

# EN 45545-2: 2013 – Test Methods T10.01, T10.02, T10.04 & T11.01



## Smoke and Toxicity Assessment

**Test Method References “T10.01” / “T10.02”/ “T10.04” (ISO 5659-2: 2012; Plastics – Smoke Generation. Part 2 Determination of Optical Density by a Single Chamber Method) and “T11.01” (Gas Analysis in the Smoke Box EN ISO 5659-2, using FTIR Technique)**

A Report To: Metamark (UK) Limited

Document Reference: 356255

Date: 12<sup>th</sup> October 2017

Issue No.: 2

Page 1

Testing  
Advising  
Assuring

## Executive Summary

**Objective** To determine the toxic fume and optical density produced from the following product when tested in accordance with methods T10.01, T10.02, T10.04 and T11.01 as defined in EN 45545-2: 2013 at an irradiance level of 50kW/m<sup>2</sup> without a pilot flame.

Generic Description		Product reference	Thickness	Weight per unit area, density or application rate
Self-adhesive film layers applied to an aluminium substrate		"MD5/M7 & MG 850 RW"	1.15mm*	2.87kg/m <sup>2</sup> *
<b>Individual components used to manufacture composite:</b>				
Top film	Film	"MG 850 RW"	20 microns	Unable to provide
	Adhesive	Unable to provide	30 microns	Unable to provide
Bottom film	Film	"MD5/M7"	70 microns	Unable to provide
	Adhesive	Unable to provide	Unable to provide	22g/m <sup>2</sup>
Substrate		None assigned	1mm	2700kg/m <sup>3</sup>
<b>Please see page 7 of this test report for the full description of the product tested</b>				

**Test Sponsor** Metamark (UK) Limited, Luneside, New Quay Road, Lancaster, LA1 5QP

**Summary of Test Results:**

**The average Ds(4) value determined was 115.**

**The average VOF4 value determined was 360.**

**The average Ds(max) value determined within 10 minutes was 121.**

**The average Ds(max) value determined within 20 minutes was 121.**



**The average CIT value at four minutes was 0.06.**

**The average CIT value at eight minutes was 0.06.**

**Date of Test** 8<sup>th</sup> and 21<sup>st</sup> October 2015

**Reason for Revision** This document replaces Issue 1 (dated 26<sup>th</sup> October 2015) of the same number which has been withdrawn. The Ds(max) was not detailed in the summary of test results section and this has now been detailed in this Issue 2 report.

## Signatories

	
Responsible Officer C. Lester* Technical Officer	Authorised B. Dean * Technical Leader

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

Report Issued: 12<sup>th</sup> October 2017

This version of the report has been produced from a .pdf format electronic file that has been provided by Exova Warringtonfire to the sponsor of the report and must only be reproduced in full. Extracts or abridgements of reports must not be published without permission of Exova Warringtonfire.

<b>CONTENTS</b>	<b>PAGE NO.</b>
<b>EXECUTIVE SUMMARY .....</b>	<b>2</b>
<b>SIGNATORIES.....</b>	<b>2</b>
<b>TEST DETAILS.....</b>	<b>5</b>
<b>DESCRIPTION OF TEST SPECIMENS.....</b>	<b>7</b>
<b>TEST RESULTS .....</b>	<b>9</b>
<b>APPENDIX I .....</b>	<b>11</b>
<b>APPENDIX II.....</b>	<b>13</b>
<b>REVISION HISTORY .....</b>	<b>14</b>



## Test Details

### Introduction

**Exova Warringtonfire** was commissioned to carry out an area based smoke and toxicity test in accordance with the method recommended in EN 45545-2: 2013. This standard recommends that the test is carried out using the apparatus and procedures detailed in ISO 5659-2: 2012. The standard provides equations which should be calculated in relation to the smoke density. In addition to this the quantitative determination of the gases emitted should be carried out in accordance with the procedure specified in EN 45545 Annex C, Method 1 (Smoke Chamber).

The test was performed in accordance with the procedures specified in EN 45545 and EN ISO 5659-2 and this report should be read in conjunction with these and other related standards.

### Test method

The principle of the test methods referenced "T10.01", "T10.02", "T10.04" and "T11.01" is to expose a material to specified thermal conditions of pyrolysis and combustion in a continuous 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 50kW/m<sup>2</sup>. The change in optical density of the smoke produced when dispersed within a fixed volume of air is recorded throughout the period of test utilising the Concept Software in order to determine information relating to the smoke density.

