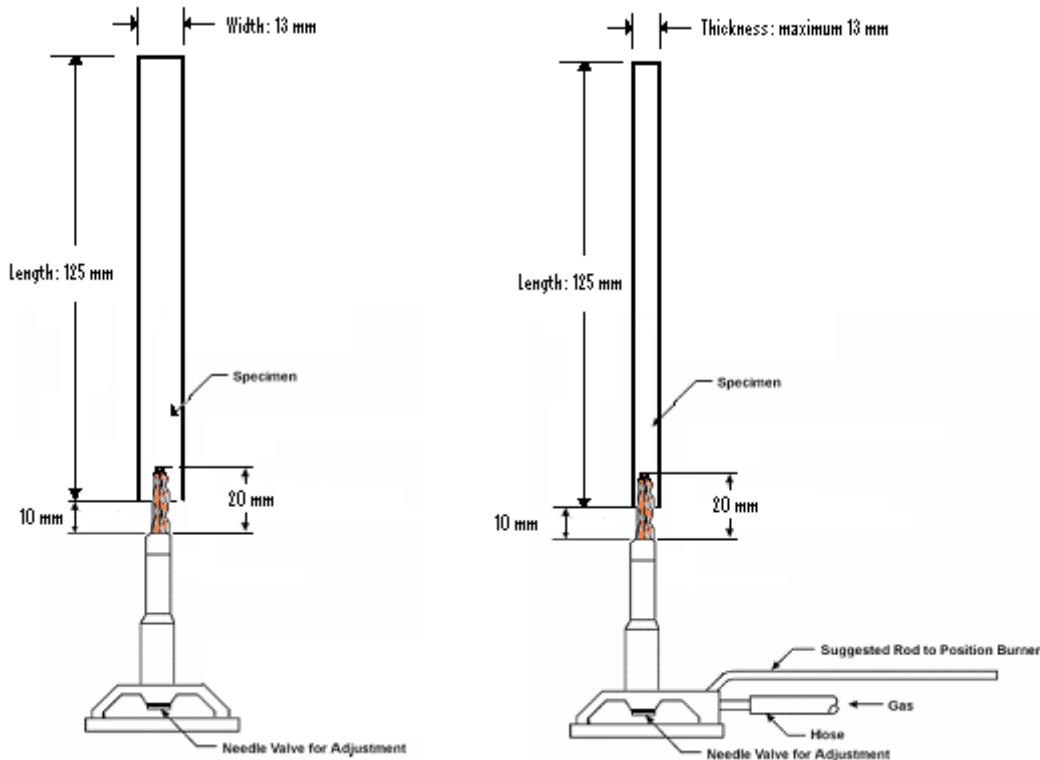


Flammability Test Results for FireShield Fire Retardant Surfacing Material (FRSM) to Underwriters Laboratories UL 94 Vertical Burn

Results for pultruded Polyester and Vinylester / E-glass laminates surfaced with FireShield FRSM

Sample details	FireShield FRSM loading (gsm)	Fibre Volume (%)	After Flame Time (t_1+t_2) (sec)	Average Flame Out Time (sec)	Flaming Drips	Result
Pultruded slat: Polyester/ E-glass	184	55	0, 0, 0, 0, 0	0	No	PASS to V0
Pultruded slat: Polyester/ E-glass	42	55	5.2, 0, 7.2, 0, 0	2.5	No	PASS to V0
Pultruded slat: Vinylester/ E-glass	184	55	0, 0, 0, 0, 0	0	No	PASS to V0
<i>Nominal specimen thickness: 6 mm</i>						

Note: All specimen cut edges were coated with one layer of Ff 88 intumescent paint. – see attached data sheet.



Front and side elevations of the UL 94 Vertical Burn Test

Flammability Test results for FireShield Fire Retardant Surfacing Material (FRSM) to FAR 25.853(a)

Results for pressed, vacuum bagged and pultruded carbon / epoxy laminates surfaced with FireShield FRSM

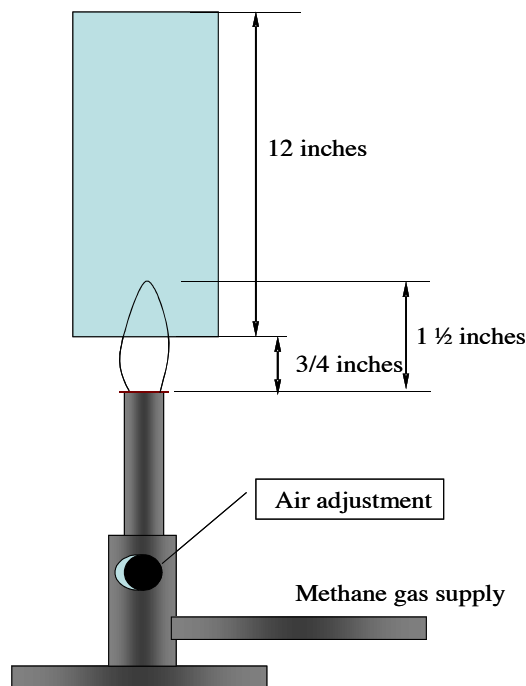
Sample details	FireShield FRSM loading (gsm)	Fibre Volume (%)	Flame Out Time (sec)	Average Flame Out Time (sec)	Av. Specimen Burn Length (in)	Result
Hot Pressed laminate: Carbon/ Epoxy	200	55	9, 7, 9, 15	10	2.5	PASS
Pultruded laminate: Carbon/ Epoxy	200	60	12, 13, 13, 14	13	1	PASS
Vacuum bagged laminate: Carbon/ Epoxy	176	53	5, 3, 11, 5	6	2.5	PASS
<i>Nominal specimen thickness: 3 mm</i>						

