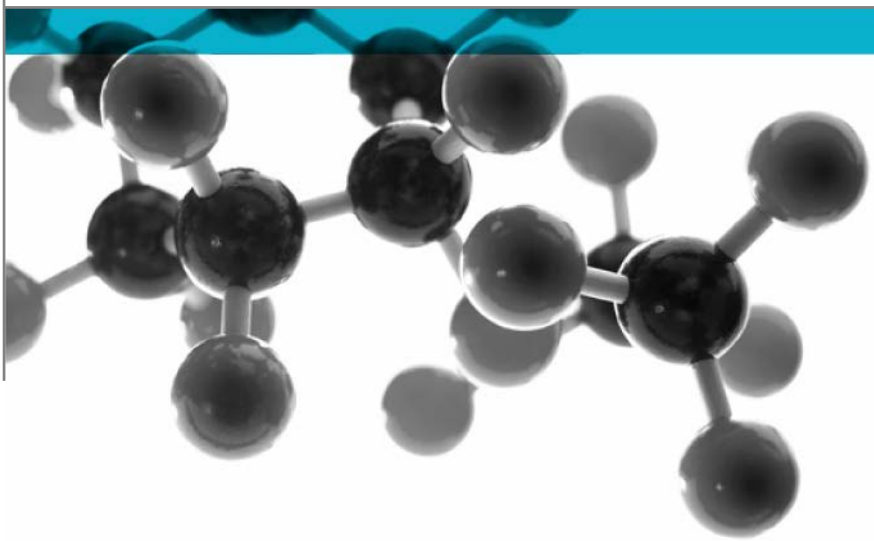
Warringtonfire
Holmesfield Road
Warrington
United Kingdom
T: +44 (0)1925 655116
W: www.warringtonfire.com

BS EN 13823:2010+A1:2014



Reaction to Fire Tests for Building Products - Building Products Excluding Floorings Exposed to the Thermal Attack by a Single Burning Item

A Report To: DSC Co., Ltd

Document Reference: 421663

Date: 6th April 2020

Issue No.: 1

Executive Summary

Objective To determine the fire performance of the following product when tested in accordance with BS EN 13823:2010+A1:2014.

Generic Description	Product reference	Thickness	Weight per unit area or density
Aluminum honeycomb panel(HIVE PANEL)	"Hive Panel"	4mm	3.11kg/m²
Individual components used to manufacture composite:			
Coating (test face)	Unwilling to provide	25 microns	4.75g/m²
Aluminium	Unwilling to provide	0.6mm	1.63kg/m²
Adhesive	Unwilling to provide	90 microns	90g/m²
Core	Unwilling to provide	3mm	27.3kg/m²
Primer	Unwilling to provide	5 microns	0.95g/m²
Substrate	"Earthwool RS45 Universal Insulation Slab"	25mm	50±20kg/m³
Please see page 6, 7 & 8 of this test report for the full description of the product tested			

Test Sponsor DSC CO., LTD, 217-6, Daeyullaechu-Gil, Bugi-Myeon, Cheongwon-Gu Cheongju-Si, Chungcheongbuk-Do, Korea 28137.

Test Results (average) :

FIGRA (w/s)		THR 600s (MJ)	SMOGRA (m²/s²)	TSP 600s (m²)
(0.2MJ)	(0.4MJ)	**3.54**	Recalculated	Recalculated
72.42	**71.46**		**3.52**	**31.52**

Lateral Flame Spread to End of Specimen? **None**
Fall of Flaming Drop/Particle? **None**
Flaming of Fallen Particle Exceeding 10s? **None**

Date of Test: 26th February 2020

Signatories

Responsible Officer K. Hughes * Senior Technical Officer	Authorised T. Deluce* Senior Technical Officer

* For and on behalf of Warringtonfire.

