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Test Report: ICL/H25/17730

International Maritime Organisation.
INTERNATIONAL CODE FOR APPLICATION OF FIRE TEST PROCEDURES, 2010 (2010 FTP CODE)
Part 2 – Smoke and toxicity test

Sponsored By
Solar Solve Ltd,
7 Waldridge Way, Simonside Industrial Park,
South Shields, Tyne and Wear, NE34 9PZ, UK

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1 Introduction

International Maritime Organisation, INTERNATIONAL CODE FOR APPLICATION OF FIRE TEST PROCEDURES, 2010 (2010 FTP CODE) Part 2 - "Smoke and Toxicity" requires test to be carried out using the test apparatus and methodology detailed in ISO 5659-2: 1994. 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 0.5mm thick film referenced "SOLASOLV Solar Control Window Film"

The sponsor of the test has supplied a product safety data sheet relating to the product tested and this is held in our file relating to this investigation.

3 Conditioning of Specimens

The specimens were received on 9th July 2025.

The specimens were conditioned to constant mass at 23 ± 3°C and 50 ± 5% RH, before testing.

4 Date of Test

The tests were performed on the 8th August 2025.

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.

The product was tested with a non-combustible Backing board 12.5 ± 3 mm thick having the density of 950 ± 100 kg/m^3.

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 cm^3
Capacity of gas sampling pump:	3 l/min
Sampling Response Period (SRP)	30Sec

6 Test Results

The test results apply to the sample as received tested after conditioning. 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 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.

Because of the nature of reaction to fire testing and the consequent difficulty in quantifying the uncertainty of measurement of reaction to fire , it is not possible to provide a stated degree of accuracy of test results Uncertainty measurement has not been taken into account when presenting the test results

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)	26.55	20.29	72.98

Full results are given in Appendix 1.

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

Gas Species	Average Concentration in each mode (ppm)	Average Concentration in each mode (ppm)	Average Concentration in each mode (ppm)
	25 kWm^{-2}	25 kWm^{-2} with pilot	50 kWm^{-2}
Carbon Dioxide, CO2	29	16	46
Carbon Monoxide, CO	ND	ND	ND
Hydrogen Chloride, HCl	ND	ND	ND
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
Acrylonitrile, CH_2CHCN	ND	ND	ND
Acrolein, CH_2CHCHO	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

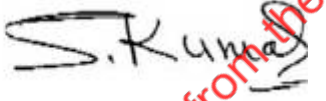
8 Conclusion

When tested in accordance with the procedure called up in International Maritime Organisation, Fire Test Procedure Code Part 2 Appendix 1 and Appendix 2 we confirm that all the requirements for the test method in this normative document have been met and the result has been determined according to that normative document. The results show that the product meets the requirements for use as Bulkhead, Lining or ceiling and Primary deck covering

Prepared by

C. B. Chong
Fire Scientist

Approved by



S. Kumar
Technical Manager

Date of Issue: 26th August 2025.

