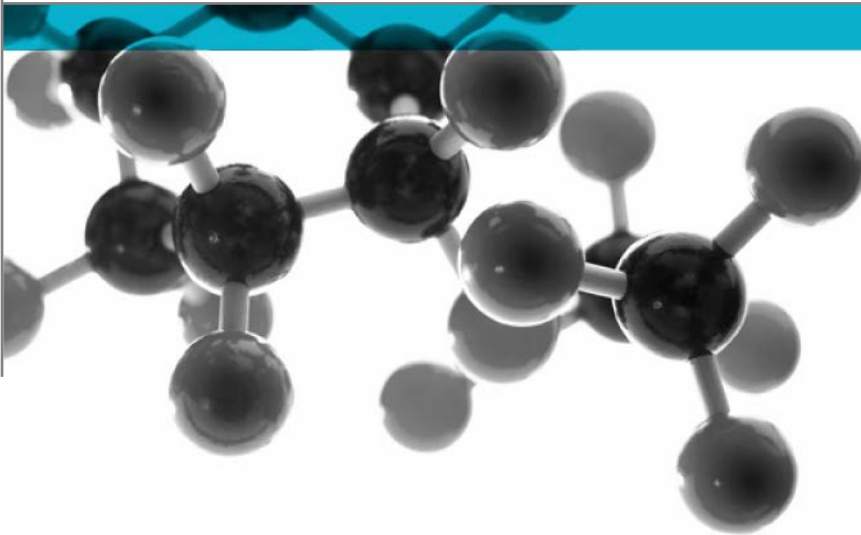


# BS EN ISO 4589-2: 2017



## Determination of Burning Behaviour By Oxygen Index

A Report To: Smyth Composites Ltd

Document Reference: 422295

Date: 21<sup>st</sup> January 2020

Issue No.: 1

Page 1



## Executive Summary

**Objective** To determine the oxygen index of the following product when tested in accordance with BS EN ISO 4589-2: 2017

Generic Description	Product reference	Thickness	Weight per unit area
Coated fibre reinforced phenolic resin sheet	"Phenclad"	3.5mm	3.4kg/m <sup>2</sup>
<b>Individual components used to manufacture composite:</b>			
Coating	"AE 265/8"	Unable to provide	Unable to provide
Moulded sheet	Phenolic resin	"Cellobond"	Not applicable
	Fibre reinforcement	"Dong Yu"	Not applicable
<b>Please see pages 5, 6 &amp; 7 of this test report for the full description of the product tested</b>			


**Test Sponsor** Smyth Composites Ltd, Panmure Industrial Estate, Carnoustie, Angus, DD7 7NP


**Test Results:** When tested in accordance with the procedure specified in BS EN ISO 4589 - 2: 2017 the material shows an oxygen index of 57.7 ±0.54%

The reported uncertainty is defined in ISO 4589-2: 2017 clause 9.4.2. The uncertainty reported is in accordance with UKAS requirements.

**Date of Test** 12<sup>th</sup> December 2019

## Signatories


Responsible Officer T. Kinder * Senior Technical Officer


Authorised T. Mort * Senior Technical Officer

\* For and on behalf of [Warringtonfire](#).


Report Issued: 21<sup>st</sup> January 2020

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## Test Details

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<b>Purpose of test</b>	<p>To assess the performance of a material when it is tested in accordance with BS EN ISO 4589 - 2: 2017 "Plastics - Determination of burning behaviour by oxygen index".</p> <p>The test was performed in accordance with the procedure specified in BS EN ISO 4589-2:2017 - Plastics - Determination of burning behaviour by oxygen index, and this report should be read in conjunction with that BS EN ISO Standard.</p>
<b>Scope of test</b>	<p>BS EN ISO 4589 – 2: 2017 specifies test methods for determining the minimum concentration of oxygen, in a mixture with nitrogen that will support combustion of small vertical test specimens under specified test conditions. The results are defined as oxygen index values.</p>
<b>Instruction to test</b>	<p>The test was conducted on the 12<sup>th</sup> December 2019 at the request of Smyth Composites Ltd, the sponsor of the test.</p>
<b>Provision of test specimens</b>	<p>The specimens were supplied by the sponsor of the test. Warringtonfire was not involved in any selection or sampling procedure.</p>
<b>Conditioning of specimens</b>	<p>The specimens were received on the 2<sup>nd</sup> December 2019.</p> <p>Prior to test the specimens were conditioned to equilibrium with air at <math>23 \pm 2^{\circ}\text{C}</math> and a relative humidity of <math>50 \pm 5</math> per cent for at least 88 hours.</p>
<b>Condition of specimen edges</b>	<p>Homogeneous product</p>
<b>Photograph of specimen</b>	
<b>Method of testing</b>	<p>Specimens measuring nominally 150mm long by 10mm wide by 3.54mm thick were used. The thickness of the specimens used conforms with the requirements specified in Table 2 of the standard for test specimen Form III for sheet materials "as received". The specimens were tested in accordance with the test procedure specified in Clause 8 of the Standard using the Concept Equipment Limiting Oxygen Index apparatus.</p>
<b>Ignition procedure</b>	<p>Ignition procedure A - top surface ignition, was used to initiate burning on the top surface of the upper end of the specimen.</p>

## Description of Test Specimens

The description of the specimens 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.