Quantitative determination of toxic gases emitted is carried out using Fourier Transform Infra Red (FT-IR) analysis using the TQ Analyst software. The FT-IR has been calibrated by the analyser manufacturer (Thermo) using library spectrum and bottled gases.

In all cases, the sample gases are taken from 300mm from the centre of the top of the chamber with sample lines being kept as short as possible to minimise sample losses.

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 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 8<sup>th</sup> and 21<sup>st</sup> October 2015 at the request of Metamark (UK) Limited, the sponsor of the test.

Document No.: 356255

Page No.: 5 of 14

Author: C. Lester

Issue Date: 12<sup>th</sup> October 2017

Client: Metamark (UK) Limited

Issue No.: 2



**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. **Exova Warringtonfire** supplied the substrate and adhered the film to the substrate.

**Test face**

The self adhesive film face of the specimen was exposed to the heating conditions.

**Conditioning of specimens**

The specimens were received on the 28<sup>th</sup> August 2015.

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.

## Description of Test Specimens

The description of the specimens given below has been prepared from information provided by the sponsor of the test. All values quoted are nominal, unless tolerances are given.

General description		Self-adhesive film layers applied to an aluminium substrate	
Product reference		"MD5/M7 & MG 850 RW"	
Overall thickness of composite		1.15mm (determined by <b>Exova Warringtonfire</b> )	
Overall weight per unit area		2.87kg/m <sup>2</sup> (determined by <b>Exova Warringtonfire</b> )	
Self-adhesive film (Top)	Overall thickness	50 microns	
	Overall weight per unit area	<b>See Note 1 below</b>	
	Name of manufacturer	<b>See Note 2 below</b>	
	Film	Generic type	Polyester film
		Product reference	"MG 850 RW"
		Name of manufacturer	<b>See Note 2 below</b>
		Thickness	20 microns
		Weight per unit area	<b>See Note 1 below</b>
		Colour reference	"Clear"
	Adhesive	Flame retardant details	<b>See Note 1 below</b>
		Generic type	Solvent acrylic
		Product reference	<b>See Note 1 below</b>
		Name of manufacturer	<b>See Note 2 below</b>
Application thickness		30 microns	
Application method	Roller		
Flame retardant details	<b>See Note 1 below</b>		
Self-adhesive film	Overall thickness of self-adhesive film	<b>See Note 1 below</b>	
	Overall weight per unit area of self-adhesive film	<b>See Note 1 below</b>	
	Name of manufacturer of self-adhesive film	<b>See Note 2 below</b>	
	Film	Generic type	Polyvinyl chloride (PVC)
		Product reference	"MD5/M7"
		Name of manufacturer	<b>See Note 2 below</b>
		Thickness	70 microns
		Weight per unit area	<b>See Note 1 below</b>
		Colour reference	"White"
	Adhesive	Flame retardant details	<b>See Note 1 below</b>
		Generic type	Solvent-based acrylic
		Product reference	<b>See Note 1 below</b>
		Name of manufacturer	<b>See Note 2 below</b>
Application rate		22g/m <sup>2</sup>	
Application method		Roller	
Flame retardant details		<b>See Note 1 below</b>	
Substrate	Generic type	Aluminium	
	Name of supplier	S & A Joinery	
	Thickness	1mm	
	Density	2700kg/m <sup>3</sup>	
	Flame retardant details	The substrate is inherently flame retardant	
Brief description of manufacturing process		<b>See Note 1 below</b>	

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

**Note 2. The sponsor of the test has provided this information but at the specific request of the sponsor, these details have been omitted from the report and are instead held on the confidential file relating to this investigation.**



## 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.

### Smoke Density

Test method referenced "T10.01" requires the Ds(4) to be calculated. That is the specific optical density at 4 minutes test duration.

Test method referenced "T10.02" requires the VOF4 to be calculated. That is the area under the Ds vs. time curve during the period zero minutes to four minutes. This is calculated utilising the trapezium rule equation (assuming a finite element (t) of one minute):

$$VOF_4 = D_1 + D_2 + D_3 + \frac{D_4}{2}$$

Test method referenced "T10.04" requires the Ds(max) within the first 10 minutes test duration to be calculated. That is the maximum specific optical density within the first 10 minutes test duration.