Report Issued: 6th April 2020

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Test Details

Purpose of test	To provide data which, in conjunction with data from other test methods, will enable building products excluding floorings, to be classified in accordance with the Classification requirements specified in BS EN 13501-1:2018. The test was performed in accordance with the procedure specified in BS EN 13823:2010+A1:2014 and this report should be read in conjunction with that standard.
Scope of test	To determine the reaction-to-fire performance of construction products, excluding floorings and excluding products which are indicated in the EC Decision 2000/147/EC, when exposed to thermal attack by a single burning item (SBI) utilising the test procedures defined in BS EN 13823:2010+A1:2014.
Fire test study group/EGOLF	Certain aspects of some fire test specifications are open to different interpretations. The Fire Test Study Group and EGOLF have identified a number of such areas and have agreed Resolutions which define common agreement of interpretations between fire test laboratories which are members of the Groups. Where such Resolutions are applicable to this test they have been followed.
Instruction to test	The test was conducted on the 26th February 2020 at the request of DSC Co., Ltd, the sponsor of the test.
Provision of test specimens	The specimens were supplied by the sponsor of the test. Warringtonfire was not involved in any selection or sampling procedure. Warringtonfire supplied the rockwool substrate.
Conditioning of specimens	The specimens were received on the 22nd January 2020 and were conditioned to constant mass at a temperature of 23 ± 2°C and a relative humidity of 50 ± 5% prior to testing.
Intended application	External cladding.
Test facility	The Single Burning Item (SBI) test facility at Warringtonfire is constructed in accordance with the specifications detailed in BS EN 13823: 2010+A1:2014.
Deviations from the test standard	None.
Exposed face	The decorative face of the specimens was exposed to the heating conditions of the test when the specimens were mounted in the test position.

Description of Test Specimens

Test specimens

The description of the system given below has been prepared from information provided by the sponsor of the test. This information has not been independently verified by Warringtonfire.
All values quoted are nominal, unless tolerances are given.

The test specimen comprised two walls (or wings) mounted into an aperture in a specimen trolley such that they formed a vertical 90° corner. The dimensions of the walls were as follows:

Short wall - 495 ± 5 mm long x 1500 ± 5 mm high
Long wall - 1000 ± 5 mm long x 1500 ± 5 mm high

Each wall (or wing) consisted of the following product:

General description		Aluminum honeycomb panel(HIVE PANEL)
Product reference of overall composite		"Hive Panel"
Name of manufacturer of overall composite		DSC Co.,Ltd
Overall thickness		4mm (stated by sponsor) 3.92mm (determined by Warringtonfire.)
Overall weight per unit area		3.11kg/m² (stated by sponsor) 3.21kg/m² (determined by Warringtonfire.)
Coating (test face)	Generic type	Polyvinylidene (PVDF) fluoride
	Product reference	**See Note 1 below**
	Name of manufacturer	PPG Korea
	Colour reference	"Fashion Grey"
	Number of coats	2
	Application thickness	25 microns
	Application rate	4.75g/m^2
	Specific gravity	1.3
	Application method	Roll coating
	Flame retardant details	**See Note 2 below**
	Curing process	Heat digestion 242°C
Aluminium	Generic type	Aluminium
	Product reference	**See Note 1 below**
	Detailed description / composition details	A3003-H18
	Name of manufacturer	Novelis
	Thickness	0.6mm
	Weight per unit area	1.63kg/m²
	Flame retardant details	This substrate is inherently flame retardant
Adhesive	Generic type	Polyethylene (PE) adhesive film
	Product reference	**See Note 1 below**
	Name of manufacturer	SHINKWANG HOTMELT Co.,Ltd
	Colour reference	"Transparency"
	Application thickness	90 microns
	Application rate	90g/m^2
	Application method	Hot press
	Flame retardant details	**See Note 2 below**
	Curing process	Heat digestion 160°C

