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Test Report: ICL/H18/9038 Rev 1

**International Maritime Organisation.
INTERNATIONAL CODE FOR APPLICATION
OF FIRE TEST PROCEDURES, 2010
(2010 FTP CODE)
PART 2 – SMOKE AND TOXICITY TEST**

Sponsored By

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1 Introduction

International Maritime Organisation, INTERNATIONAL CODE FOR APPLICATION OF FIRE TEST PROCEDURES, 2010 (2010 FTP CODE) Part 2 details a test procedure to determine smoke & toxic gas emission of products. The Smoke generation tests is carried out in accordance with Appendix 1, and the gas measuring are carried out in accordance with Appendix 2 to this part and additional test procedures as described in this part of the Code. To carry out the tests in accordance with this part, modifications of the arrangements and procedures of the ISO 5659-2 is made for toxic gas measurement. Toxicity measurements are carried at when maximum specific density of smoke is reached (DmST) is reached.

The principle of the test method, ISO 5659-2, 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.

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.

2 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.

The product was a 0.37mm thick Vescom vinyl wall covering with digital printing (Batch Number 165618-001) having a nominal mass of 350g/m² and consisting of :
Face: Flame retardant Vinyl film nominally 0.2mm thick. (Weight approximately 310g/m²) Backing: Non woven Cutron (Weight 40g/m²).

The wall covering was bonded to one face of a 12mm thick Calcium silicate board (Density 780g/m³) using Starch and PVAc adhesive referenced “Vescom 2000” applied at 170g/m².

The sponsor of the test did not provide further details relating to the composition of the product that was tested.

3 Conditioning of Specimens

The specimens were received on 6th March 2018.

The specimens were conditioned to constant mass at $23 \pm 3^{\circ}\text{C}$ and $50 \pm 5\%$ RH, before testing.

4 Date of Test

The tests were performed on 5th April 2018.

5 Test Procedure

The test was performed in accordance with the procedure called up in International Maritime Organisation, INTERNATIONAL CODE FOR APPLICATION OF FIRE TEST PROCEDURES, 2010 (2010 FTP CODE) Part 2- “Smoke and Toxicity” and this report should be read in conjunction with that Standard.

Gas samples were taken at DmST and analysed using FTIR apparatus having:

Gas cell having a volume of: 1.33 l
 Length of gas sampling line: 2 m
 Inner volume gas sampling tube: 56 cm³
 Capacity of gas sampling pump: 3 l/min

6 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 toxic emission 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. Uncertainty measurement has not been taken into account when presenting the test results.

The results of tests are summarised below:-

Smoke emission: The maximum Ds values, average of three tests in each mode, are given below:

Test Mode	25kW m ⁻²	25kW m ⁻² with pilot flame	50kW m ⁻²
Ds max (average)	111.65	76.38	150.00

Full results are given in Appendix 1.

Toxic gas emission: Toxic gas emission result are summarised in Table 1 below:

Table 1:

Gas Species	Average Concentration in each mode (ppm)		
	25 kWm ⁻²	25 kWm ⁻² with pilot	50 kWm ⁻²
Carbon Monoxide, CO	122	49	134
Hydrogen Chloride, HCl	15	ND	20
Hydrogen Bromide, HBr	ND	ND	ND
Hydrogen Cyanide, HCN	ND	ND	ND
Hydrogen Fluoride, HF	ND	ND	ND
Sulphur Dioxide, SO ₂	ND	ND	ND
Nitrous Fumes, NO _x	ND	ND	ND

Where ND = not detected

Full results are given in Appendix 2.