	Specimen 1	Specimen 2	Specimen 3	Mean Average
Ds(4)	141	100	103	115
VOF4	393	317	370	360
Ds(max) within 10 minutes	143	102	119	121

### Toxic Gas Emission

Test method referenced "T11.01" required the CIT to be calculated. That is the conventional index of toxicity, a summation term from the analysis of gases taken at four minutes and eight minutes test duration.

	Specimen 1	Specimen 2	Specimen 3	Mean Average
CIT (4 minutes)	0.02	0.04	0.10	0.06
CIT (8 minutes)	0.03	0.05	0.09	0.06

### Additional Test Data

Additional test data relating to the smoke & toxicity performance of the product is detailed in Appendix I of this report.

A graph of the results obtained is illustrated in Appendix II.

- Summary of results**
- The average Ds(4) value determined was 115.**
  - The average VOF4 value determined was 360.**
  - The average Ds(max) value determined within 10 minutes was 121.**
  - The average Ds(max) value determined within 20 minutes was 121.**
  - The average CIT value at four minutes was 0.06.**
  - The average CIT value at eight minutes was 0.06.**

#### 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.

These 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 obscuration hazard of the product in use.

This report may only be reproduced in full. Extracts or abridgements shall not be published without permission of **Exova Warringtonfire**.

## Appendix I

### Gas Concentration At Four Minutes:

The concentration of each gas species for which analysis was conducted for at the four minute sampling point (expressed in ppm and kg/m<sup>3</sup>) is provided in the below table:

Gas	Specimen 1		Specimen 2		Specimen 3		Mean Average	
	ppm	kg/m <sup>3</sup>	ppm	kg/m <sup>3</sup>	ppm	kg/m <sup>3</sup>	ppm	kg/m <sup>3</sup>
Carbon Monoxide	249	0.0002	178	0.0002	258	0.0003	228	0.0002
Carbon Dioxide	425	0.0006	1149	0.0018	1444	0.0022	1006	0.0015
Sulphur Dioxide	ND	ND	ND	ND	ND	ND	ND	ND
Hydrogen Chloride	ND	ND	12	0.0000	49	0.0001	20	0.0000
Hydrogen Bromide	ND	ND	ND	ND	ND	ND	ND	ND
Hydrogen Fluoride	ND	ND	ND	ND	ND	ND	ND	ND
Hydrogen cyanide	2	0.0000	3	0.0000	3	0.0000	3	0.0000
Nitrogen Oxides	2	0.0000	3	0.0000	4	0.0000	3	0.0000

Where ND indicates None Detected

### Gas Concentration At Eight Minutes:

The concentration of each gas species for which analysis was conducted for at the eight minute sampling point (expressed in ppm and kg/m<sup>3</sup>) is provided in the below table:

Gas	Specimen 1		Specimen 2		Specimen 3		Mean Average	
	ppm	kg/m <sup>3</sup>	ppm	kg/m <sup>3</sup>	ppm	kg/m <sup>3</sup>	ppm	kg/m <sup>3</sup>
Carbon Monoxide	336	0.0003	267	0.0003	295	0.0003	299	0.0003
Carbon Dioxide	583	0.0009	1319	0.0020	1508	0.0023	1137	0.0017
Sulphur Dioxide	ND	ND	ND	ND	ND	ND	ND	ND
Hydrogen Chloride	ND	ND	15	0.0000	41	0.0001	19	0.0000
Hydrogen Bromide	ND	ND	ND	ND	ND	ND	ND	ND
Hydrogen Fluoride	ND	ND	ND	ND	ND	ND	ND	ND
Hydrogen cyanide	3	0.0000	3	0.0000	3	0.0000	3	0.0000
Nitrogen Oxides	2	0.0000	2	0.0000	3	0.0000	2	0.0000