Continued on next page

Core	Generic type	Aluminium honeycomb core
	Product reference	**See Note 1 below**
	Detailed description	A3104-H18
	Name of manufacturer	KOREA ALUMINUM CO.,LTD
	Thickness	3mm
	Density	9.1 kg/m^3
	Weight per unit area	27.3g/m^2
	Cell diameter	4.3mm
	Wall thickness	50 microns
	Colour reference	“Sliver”
	Flame retardant details	**See Note 2 below**
Adhesive	Generic type	Polyethylene (PE) film
	Product reference	**See Note 1 below**
	Name of manufacturer	SHINKWANG HOTMELT Co.,Ltd
	Colour reference	“Transparency”
	Application thickness	90 microns
	Application rate	90g/m^2
	Application method	Hot press
	Flame retardant details	**See Note 2 below**
	Curing process	Heat digestion 160°C
Aluminium	Generic type	Aluminium
	Product reference	**See Note 1 below**
	Detailed description	A3003-H18
	Name of manufacturer	Novelis
	Thickness	0.4mm
	Weight per unit area	1.09kg/m²
	Flame retardant details	This substrate is inherently flame retardant
Primer	Generic type	Epoxy primer coating
	Product reference	**See Note 1 below**
	Name of manufacturer	PPG KOREA
	Colour reference	“Light yellow”
	Number of coats	1
	Application thickness	5 microns
	Application rate	0.95g/m^2
	Specific gravity	1.3g
	Application method	Roll coating
	Curing process	Heat digestion 242°C
	Flame retardant details	**See Note 2 below**
Substrate	Product reference	“Earthwool RS45 Universal Insulation Slab”
	Generic type	Unfaced rockwool
	Name of supplier to Warringtonfire**.**	Knauf
	Thickness	25mm
	Density	50±20kg/m³
	Flame retardant details	The substrate is inherently flame retardant
Mounting and fixing details		The specimen was tested with a rockwool slab butted up against the reverse face of the specimen
Brief description of manufacturing process		Hot pressing process

Note 1: The sponsor was unwilling to provide this information.

Note 2: The sponsor of the test has confirmed that no flame retardant additives were utilised in the production of the component.

The specimen walls (or wings) were placed in the trolley in accordance with the requirements of section 5.3 of the Standard.

Photographs of the installed product are appended as Plates 1 and 2 in Appendix 1 of this report.

Each wing was retained in the trolley using mechanical clamps which pushed the wing against a lip at the top and bottom of the aperture in the trolley.

The trolley incorporated a triangular propane sand burner of side length 250mm, which was positioned in the base of the corner formed by the two wings of the test specimen, with a horizontal separation of 40mm between the edge of the burner and the lower edges of the wings. The burner is referred to as the primary burner and has an output of 30kW. A secondary propane sand burner was attached to the fixed frame, beneath the hood but at the furthest possible distance from the specimen when the trolley was in place. The purpose of this burner is to obtain base line data without affecting the assembled specimen. The trolley incorporated a grill in its base and this was the sole source of ventilation for the test enclosure whilst the test was in progress.

Test Results

Results and observations

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.

The test results relate only to the specimens of the product in the form in which they were tested. Small differences in the composition or thickness of the product may significantly affect the performance during the test and may therefore invalidate the test results. Care should be taken to ensure that any product which is supplied or used is fully represented by the specimens which were tested.

A total of three specimens were tested. The results obtained, relevant to the 'Euroclassification' of Building Products are given in Table 1.

Observations made during the test and comments on any difficulties encountered during the test are given in Table 2.

Table 1

Parameter	Result			
	Specimen 1	Specimen 2	Specimen 3	Mean
FIGRA (W/s) (*THR(t) threshold of 0.2MJ*)	104.33	55.97	56.97	72.42
FIGRA (W/S) *(THR(t) threshold of 0.4MJ)*	104.33	55.97	54.09	71.46
THR 600s (MJ)	3.53	2.58	4.50	3.54
SMOGRA (m^2/s^2) (Recalculated results)	0.00	6.93	3.64	3.52
TSP 600s (m^2) (Recalculated results)	14.34	32.36	47.85	31.52
Lateral Flame Spread to End of Specimen?	None	None	None	-
Fall of Flaming Drop/Particle?	None	None	None	-
Flaming of Fallen Particle Exceeding 10s?	None	None	None	-

Curves of time averaged rate of heat release contribution of the specimen (HRRav(t)), cumulative heat release (THR(t)), and Fire Growth Rate (FIGRA) are appended as Figures 1 to 3. Curves of time averaged rate of smoke production (SPRav(t)), cumulative smoke production (TSP(t)) and smoke growth rate (SMOGRA) are appended as Figures 4 to 6 in appendix 2 of this report.