7

Requirements

Smoke:

An average (Dm) of the maximum of Ds of three tests at each test conditions shall satisfy the following requirements:

Product type	Ds max
1. Bulkhead, Lining or ceiling	200
2. Primary deck covering	400
3. Floor Covering	500
4. Plastic pipes	400

Toxicity

The gas concentration measured at each test condition shall not exceed the following limits in any of the three test modes:

Gas Species	Requirements (ppm)
Carbon Monoxide, CO	≤1450
Hydrogen Chloride, HCl	≤600
Hydrogen Bromide, HBr	≤600
Hydrogen Cyanide, HCN	≤140
Hydrogen Fluoride, HF	≤600
Sulphur Dioxide, SO ₂	≤120 (≤200 for floor coverings)
Nitrous Fumes, NO _x	≤350

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8 **Conclusion**

When tested in accordance with the procedure called up in International Maritime Organisation, Fire Test Procedure Code 2010 Part 2: Smoke and Toxicity test, the product satisfies the smoke and toxicity requirements for use as Bulkhead, Lining or ceiling

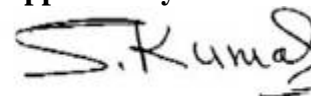
Prepared by

A handwritten signature in black ink, appearing to read "Chong", with a horizontal line underneath.

C. B. Chong
Fire Scientist

Date of Issue: 6th April 2018

Approved by

A handwritten signature in black ink, appearing to read "S. Kumar", with a horizontal line underneath.

S. Kumar
Technical Manager

Date of issue Revision 1: 10th April 2018.

Appendix 1

Smoke Data

25kW/m² without pilot flame

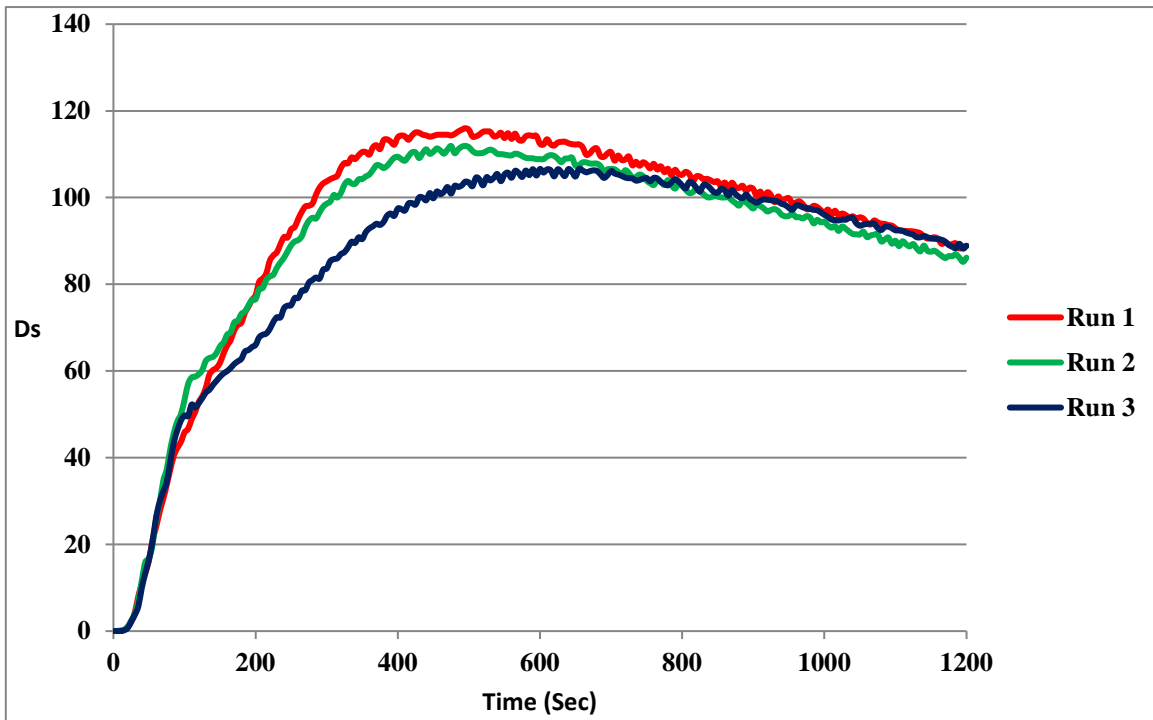
Run	Maximum specific density (D_{Smax})	Time to maximum specific density (s)	Time to ignition (s)
1	116.08	499	-
2	112.11	489	-
3	106.75	626	-
Average	111.65	538	

