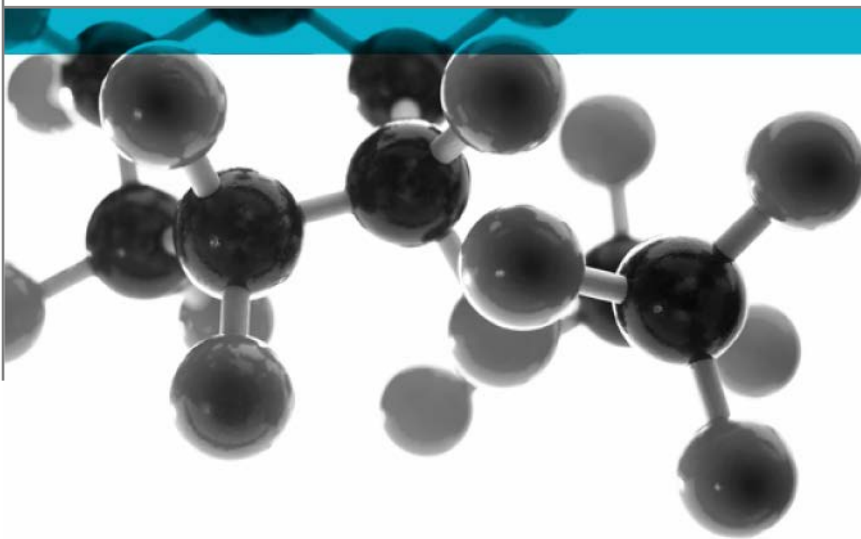


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# BS 6853: 1999: Annex D.8.4 (Withdrawn) / LUL S1085: 2015: Attachment B.6



## Methods For Measuring Smoke Density – Panel Test

A Report To: Mapei UK Ltd

Document Reference: 403272

Date: 20th September 2018

Issue No.: 1

Page 1

Testing  
Advising  
Assuring



## Executive Summary

**Objective** To determine the smoke density of the following product when tested in accordance with BS 6853: 1999 incorporating amendment No. 1 Annex D.8.4 (Withdrawn) / LUL S1085: 2015: Attachment B.6.

Generic Description	Product reference	Thickness or application rate	Weight per unit area or density
Coating system applied to calcium silicate based board	None assigned	14.98mm*	14.97kg/m <sup>2</sup> *
<b>Individual components used to manufacture composite:</b>			
Top coating	"Mapecoat ACT 196"	2 x 0.15kg/m <sup>2</sup>	1.2g/cm <sup>2</sup>
Mesh	"Mapetherm Net"	1mm	160g/m <sup>2</sup>
Coating	"Planitop 210"	3mm	1310kg/m <sup>3</sup>
Primer	"Malech"	0.1kg/m <sup>2</sup>	1.01g/cm <sup>3</sup>
Substrate	"Promat – Brandschultzbauplatten; Promatect-H"	12mm	870kg/m <sup>3</sup>
<b>Please see pages 5 &amp; 6 of this test report for the full description of the product tested</b>			



**Test Sponsor** Mapei UK Ltd, Mapei House, Steel Park Road, Halesowen, West Midlands, B62 8HD

### Test Results:

	Specimen No. 1	Specimen No. 2	Average
A <sub>0</sub> (ON)	0.940	1.01	0.975
A <sub>0</sub> (OFF)	1.35	1.44	1.40

**Date of Test** 23<sup>rd</sup> August 2018

## Signatories

	
Responsible Officer T. Kinder * Senior Technical Officer	Authorised S. Deeming * Business Unit Head

\* For and on behalf of **Exova Warringtonfire**.