Appendix 1
Smoke data

25kW/m^2 without pilot flame

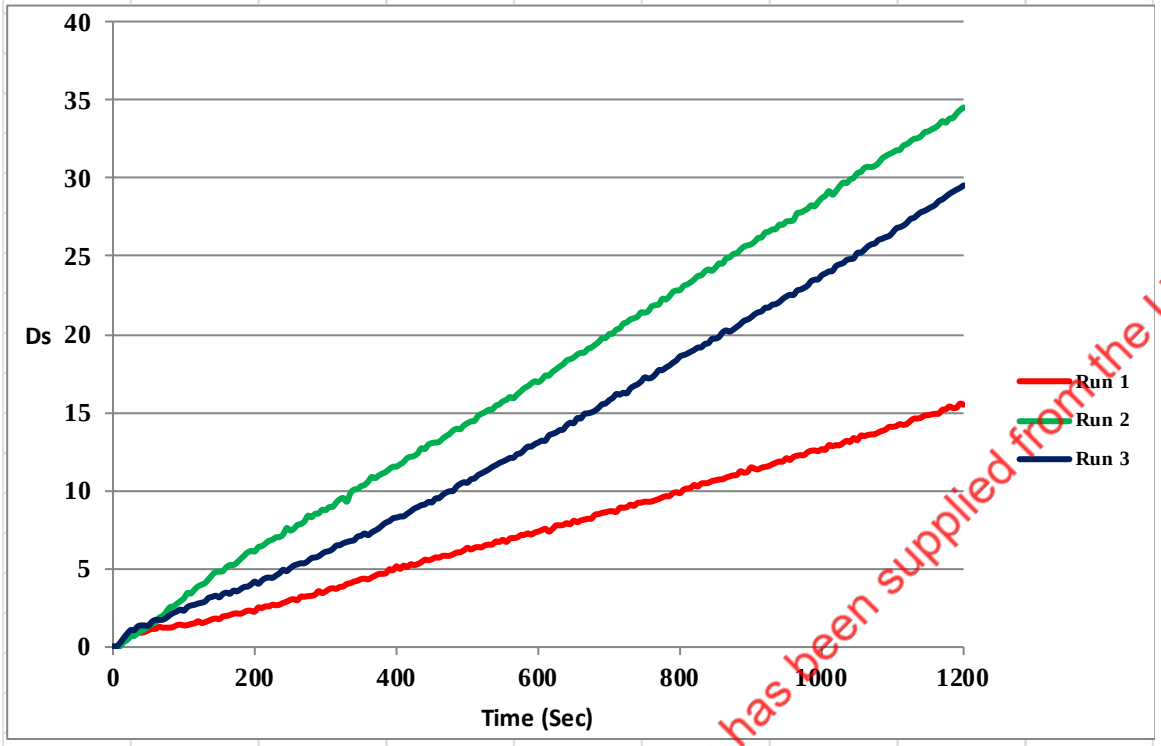
Run	Maximum specific density (Ds_{max})	Time to maximum specific density (s)	Time to ignition (s)
1	15.55	1195.00	No ignition
2	34.60	1200.00	No ignition
3	29.51	1199.00	No ignition
Average	**26.55**	**1198.00**	
Maximum smoke density sampling time (DmST) Sec			1165.00

25kW/m^2 with pilot flame

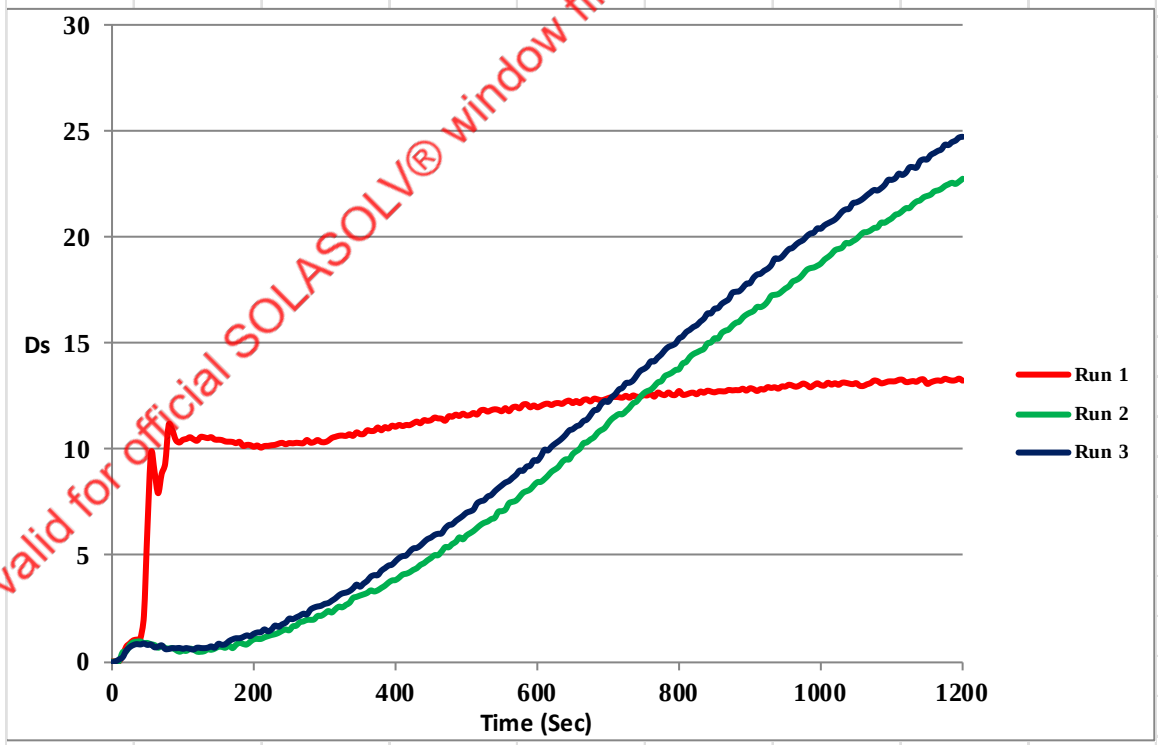
Run	Maximum specific density (Ds_{max})	Time to maximum specific density (s)	Time to ignition (s)
1	13.34	1182.00	Time to ignition = 40s. Time to flameout = 64s.
2	22.81	1201.00	No ignition
3	24.73	1198.00	No ignition
Average	**20.29**	**1193.67**	
Maximum smoke density sampling time (DmST) Sec			1152.00