- Notes: 1. M24B Epoxy used in hot pressed, pultruded laminates and vacuum bagged laminates.
2. All laminates were a balanced lay-up of 2x 1250 gsm quadrax carbon and 3x 300gsm carbon uni, surfaced with a 50 gsm fibreglass scrim (FR carrier).

Results for hand laminated epoxy and vinylester / E-glass laminates surfaced with FireShield FRSM


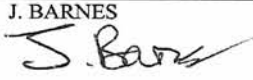



Sample details	FireShield FRSM loading (gsm)	Fibre Volume (%)	Flame Out Time (sec)	Average Flame Out Time (sec)	Av. Specimen Burn Length (in)	Result
Hand lay-up: Epoxy/ E-glass	128	13 - 15	5, 3, 5, 3, 5.	4.2	0.5	PASS
Hand lay-up: Vinylester/ E-glass	128	16 - 19	2, 10, 14, 14, 2.	8.4	1.3	PASS
<i>Nominal specimen thickness: 4 mm</i>						

- Notes: 1. All specimen cut edges were coated with one layer of an epoxy based intumescent paint.
2. Laminates were a lay-up of 5x 300 gsm fibreglass CSM surfaced above and below with 125 gsm plain weave fibreglass cloth (FR carrier).



Front elevation of FAR 25.853(a) vertical burn test of a composite specimen.

Requirements to Meet FAR/JAR 25.853(d)/(c) and ABD0031

 FST 3963	Material Description: SAMPLE I - UNCONDITIONED Surface zone intumescent loading = 200 gsm		Report Number: R14487/F
	Usage:		Page 1 of 2 Purchase Order No:
Manufacturer/Supplier : CRC-ACS LIMITED, 506, LORIMER STREET, FISHERMENS BEND, VICTORIA 3207, AUSTRALIA	Model/Program:	Test Location : AIM Composites Ltd, Pembroke Avenue, Waterbeach, Cambridgeshire, CB5 9QR Tel: 01223 441000 Fax: 01223 862336 E-mail: testing@aimcomposites.com	Work Order No: L2491
Tested by: J. BARNES Signature:  	Approved by : D.J.DREWRY Signature :  	Test Date: 5/11/01	

Test Method		Test Requirements (Maximum Average)									
Pass/ Fail	Reqd. Tests	Test (FAR / JAR 25.853 & 25.855)	After Flame	Burn Length	Drip Exting	Burn Rate	Flame Penetr'n	After Glow	OSU Total	OSU Peak	
		F1 FAR/JAR 25.853(a) - 60s Vert App F Pt I(a)(1)(i)	15 sec	6 in	3 sec						
		F2 FAR/JAR 25.853(a) - 12s Vert App F Pt I(a)(1)(ii)	15 sec	8 in	5 sec						
		F3 FAR/JAR 25.853(a) -15s Horiz App F Pt I(a)(1)(iv)				2.5 in/min					
		F4 FAR/JAR 25.853(a) -15s Horiz App F Pt I(a)(1)(v)				4 in/min					
		F5 FAR/JAR 25.855(d) - 30s 45° App F Pt I(a)(2)(ii)	15 sec				None	10 Sec			
		F6 FAR/JAR 25.869(a)(4) - 30s 60° App F Pt I(a)(3)	30 sec		3 sec						
		F7 FAR/JAR 25.853(d)/(c) - Heat Release App F Pt IV							65 kWmin/m ²	65 kW/m ²	
Pass	√	F8 FAR/JAR 25.853(d)/(c)-Smoke Density App F Pt V	Flaming Mode D _s 200 after 4 minutes.								
Pass	√	F9.ABD0031 / ATSI000 / D6-51377 - Smoke Density	Flaming / Non-Flaming Mode D _s 200/150 after 4 minutes.								
Pass	√	F10. ABD0031 - Toxic Gas Emission ATSI000 / D6-51377	CO - 1000 -3500 / 3500	HCN - 150 150 / 150	HF - 100 100 / 200	HC1 - 150 150 / 500	SO2 - 100 100 / 100	NOx - 100 100 / 100			

Passed ABD0031
Smoke Density and
Toxic Gas Emission tests

COMMENTS:

RESULT SUMMARY: PASSED SMOKE EMISSION REQUIREMENTS OF FAR / JAR 25.853(d)/(c) APP.F Pt.V(b) AND ABD0031 para.7.3.1 AND TOXIC GAS EMISSION REQUIREMENTS OF ABD0031 para.7.4,

Also met requirements of
FAR 25.853 (d) / (c)
Flaming Mode Smoke
Density test.