General description		Coated fibre reinforced phenolic resin sheet	
Product reference		"Phenclad"	
Name of manufacturer		Smyth Composites	
Colour		"White"	
Thickness		3.5mm (stated by sponsor) 3.83mm (determined by <a href="#">Warringtonfire</a> )	
Weight per unit area		3.4kg/m <sup>2</sup> (stated by sponsor) 4.77kg/m <sup>2</sup> (determined by <a href="#">Warringtonfire</a> )	
Coating	Generic type	2 pack polyurethane	
	Product reference	"AE 265/8"	
	Name of manufacturer	"Trimite"	
	Number of layers	<b>See Note 1 Below</b>	
	Specific gravity	<b>See Note 1 Below</b>	
	Application method	Spray	
	Colour reference	"Ral 9010" "White" (observed by <a href="#">Warringtonfire</a> )	
	Flame retardant details	<b>See Note 1 Below</b>	
Moulded sheet	Resin	Generic type	Phenolic
		Product reference	"Cellobond"
		Name of manufacturer	Hexion
		Specific gravity/density	<b>See Note 1 Below</b>
		Flame retardant details	<b>See Note 2 Below</b>
	Glass reinforcement	Generic type	Powder bound chopped strand matt
		Product reference	"Dong Yu"
		Number of layers	2
		Weight per unit area of each layer	600g/m <sup>2</sup>
		Configuration of glass reinforcement	<b>See Note 1 Below</b>
		Name of manufacturer	Dong Yu
	Resin to glass ratio (by weight)		2.7:1
	Percentage glass reinforcement (by weight)		27%
	Curing process (duration and temperature)		2 hours at 90°C
	Brief description of manufacturing process		Hand lay

**Note 1: The sponsor of the test was unable to provide this information.**

**Note 2: The sponsor of the test has confirmed that no flame retardants were used in the production of this component.**

## Test Results

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### Applicability of test results

The test results relate only to the behaviour of the specimens under the particular conditions of this test, they should not be used to infer the fire hazards of the material in other forms or under other fire conditions.

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.

In accordance with Sections 8 and 9 of the Standard, the results obtained are given in appendix A.

### Conclusion

**When tested in accordance with the procedure specified in BS EN ISO 4589 - 2: 2017 the material shows an oxygen index of  $57.7 \pm 0.54\%$**

**The reported uncertainty is defined in ISO 4589-2: 2017 clause 9.4.2. The uncertainty reported is in accordance with UKAS requirements.**

### Validity

The specification and interpretation of fire test methods are 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. Where this report is used to confirm compliance for use on European rolling stock as per the Technical Specification for Interoperability (LOC&PAS TSI (Commission Regulation (EU) No. 1302/2014)), all tests must have been conducted within the last 5 years or the test reports must have been reviewed within the last five years. 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.

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## Appendix A

### MATERIAL TESTED

#### Part 1 - Preliminary oxygen concentration

Oxygen Concentration (%)	30.0	40.0	50.0	55.0	60.0	58.0	56.0	57.0
Burning Period (s)	0	1.0	11.0	31.0	>180	>180	10.0	18.0
Length Burnt (mm)	0	<10	<10	<10	20	20	<10	<10
Response ('X' or 'O')	O	O	O	O	X	X	O	O

#### Part 2 - Determination of the oxygen index value

N <sub>T</sub> series measurements											
N <sub>L</sub> series measurements (8.6.1 & 8.6.2)						(8.6.3)					C <sub>f</sub>
Oxygen Concentration (%)	57.0	57.2	57.4	57.6	57.8		57.8	57.6	57.8	57.6	57.8
Burning Period (s)	18.0	28.5	14.5	16.0	>180		>180	20.0	>180	16.0	>180
Length Burnt (mm)	<10	<10	<10	<10	20		20	<10	20	<10	20
Response ("X" or "O")	O	O	O	O	X		X	O	X	O	X
Column (2,3,4 or 5)	5						Row (1 to 16)		6		
k value from table 4	-0.45										

Hence k = -0.45

Oxygen index value OI = C<sub>F</sub> + kd  
d is oxygen concentration increment

$$OI = 57.8 + (-0.45 \times 0.2)$$

Oxygen index value = 57.7 (to one decimal place for reporting)

= 57.71 (to two decimal places, for calculation of and verification of *d* as required in Part 3)

Standard Deviation = 0.11 Therefore, the test result is valid.

#### Part 3 – Burning characteristics of the material

No relevant ancillary characteristics or behaviour such as, charring, dripping, severe shrinkage, erratic burning, or after-glow were observed during the test.

## Revision History

Issue No :	Issue Date:
Revised By:	Approved By:
Reason for Revision:	

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