50kW/m^2 without pilot flame

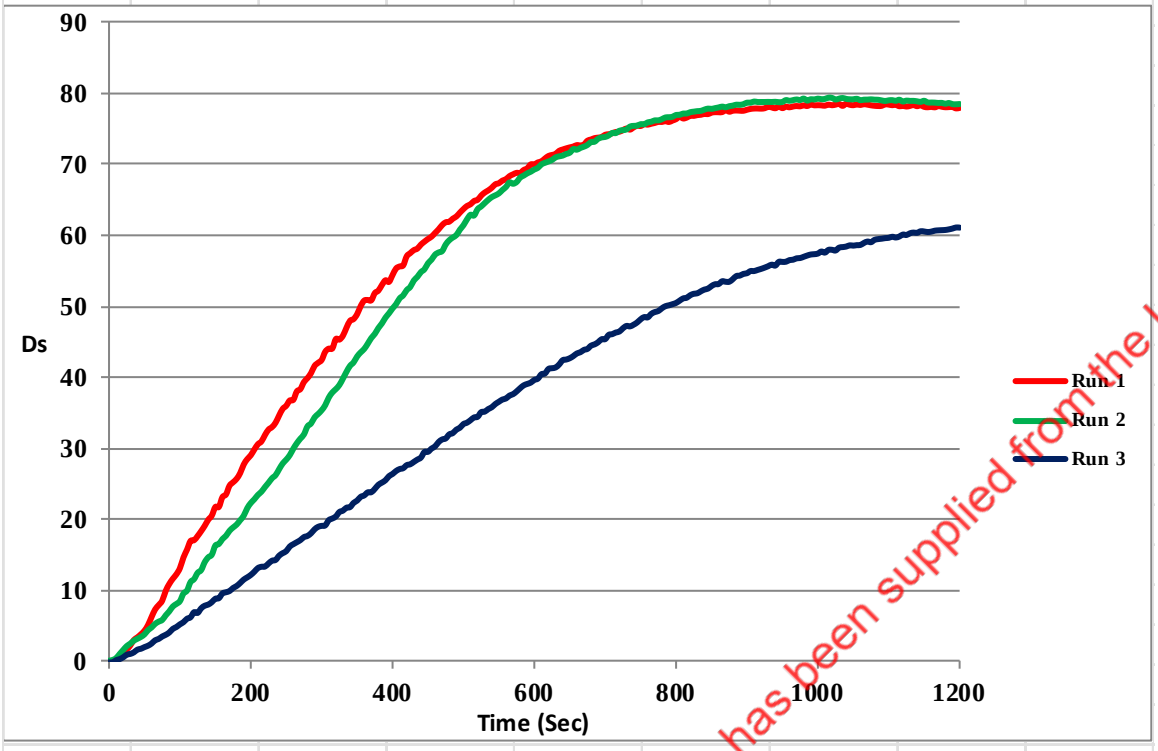
Run	Maximum specific density (Ds_{max})	Time to maximum specific density (s)	Time to ignition (s)
1	78.53	1066	No ignition
2	79.34	1015	No ignition
3	61.07	1200	No ignition
Average	**72.98**	**1094**	
Maximum smoke density sampling time (DmST) Sec			1036.00



