

BS 6853:1999: Annex B.2 (Withdrawn) / LUL S1085 Attachment A.2



**Determination of weighted summation of toxic
fume, R – Area based test method**

A Report To: Mapei UK Ltd

Document Reference: 403273

Date: 25th September 2018

Issue No.: 1

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Testing
Advising
Assuring

Executive Summary

Objective To determine the toxic fume produced from the following product when tested in accordance with BS 6853: 1999 incorporating amendment No. 1: Annex B.2 (Withdrawn) / LUL S1085 Attachment A.2:



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 ² *
Individual components used to manufacture composite:			
Top coating	"Mapecoat ACT 196"	2 x 0.15kg/m ²	1.2g/cm ²
Mesh	"Mapetherm Net"	1mm	160g/m ²
Coating	"Planitop 210"	3mm	1310kg/m ³
Primer	"Malech"	0.1kg/m ²	1.01g/cm ³
Substrate	"Promat – Brandschultzbauplatten; Promatect-H"	12mm	870kg/m ³
Please see pages 5 & 6 of this test report for the full description of the product tested			

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

Summary of Test Results: The R Value determined was 0.25.

Date of Test 5th September 2018

Signatories

	
Responsible Officer C. Henry * Fire Scientist	Authorised B. Dean * Technical Leader

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

Report Issued: 25th September 2018

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Test Details

Introduction

Exova Warringtonfire was commissioned to carry out an area based toxicity test in accordance with the method recommended in BS 6853:1999 Incorporating Amendment 1, Informative Annex B.2 (Withdrawn) / LUL S1085 Attachment A.2. This standard recommends that the test is carried out using the apparatus detailed in prEN2824 but the ignition cone used should conform with the requirements given in BS ISO 5659-2 and that the quantitative determination of the gases emitted should be carried out in accordance with the procedure specified in prEN2826.

The test was performed in accordance with the procedure specified in prEN2825 and prEN2826 amended in accordance with the recommendations given in BS6853: 1999 Annex B (Withdrawn) / LUL S1085 Attachment A.2 and this report should be read in conjunction with these and other related standards.

Test method

The principle of the test methods detailed in prEN2825 and prEN2826 is to expose a material to specified thermal conditions of pyrolysis and combustion in a continuous procedure. The change in optical density of the smoke produced when dispersed within a fixed volume of air is recorded throughout the period of test. Quantitative determination of toxic gases emitted is carried out.

The test method provides a means for the comparative assessment of products, however, it does not model a real fire situation and the results cannot therefore be used to describe the fire hazard of materials under actual fire conditions.

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 has 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.

Deviation to test standard

prEN 2826 specifies the use of colorimetric tubes and wet analysis. Colorimetric tubes are generally no longer considered as an accurate method of analysis and have been rejected by other industries. The analysis techniques selected are proven techniques, as detailed in the test procedure section of this test report.

Instruction to test

The test was conducted on the 5th September 2018 at the request of Mapei UK Ltd, the sponsor of the test.

Provision of test specimens

The specimens were supplied by the sponsor of the test. **Exova Warringtonfire** was not involved in any selection or sampling procedure.

Conditioning of specimens

The specimens were received on the 7th August 2018.

The specimens were conditioned at temperatures of $23 \pm 2^{\circ}\text{C}$ and a relative humidity of $50 \pm 5\%$ RH, for a minimum period of 24 hours prior to testing.

Test Face

The coated face of the specimens was exposed to the radiant heat source.

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Description of 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 **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 Exova Warringtonfire)
Overall weight per unit area		14.97kg/m ² (determined by Exova Warringtonfire)
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 ²
	Weight per unit area	1.2g/cm ²
	Application method	Roller or brush
	Curing process per coat	24 hours touch dry
Flame retardant details		See Note 1 below
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 ²
	Flame retardant details	
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 ³
	Application method	Trowel
	Curing process per coat	24 hours touch dry
Flame retardant details		See Note 1 below
Primer	Generic type	Acrylic primer
	Product reference	"Malech"
	Name of manufacturer	Mapei
	Colour reference	"Clear"
	Number of coats	One
	Application rate	0.1kg/m ²
	Density	1.01g/cm ³
	Application method	Trowel
	Curing process per coat	24hrs touch dry
Flame retardant details		See Note 1 below

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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 ³
	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 Procedure

Specimens were tested in the flaming mode in a horizontal position by exposure to the heating arrangement specified in ISO 5659-2. The heat flux was 25kW/m^2 .