Report Issued: 20th September 2018

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 Author: T. Kinder  
 Client: Mapei UK Ltd

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## Test Details

<b>Purpose of test</b>	<p>To determine the performance of a specimen when it is subjected to the conditions of test specified in BS 6853: 1999, Incorporating Amendment No.1, "Code of practice for fire precautions in the design and construction of passenger carrying trains" Annex D.8.4 (Withdrawn) / LUL S1085: 2015: Attachment B.6 "Panel test".</p> <p>The test was performed in accordance with the procedure specified in BS 6853: 1999 Annex D, Incorporating Amendment No. 1, Clause D.8.4 (Withdrawn) / LUL S1085: 2015: Attachment B.6 and this report should be read in conjunction with that Standard.</p>
<b>Scope of test</b>	<p>BS 6853: 1999, Incorporating Amendment No.1, Annex D.8.4 (Withdrawn) / LUL S1085: 2015: Attachment B.6 details a test procedure, the results being expressed as <math>A_O</math> (ON) and <math>A_O</math> (OFF) values, for the measurement of the density of smoke emitted from a panel burning under the defined conditions of test. The results are used to determine compliance with the criteria given in BS 6853: 1999 Incorporating amendment No. 1 Tables 2, 3, 5, 6 &amp; 10 (Withdrawn) and LUL S1085: 2015: Table 2.</p> <p>The requirements specified in these tables are detailed in Appendix 2.</p>
<b>Instruction to test</b>	<p>The test was conducted on the 23<sup>rd</sup> August 2018 at the request of Mapei UK Ltd, the sponsor of the test.</p>
<b>Provision of test specimens</b>	<p>The specimens were supplied by the sponsor of the test. <b>Exova Warringtonfire</b> was not involved in any selection or sampling procedure.</p>
<b>Conditioning of specimens</b>	<p>The specimens were received on the 7<sup>th</sup> August 2018.</p> <p>The test specimens were conditioned by maintaining them in indoor ambient conditions for 72 hours and then for a minimum of 16 hours at <math>23 \pm 2^\circ\text{C}</math> and a relative humidity of <math>50 \pm 5\%</math>.</p>
<b>Exposed face</b>	<p>The coated face of the specimens was exposed to the flame. Restraining clips were used to prevent excessive movement of the test specimen.</p>
<b>Ignition source</b>	<p>Fire source No 1, alcohol, as detailed in LUL S1085: 2015: clause B.3.1 was used.</p>

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## 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 **Exova Warringtonfire**. All values quoted are nominal, unless tolerances are given.

General description		Coating system applied to calcium silicate based board
Name of manufacturer		Mapei
Overall thickness		14.98mm (determined by <b>Exova Warringtonfire</b> )
Overall weight per unit area		14.97kg/m <sup>2</sup> (determined by <b>Exova Warringtonfire</b> )
Top coating	Generic type	Acrylic based paint
	Product reference	"Mapecoat ACT 196"
	Name of manufacturer	Mapei
	Colour reference	"White"
	Number of coats	Two
	Application rate per coat	0.15kg/m <sup>2</sup>
	Weight per unit area	1.2g/cm <sup>2</sup>
	Application method	Roller or brush
	Curing process per coat	24 hours touch dry
	Flame retardant details	<b>See Note 1 below</b>
Mesh	Generic type	Reinforcing mesh
	Product reference	"Mapetherm Net"
	Name of manufacturer	Mapei
	Colour reference	"White"
	Number of layers	1
	Thickness	1mm
	Cell dimensions	4mm x 4mm
	Weight per unit area	160g/m <sup>2</sup>
Flame retardant details	The component is inherently flame retardant	
Coating	Generic type	Cement render
	Product reference	"Planitop 210"
	Name of manufacturer	Mapei
	Colour reference	"White"
	Number of coats	One
	Application thickness	3mm
	Density	1310kg/m <sup>3</sup>
	Application method	Trowel
	Curing process per coat	24 hours touch dry
Flame retardant details	<b>See Note 1 below</b>	
Primer	Generic type	Acrylic primer
	Product reference	"Malech"
	Name of manufacturer	Mapei
	Colour reference	"Clear"
	Number of coats	One
	Application rate	0.1kg/m <sup>2</sup>
	Density	1.01g/cm <sup>3</sup>
	Application method	Trowel
	Curing process per coat	24hrs touch dry
Flame retardant details	<b>See Note 1 below</b>	