Interpretation of the test results given above in the context of Euroclassification of building products should be carried out using BS EN 13501–1:2018.

The determination of the uncertainty of measurement of FIGRA, THR_{600s}, SMOGRA and TSP_{600s} is an ongoing topic within CEN. PD CEN/TR 16988: 2016 provides the latest work of the CEN committee tasked with working on this matter. Until this work is finalised the measurement of uncertainty is not reported.

Table 2

Time		Observations during test of Specimen 1
min	Sec	
00	00	Pre-checks performed on analysers
02	00	Auxiliary burner switched on to check correct burner operating conditions
05	00	Gas flow switched from auxiliary burner to main burner & test flames impinge on specimen
05	06	Discolouration of the surface of the product occurred in the region of the burner.
05	45	The coating on the surface of the product began to delaminate in the region of the burner.
06	06	The coating on the surface of the product began to flame in the region of the burner.
06	51	The coating on the surface of the product began to warp in the region of the burner.
26	00	End of test conditions. Flaming continued to the end of the test.

Time		Observations during test of Specimen 2
min	Sec	
00	00	Pre-checks performed on analysers
02	00	Auxiliary burner switched on to check correct burner operating conditions
05	00	Gas flow switched from auxiliary burner to main burner & test flames impinge on specimen
05	06	Discolouration of the surface of the product occurred in the region of the burner.
05	45	The coating on the surface of the product began to delaminate in the region of the burner.
06	00	The coating on the surface of the product began to flame in the region of the burner.
07	00	The coating on the surface of the product began to warp in the region of the burner.
26	00	End of test conditions. Flaming continued to the end of the test.

Time		Observations during test of Specimen 3
min	Sec	
00	00	Pre-checks performed on analysers
02	00	Auxiliary burner switched on to check correct burner operating conditions
05	00	Gas flow switched from auxiliary burner to main burner & test flames impinge on specimen
05	06	Discolouration of the surface of the product occurred in the region of the burner.
05	45	The coating on the surface of the product began to delaminate in the region of the burner.
06	00	The coating on the surface of the product began to flame in the region of the burner.
06	51	The coating on the surface of the product began to warp in the region of the burner.
26	00	End of test conditions. Flaming continued to the end of the test.

Note: Impingement of the burner flame onto all three specimens commenced at 5 minutes.

Validity

The specification and interpretation of fire test methods is the subject of ongoing development and refinement. Changes in associated legislation may also occur. For these reasons it is recommended that the relevance of test reports over five years old should be considered by the user. The laboratory that issued the report will be able to offer, on behalf of the legal owner, a review of the procedures adopted for a particular test to ensure that they are consistent with current practices, and if required may endorse the test report.

Appendix 1

Photographs

Plate 1: Total View of the exposed surface of the long wing.

Plate 2: Close up view of the vertical outer edge of the long wing at a height of 500mm

Appendix 2

Graphs

Figure 1. $HRR_{av}(t)$ (kW)