Where ND indicates None Detected

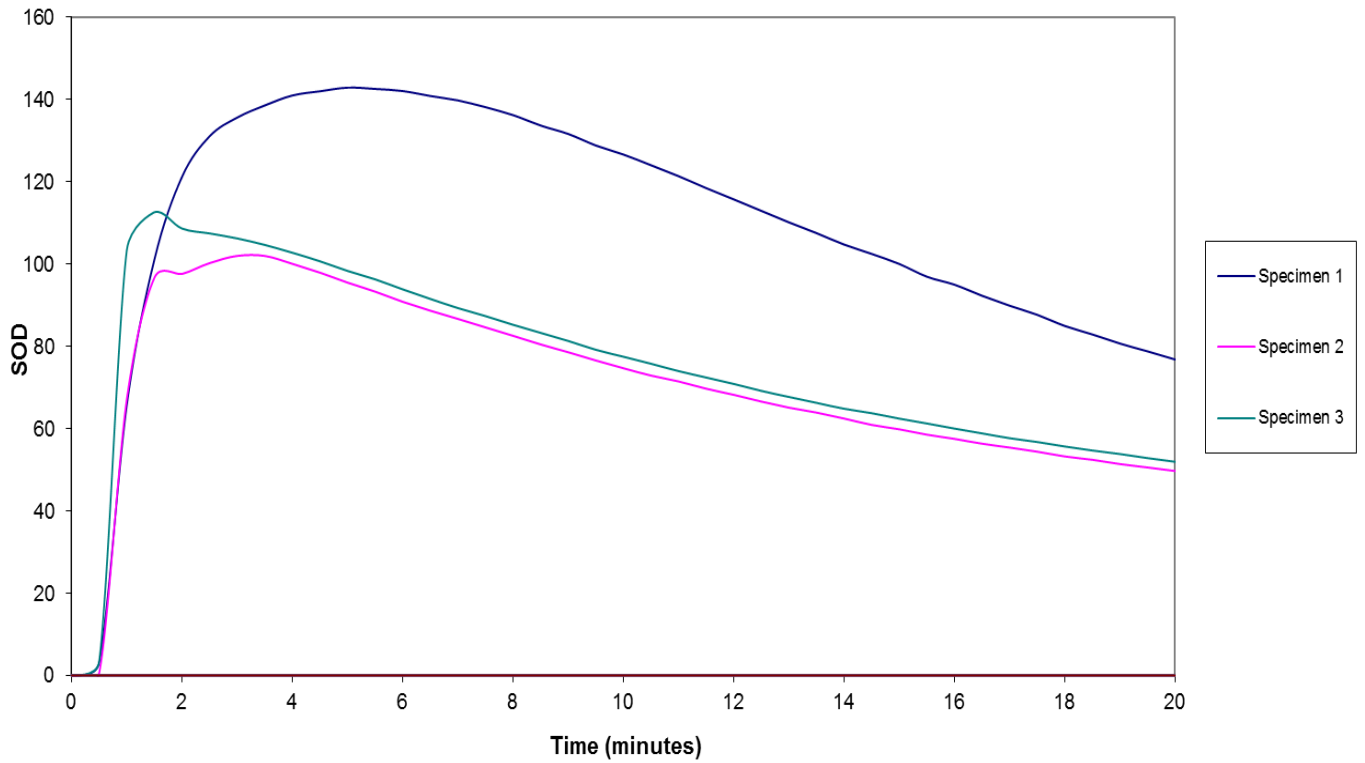
	SPECIMEN NUMBER			Mean
	1	2	3	
Clear Beam Correction Factor ( $D_c$ )	9	15	16	
Specific Optical Density at 10 minutes ( $D_{s10}$ )	127	75	77	93
Specimen thickness	1.17	1.14	1.15	1.15
Initial specimen weight (g)	16.1	16.1	16.2	16.1
Final specimen weight (g)	14.7	14.8	14.6	14.7
Mass Loss (g)	1.4	1.3	1.6	1.4
Wire Grid (if applicable)	N/A	N/A	N/A	N/A
Neutral-density correction factor ( $C_f$ ) (if applicable)	N/A	N/A	N/A	N/A
Test Duration (s)	1200	1200	1200	1200

**Observations:**

	50kW/m <sup>2</sup> In The Absence Of A Pilot Flame		
Specimen No.	1	2	3
Colour of smoke produced	Dark	Dark	Dark
Expansion distance towards heater (mm)	N/A	N/A	N/A
Ignition time in seconds (if applicable)	N/A	49	43
Extinction time in seconds (if applicable)	N/A	76	74
Re-ignition time in seconds (if applicable)	*	*	*
Extinction time in seconds (if applicable)	N/A	N/A	N/A
* = Did Not Re-ignite      N/A = Not Applicable			

## Appendix II

### 50kW/m<sup>2</sup> in the absence of a pilot flame



## Revision History

Issue No : 2	Re - Issue Date: 12 <sup>th</sup> October 2017
Revised By: C. Lester	Approved By: B. Dean
Reason for Revision: This document replaces Issue 1 (dated 26 <sup>th</sup> October 2015) of the same number which has been withdrawn. The Ds(max) was not detailed in the summary of test results section and this has now been detailed in this Issue 2 report.	

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