Continued on next page

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Substrate	Product reference	"Promat – Brandschutzbauplatten; Promatect-H"
	Generic type	Calcium Silicate based board
	Name of manufacturer	Promat
	Thickness	12mm
	Density	870kg/m <sup>3</sup>
	Flame retardant details	The substrate is inherently flame retardant
Brief description of manufacturing process		Net is applied into wet basecoat material.

**Note 1. The sponsor of the test has confirmed that no flame retardant additives were utilised in the production of the component.**

## Test Results

### Applicability of test results

The test results relate only to the behaviour of the test specimens of the product under the particular conditions of 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.

### Test results

	Specimen No. 1	Specimen No. 2	Average
A <sub>0</sub> (ON)	0.940	1.01	0.975
A <sub>0</sub> (OFF)	1.35	1.44	1.40

Standard Deviation

A<sub>0</sub> (ON) = 0.0495

A<sub>0</sub> (OFF) = 0.0636

Visual observations made during the test are given in Appendix 1.

The changes in A<sub>0</sub> with time and % transmittance with time were continuously recorded and graphs are presented in Figures 1 and 2.

### 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. 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 1

### Observations during test of Specimen 1

- 00:01 Ignition of fire source, test commenced.
- 02:47 The surface of the specimen began to char and blister.
- 10:00 No change, the fire source continued to flame.
- 20:00 No change, the fire source continued to flame.
- 23:46 Fire source consumed. All flaming ceased.
- 40:00 Test terminated.

### Observations during test of Specimen 2

- 00:01 Ignition of fire source, test commenced.
- 02:52 The surface of the specimen began to char and blister.
- 10:00 No change, the fire source continued to flame.
- 20:00 No change, the fire source continued to flame.
- 23:39 Fire source consumed. All flaming ceased.
- 40:00 Test terminated.



## Appendix 2

**Table 2 of BS 6853:1999 (Withdrawn) – Interior Vertical Surfaces**

Test	Parameter	Pass / Fail Criteria		
		Vehicle Cat 1a	Vehicle Cat 1b	Vehicle Cat 2
BS 476: Part 6	Index I1 (max) Index I (max)	6 (VL surfaces: nc) 12 (VL surfaces: nc)	6 (VL surfaces: nc) 12 (VL surfaces: nc)	nc nc
BS 476: Part 7	Worst permissible Class	Class 1 (VL surfaces Class 2)	Class 1 (VL surfaces Class 2)	Class 1 (VL surfaces Class 2)
Annex D Panel Smoke test	A <sub>0</sub> (ON)	2.6	4.2	9.4
	A <sub>0</sub> (OFF)	3.9	6.3	14
Annex B Toxicity test	R (max)	1.0	1.6	3.6

Nc: no criterion, Note, values of A<sub>0</sub> are maxima

**Table 3 of BS 6853:1999 (Withdrawn) – Interior Horizontal Prone Surfaces**

Test	Parameter	Pass / Fail Criteria		
		Vehicle Cat 1a	Vehicle Cat 1b	Vehicle Cat 2
BS 476: Part 6	Index I1 (max) Index I (max)	6 (HPL surfaces: nc) 12 (HPL surfaces: nc)	6 (HPL surfaces: nc) 12 (HPL surfaces: nc)	nc nc
BS 476: Part 7	Worst permissible Class	Class 1 0mm <sup>a</sup> (HPL surfaces Class 1)	Class 1	Class 1
Annex D Panel Smoke test	A <sub>0</sub> (ON)	2.6	4.2	9.4
	A <sub>0</sub> (OFF)	3.9	6.3	14
Annex B Toxicity test	R (max)	1.0	1.6	3.6