25kW/m² with pilot flame

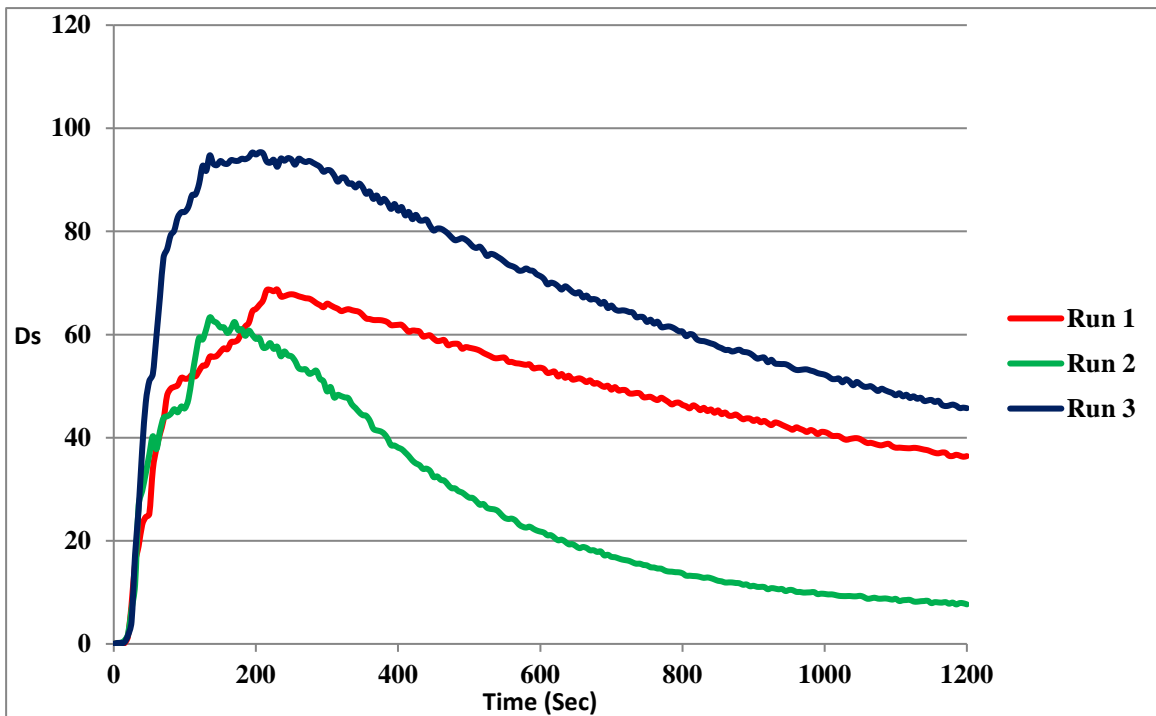
Run	Maximum specific density (D_{Smax})	Time to maximum specific density (s)	Time to ignition (s)
1	68.81	227	10
2	64.57	137	13
3	95.76	197	14
Average	76.38	187	12

50kW/m² without pilot flame

Run	Maximum specific density (D_{Smax})	Time to maximum specific density (s)	Time to ignition (s)
1	160.68	59	-
2	140.40	125	-
3	148.94	54	-
Average	150.00	79	

