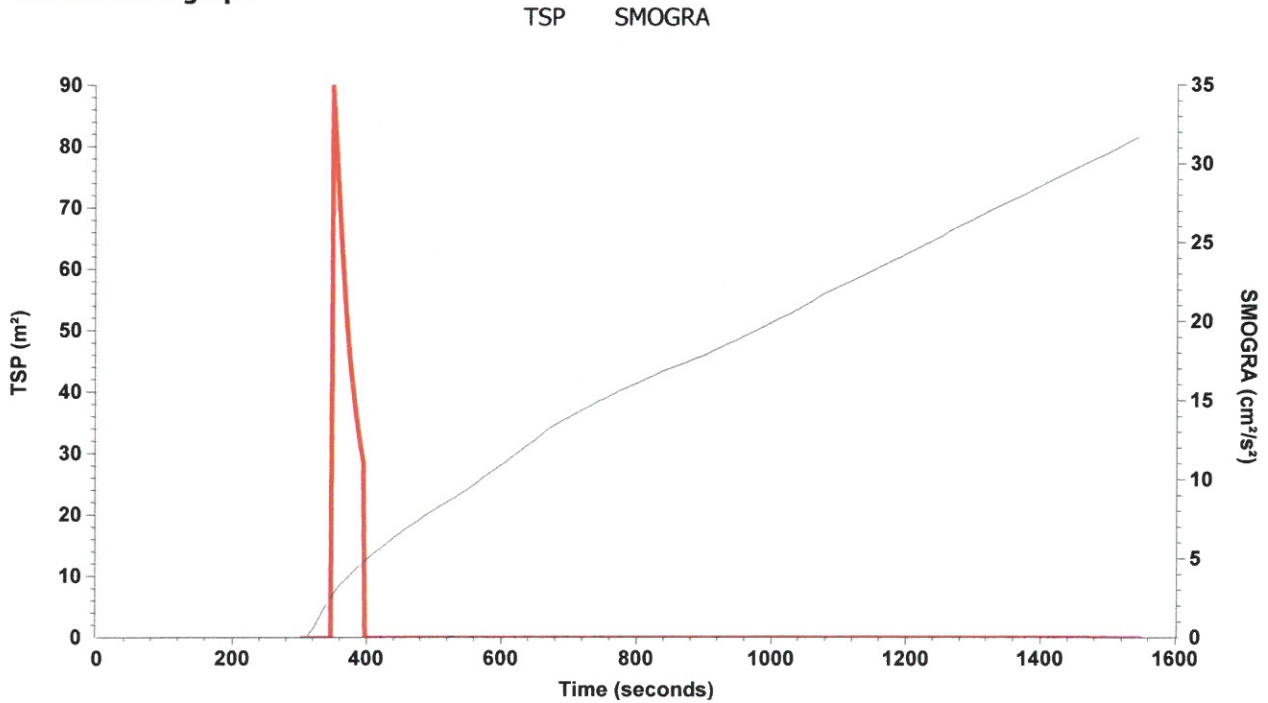
# SBI Test Report

Laboratory name LFF  
Operator João Rodrigues  
Filename C:\SBICALC\DATA\17010003.RW1  
Report identification 48/LFF/16/03  
Product identification Terra Opak 300 FR

## SPR and SPR(60) graph



## TSP and SMOGRA graph



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 be the sole criterion for assessing the potential fire hazard of the product in use.