Nc: no criterion, <sup>a</sup> No spread of flame, Note, values of A<sub>0</sub> are maxima

**Table 5 of BS 6853:1999 (Withdrawn) Exterior Vertical Surfaces**

Test	Parameter	Pass / Fail Criteria		
		Vehicle Cat 1a	Vehicle Cat 1b	Vehicle Cat 2
BS 476: Part 7	Worst permissible Class	Class 1 (VL surfaces Class 2)	Class 1 (VL surfaces Class 2)	Class 2
Annex D Panel Smoke test	A <sub>0</sub> (ON)	4.4	7.0	nc
	A <sub>0</sub> (OFF)	6.6	10.5	nc
Annex B Toxicity test	R (max)	1.7	2.7	nc

Nc: no criterion, Note, values of A<sub>0</sub> are maxima

**Table 6 of BS 6853:1999 (Withdrawn) Exterior Horizontal Prone Surfaces**

Test	Parameter	Pass / Fail Criteria		
		Vehicle Cat 1a	Vehicle Cat 1b	Vehicle Cat 2
BS 476: Part 7	Worst permissible Class	Class 1, 0mm <sup>a</sup> (HPL surfaces Class 1)	Class 1 (HPL surfaces Class 2)	Class 1 (HPL surfaces Class 2)
Annex D Panel Smoke test	A <sub>0</sub> (ON) A <sub>0</sub> (OFF)	4.4 6.6	7.0 10.5	nc nc
Annex B Toxicity test	R (max)	1.7	2.7	nc

Nc: no criterion, <sup>a</sup> No spread of flame

**Table 10 of BS 6853:1999 (Withdrawn) Seat Shell (Back and Base)**

Test	Parameter	Pass / Fail Criteria		
		Vehicle Cat 1a	Vehicle Cat 1b	Vehicle Cat 2
BS 476: Part 6	Index I1 (max) Index I (max)	6 (VL and HPL surfaces: nc) 12 (VL and HPL surfaces: nc)	6 (VL and HPL surfaces: nc) 12 (VL and HPL surfaces: nc)	nc nc
BS 476: Part 7	Worst permissible Class	Class 1 (VL and HPL surfaces Class 2)	Class 1 (VL and HPL surfaces Class 2)	Class 1 (VL and HPL surfaces Class 2)
Annex D Panel Smoke test	A <sub>0</sub> (ON) A <sub>0</sub> (OFF)	2.6 3.9	4.2 6.3	9.4 14.0
Annex B Toxicity test	R (max)	1.0	1.6	3.6