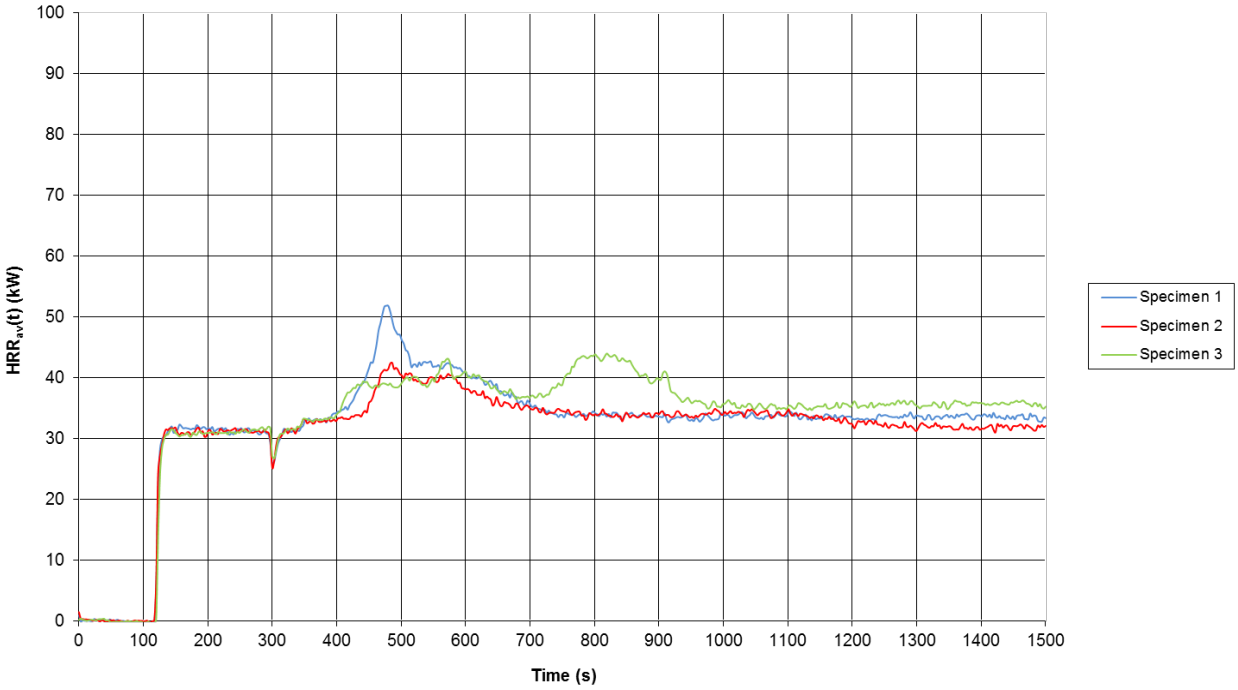


Figure 2. THR(t) (MJ)