		Material Description: SAMPLE I - UNCONDITIONED								Report Number: R14487/F Page 2 of 2			
		Surface zone intumescent loading = 200 gsm								Purchase Order No:			
Manufacturer/Supplier : CRC-ACS LIMITED		Model/Program:		Test Location : AIM Composites Ltd				Work Order No: L2491					
Tested by: J.BARNES Signature: <i>J. Barnes</i>		Approved by: D.J.DREWRY Signature: <i>D. Drewry</i>		Test Date: 5/11/01				Release Certificate No:					
Sample Number	Orientation	Test Method	After Flame (secs)	Burn Length (in)	Drip Exting Time (secs)	Burn Time (secs)	Burn Rate (in./min)	Flame Penetration	After Glow (Secs)	OSU Total (kWmin/m ²)	OSU Peak (kW/m ²)	D _s after 4 mins	
FAR/JAR Flammability Test Results			Bunsen Burner Temperature: 980°C										
1													
2													
3													
4													
Average													
1													
2													
3													
4													
Average													
FAR/JAR Heat Release test results													
1		F7											
2													
3													
4													
Average													
FAR/JAR Smoke Density Test Results													
1		F8										158	
2												124	
3													
4													
Average												141	
ABD003 / ATSI000 / D6-51377 Smoke Density & Toxic Gas Emission Test Results			Gas Concentrations (ppm)										
Sample Number	Mode	Test Method	D _s Max Flam Non-F	CO Flam Non-Flam	HCN Flam Non-Flam	HF Flam Non-Flam	HCl Flam Non-Flam	SO ₂ Flam Non-Flam	NO _x Flam Non-Flam				
1		F9 / F10	158	200	10	5	<1	<1	<1				
2			124	200	10	5	<1	<1	<1				
3													
4													
Mean			141	200	10	5	<1	<1	<1				

Smoke Density (Ds) < 150 after 4 minutes flaming.

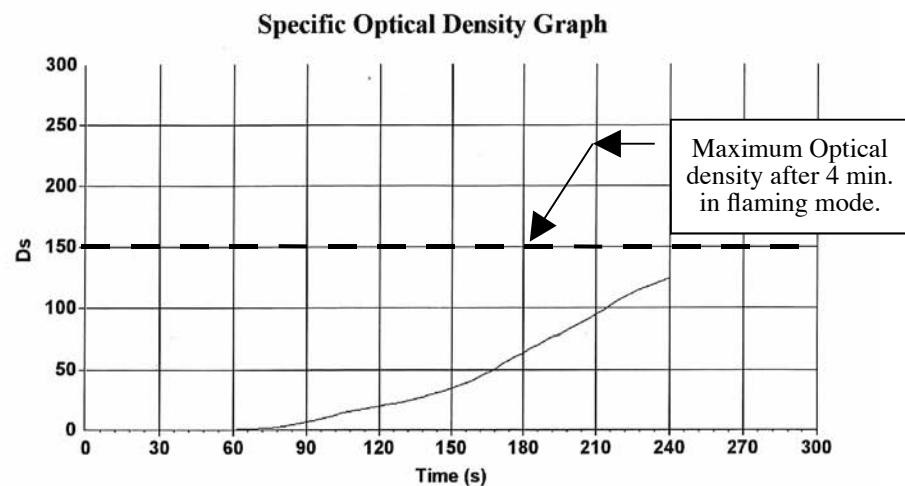
Toxic Gases evolved were significantly less than requirements

LAB.RPT.02/2

Requirement CO < 1000	Requirement HCN < 150	Requirement HF < 100	Requirement HCl < 150	Requirement SO ₂ < 100	Requirement NO _x < 100
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**Smoke Optical Density to: ABD0031 on epoxy laminate with intumescent chemical loading of 200 gsm at surface.
(Flaming Mode D_s 150 after 4 minutes) Result: PASS**

Report produced with the Fire Testing Technology SmokeBox software



Test name : FST3963 FLAM - SAMPLE I
File name : C:\NONFTTSB\DATA\ASTME662\01110014.SBA

Tabulated Results

Time (s)	T (%)	Ds
0	100.0	0.0
30	99.9	0.03984
60	99.6	0.2443
90	89.5	6.387
120	71.2	19.47
150	54.7	34.58
180	33.3	63.12
210	19.1	94.96
240	11.4	124.3

These results relate only to the behaviour of the specimens of the product under the particular conditions of the test; they are not intended to be the sole criterion for assessing the potential smoke obscuration hazard of the product in use.