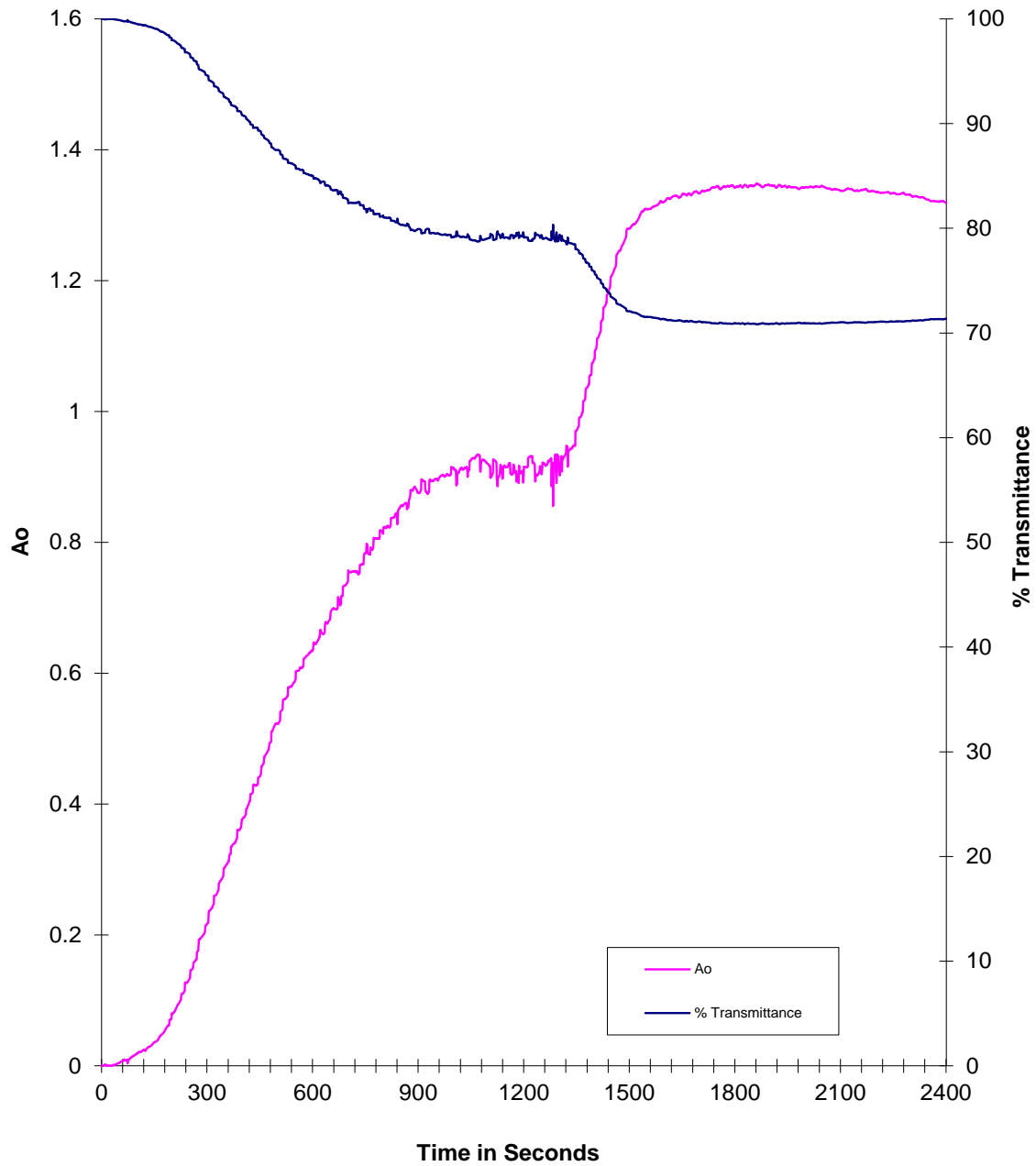
Nc: no criterion,  
NOTE Values of A<sub>0</sub> are maxima

**Table 2 of LUL S1085: 2015: – Smoke emission requirements for all vertical and ceiling surfaces**

Location	Test method	Requirement
Option 1		
Vertical and ceiling surfaces in tunnels	S1085: 2015: Attachment B.6	A <sub>0</sub> (ON) < 2.4 m <sup>2</sup> /burn area A <sub>0</sub> (OFF) < 3.6 m <sup>2</sup> /burn area
Vertical and ceiling surfaces in stations	S1085: 2015: Attachment B.6	A <sub>0</sub> (ON) < 3.6 m <sup>2</sup> /burn area A <sub>0</sub> (OFF) < 5.4 m <sup>2</sup> /burn area
Option 2		
Vertical and ceiling surfaces in stations	EN ISO 5659-2: 50 kWm <sup>-2</sup> , without pilot flame	a) D <sub>s</sub> maximum, dimensionless, ≤150  b) VOF4 minutes ≤ 300