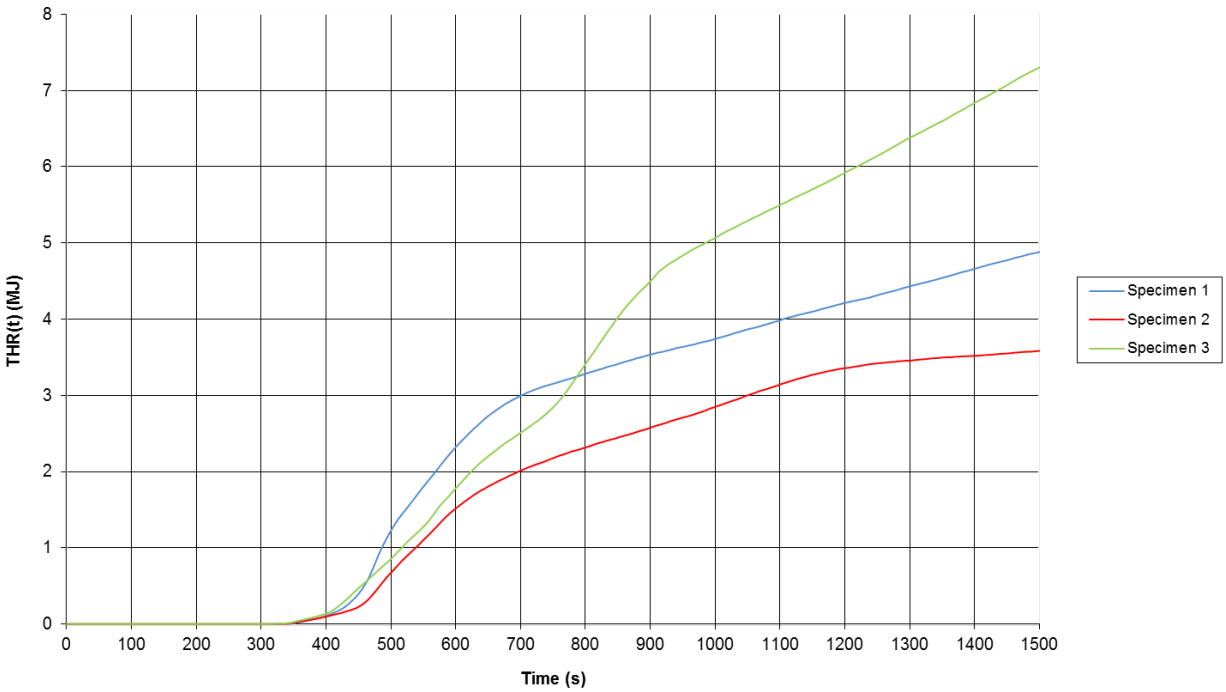


Figure 3. FIGRA

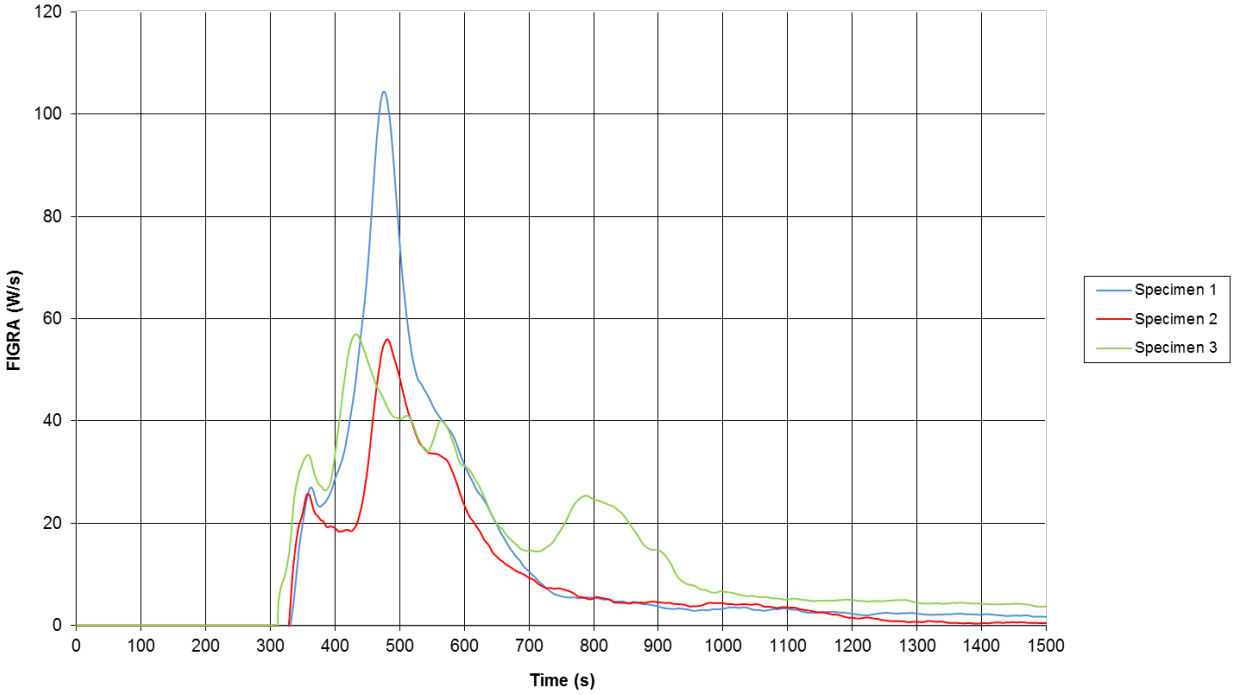


Figure 4. $SPR_{av}(t)$ (m^2/s)