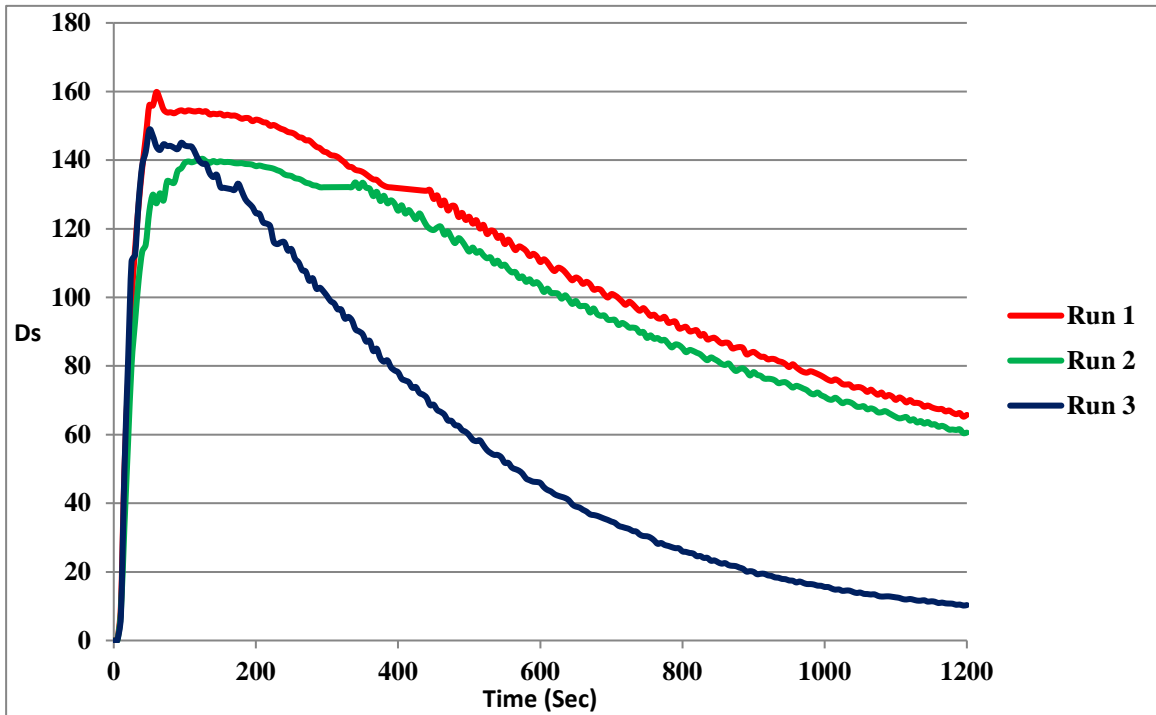


Graph 1 – Optical Density v Time curve for 25 kWm⁻² without pilot flame



Graph 2 – Optical Density v Time curve for 25 kWm⁻² with pilot flame

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Graph 3 – Optical Density v Time curve for 50 kWm⁻² without pilot flame

Appendix 2

Toxicity Data

25kW/m2 without pilot

Gas species	Concentration (ppm)		
	Run 2	Run 3	Average
Carbon monoxide, CO	125	118	122
Oxides of Nitrogen, NOx	0	0	0
Sulphur dioxide, SO2	0	0	0
Hydrogen Chloride, HCl	15	15	15
Hydrogen Bromide, HBr	0	0	0
Hydrogen Fluoride, HF	0	0	0
Hydrogen Cyanide, HCN	0	0	0

25kW/m2 with pilot

Gas species	Concentration (ppm)		
	Run 2	Run 3	Average
Carbon monoxide, CO	45	32	39
Oxides of Nitrogen, NOx	0	0	0
Sulphur dioxide, SO2	0	0	0
Hydrogen Chloride, HCl	0	0	0
Hydrogen Bromide, HBr	0	0	0
Hydrogen Fluoride, HF	0	0	0
Hydrogen Cyanide, HCN	0	0	0

50kW/m2 without pilot

Gas species	Concentration (ppm)		
	Run 2	Run 3	Average
Carbon monoxide, CO	132	135	134
Oxides of Nitrogen, NOx	0	0	0
Sulphur dioxide, SO2	0	0	0
Hydrogen Chloride, HCl	18	21	20
Hydrogen Bromide, HBr	0	0	0
Hydrogen Fluoride, HF	0	0	0
Hydrogen Cyanide, HCN	0	0	0

Where 0= not detected