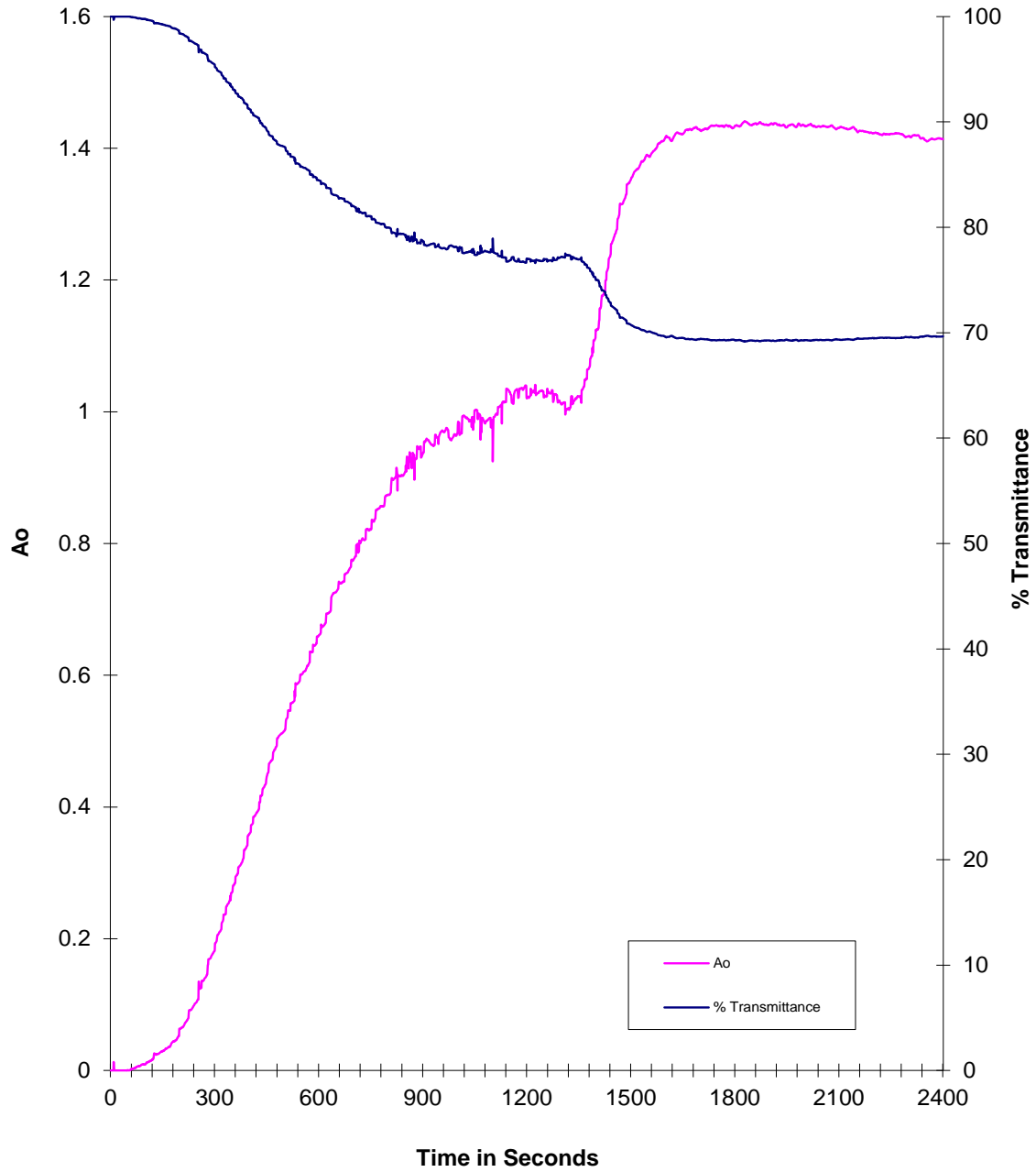
**Figure 1**

**EWF No: 403272 - Specimen No: 1**  
**Ao v Time and % Transmittance v Time**



**Figure 2**

**EWF No: 403272 - Specimen No: 2**  
**Ao v Time and % Transmittance v Time**



## Revision History

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

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Revised By:	Approved By:
Reason for Revision:	