The sampling and analysis of the fire gases generated during the test is conducted using a variety of methods as defined in the internal operating procedure.

In all cases, the sample is taken from the geometric centre of the chamber with sample lines being kept as short as possible to minimise sample losses.

For the analysis of oxides of carbon and nitrogen, continuous measurements are made throughout the duration of the test.

Carbon dioxide (CO_2), carbon monoxide (CO) and oxides of nitrogen (NO_x) are determined continuously using a precalibrated Fourier Transform Infra-Red analyser. The values reported are those measured at 85% smoke obscuration.

For the other gases, single point analysis is conducted, the gases being absorbed into an aqueous media and analysed remotely. Two types of media are used, 0.1M sodium hydroxide solution and 0.3% hydrogen peroxide solution. The gases are sampled over a two minute period commencing when smoke density has reached 85% obscuration by bubbling the gases through the aqueous media using a fitted funnel Dreschel bottle arrangement.

Hydrogen cyanide (HCN) is determined from gases absorbed into a 0.1M solution of sodium hydroxide and analysed using ion chromatography. The concentration determined is an average over each 2 minute period beginning at 85% smoke obscuration.

Hydrogen chloride (HCl), hydrogen bromide (HBr), hydrogen fluoride (HF) and sulphur dioxide (SO_2) are absorbed into a 0.3% solution of hydrogen peroxide and are also analysed by ion chromatography. The concentration determined is an average over each 2 minute period beginning at 85% smoke obscuration.

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Test Results

Applicability of test results

The test results relate only to the behaviour of the specimens of the product under the particular conditions of test; they are not intended to be the sole criterion for assessing the potential smoke and toxicity 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 will therefore invalidate the test results. It is the responsibility of the supplier of the product to ensure that the product which is supplied is identical with the specimens which were tested.

Gases sampled

One specimen was tested to determine the $D_{s_{max}}$ and time to $D_{s_{max}}$. From the results of this test time to reach 85% of $D_{s_{max}}$ was calculated. The results are given below:

$D_{s_{max}}$	15
Time to $D_{s_{max}}$ (T_{max})	13:01
Time to 85% of $D_{s_{max}}$ (T_{max} 85%)	9:16

Three further specimens were then tested. Gases generated were sampled after nine minutes sixteen seconds test duration. The quantitative determinations were then carried out using the procedures described. The test results obtained are provided below and test observations are detailed in Table 1.

Gas	Specimen No. 1	Specimen No. 2	Specimen No. 3	Average
Carbon Monoxide	10.05	8.95	7.14	8.71
Carbon Dioxide	1024.80	1091.93	1055.91	1057.55
Sulphur Dioxide	ND	ND	ND	ND
Hydrogen Chloride	ND	ND	ND	ND
Hydrogen Bromide	ND	ND	ND	ND
Hydrogen Fluoride	ND	ND	ND	ND
Hydrogen Cyanide	ND	ND	ND	ND
Nitrogen Oxides	0.99	1.16	1.16	1.10

Where: ND indicates non-detected.
 Note: All values given are in g/m^2 .

Weighted Summation of Toxic Fume, R

The test results obtained for toxicity measurements were used to calculate the weighted summation index, R, as described in BS 6853: 1999: Annex B.4.2 (Withdrawn) / LUL S1085 Attachment A.4.2.

The R Value determined was 0.25.

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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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Table 1

Testing with Flame Application									
Specimen	D _s after t in minutes							D _s max. within 1.5 min	D _s max. within 4 min
	1	1.5	2	3	4	5	6		
Smoke run	0	0	0	0	1	2	5	0	1

Observations during test

Specimen No.	Initial Smoke Production Test	Toxicity Tests		
		1	2	3
Colour of smoke produced	Dark	Dark	Dark	Dark
Expansion distance towards heater (mm)	N/A	N/A	N/A	N/A
Ignition time in seconds (if applicable)	N/A	N/A	N/A	140
Extinction time in seconds (if applicable)	N/A	N/A	N/A	165
Re-ignition time in seconds (if applicable)	N/A	N/A	N/A	*
Extinction time in seconds (if applicable)	N/A	N/A	N/A	N/A

* = Did Not Re-ignite N/A = Not Applicable

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Revision History

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Revised By:	Approved By:
Reason for Revision:	

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Revised By:	Approved By:
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