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



Graph 3 – Optical Density v Time curve for 50 kWm^{-2} without pilot flame

Appendix 2
Toxicity Data

25kW/m^2 without pilot

Gas species	Concentration (ppm)		
	Run 2	Run 3	Average
Carbon Dioxide, CO_2	26	32	29
Carbon monoxide, CO	ND	ND	ND
Oxides of Nitrogen, NOx	ND	ND	ND
Sulphur dioxide, SO2	ND	ND	ND
Hydrogen Chloride, HCl	ND	ND	ND
Hydrogen Bromide, HBr	ND	ND	ND
Hydrogen Fluoride, HF	ND	ND	ND
Hydrogen Cyanide, HCN	ND	ND	ND

Where ND= Not detected.

25kW/m^2 with pilot

Gas species	Concentration (ppm)		
	Run 2	Run 3	Average
Carbon Dioxide, CO_2	17	15	16
Carbon monoxide, CO	ND	ND	ND
Oxides of Nitrogen, NOx	ND	ND	ND
Sulphur dioxide, SO2	ND	ND	ND
Hydrogen Chloride, HCl	ND	ND	ND
Hydrogen Bromide, HBr	ND	ND	ND
Hydrogen Fluoride, HF	ND	ND	ND
Hydrogen Cyanide, HCN	ND	ND	ND

Where ND= Not detected.

50kW/m^2 without pilot

species	Concentration (ppm)		
	Run 2	Run 3	Average
Carbon Dioxide, CO_2	43	49	46
Carbon monoxide, CO	ND	ND	ND
Oxides of Nitrogen, NOx	ND	ND	ND
Sulphur dioxide, SO2	ND	ND	ND
Hydrogen Chloride, HCl	ND	ND	ND
Hydrogen Bromide, HBr	ND	ND	ND
Hydrogen Fluoride, HF	ND	ND	ND
Hydrogen Cyanide, HCN	ND	ND	ND

Where ND= Not detected.

Appendix 3

Photo 1: showing the exposed .

Photo 2: Specimens after test 25kW/m^2 without pilot flame.

Photo 3: Specimens after test 25kW/m^2 with pilot flame.

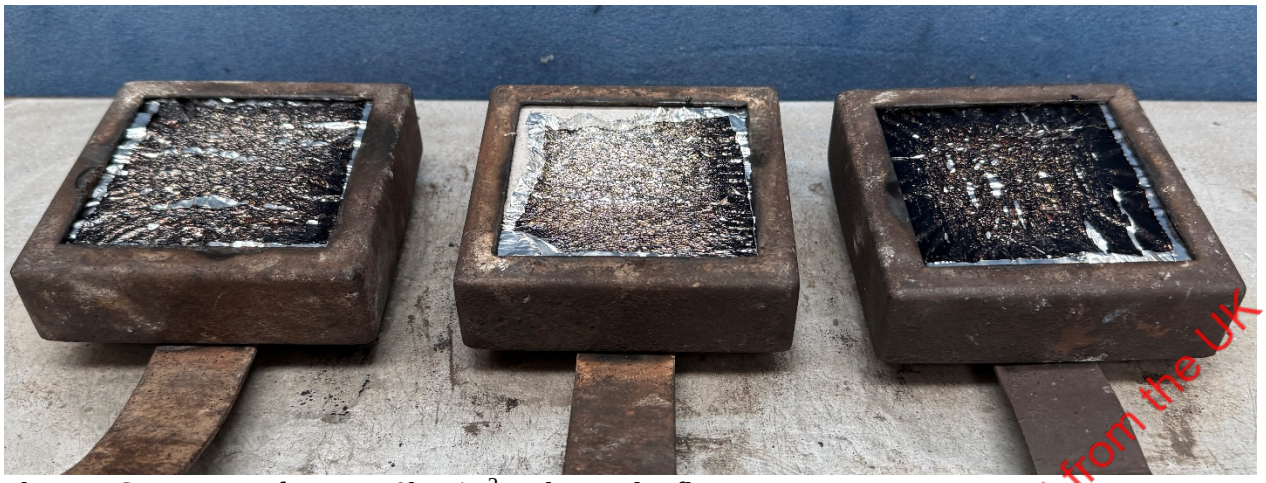


Photo 4: Specimens after test 50kW/m^2 without pilot flame.