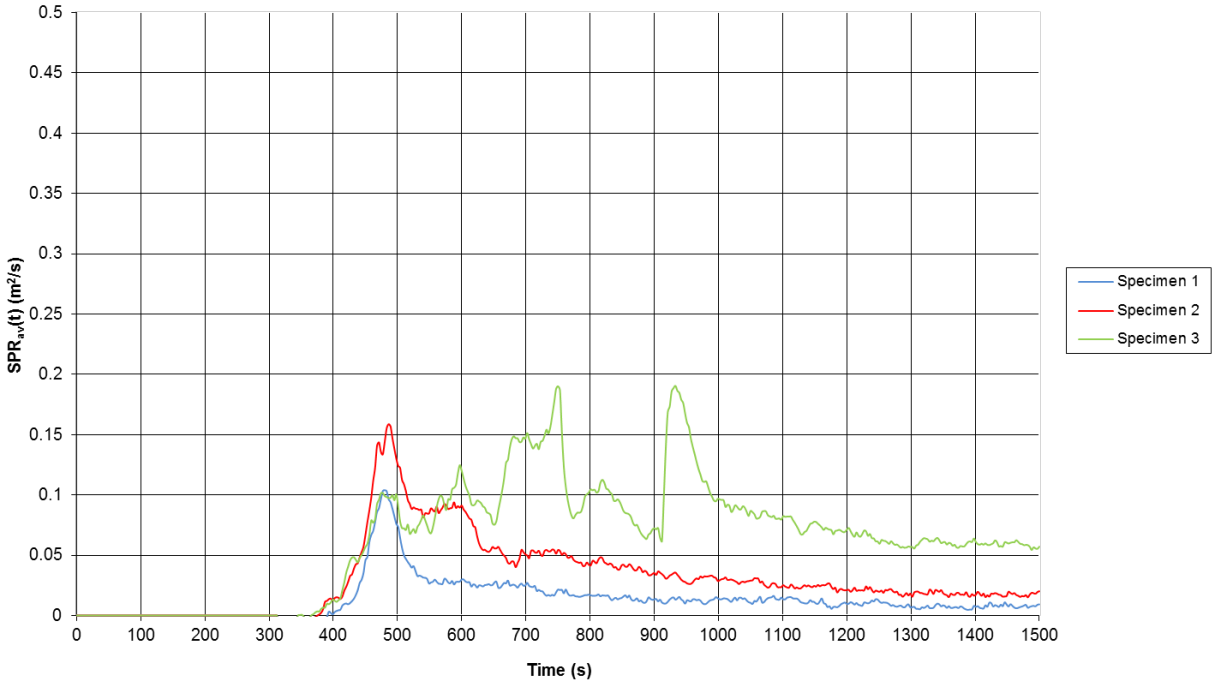


Figure 5. TSP(t) (m^2)

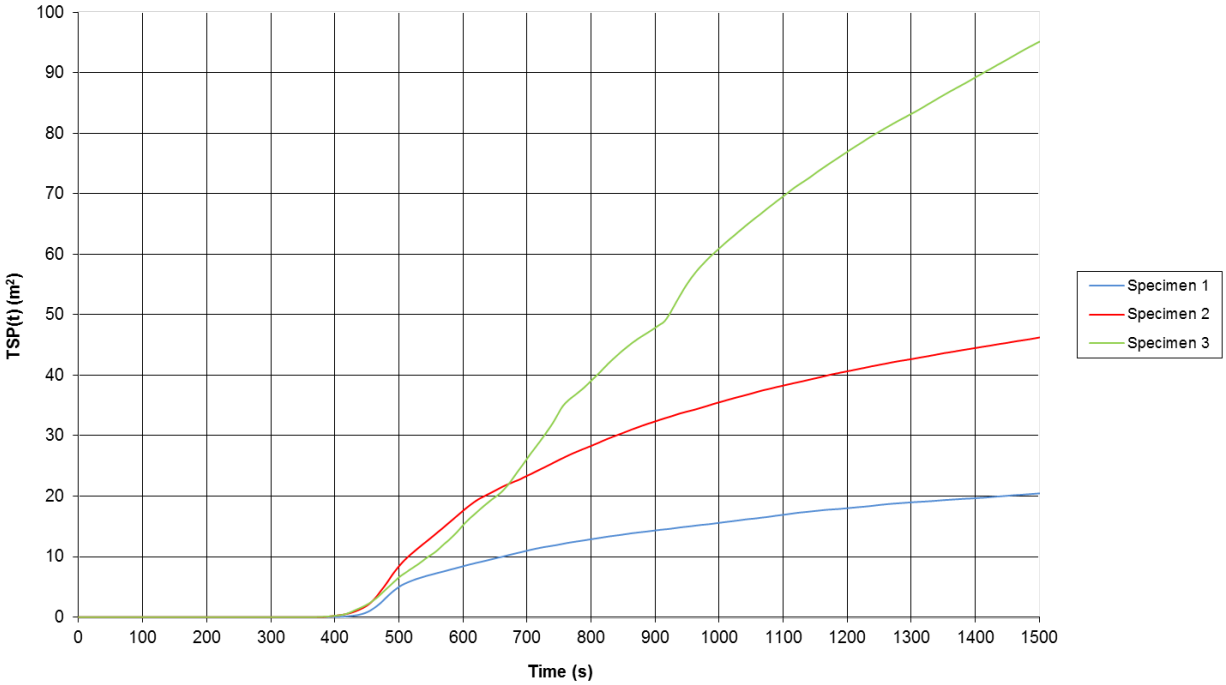
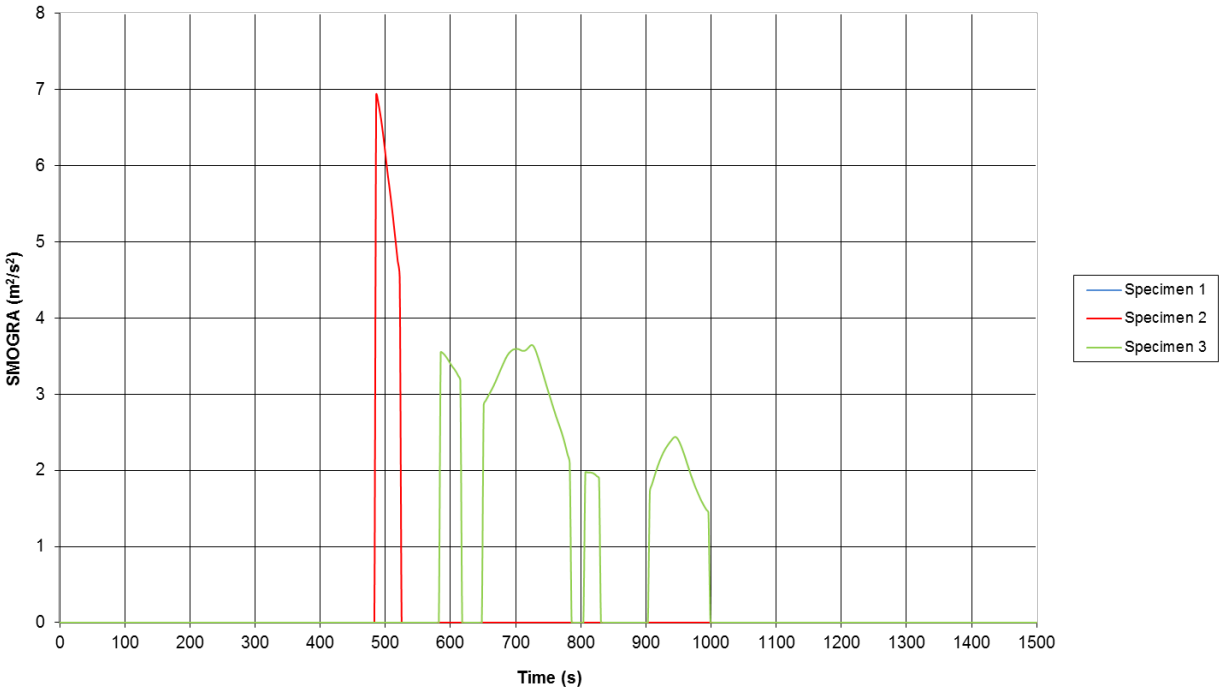


Figure 6. SMOGRA Graph.



Revision History

Issue No :	Re-issue Date:
Revised By:	Authorised By:
Reason for Revision:	

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