# A Physical Comparison of Films Used to Encapsulate Aircraft Thermal/Acoustic Insulation

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### Flammability Standards



Horizontal Flame Test

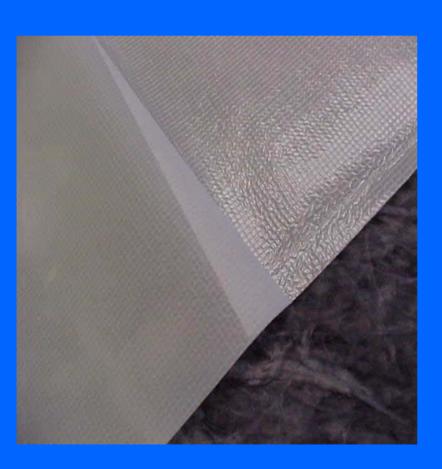
- Vertical Flame Test
  - FAR 25.853(a)
  - FAR 25.855(d)

#### Construction



- Insulation
  - Thermal and AcousticBarrier
- Covering film
  - Encapsulate Batting
  - ContaminationProtection
  - Moisture Protection

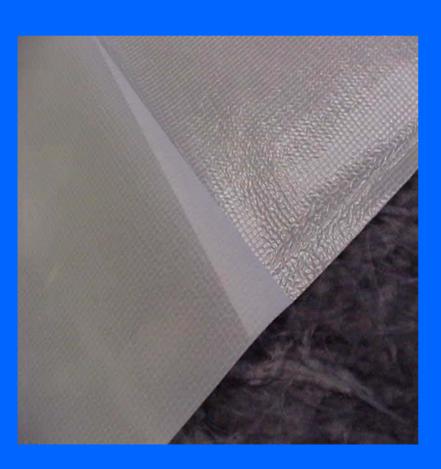
## PET Covering Film



#### Film

- Light Weight
- Chemical Resistance
- Easy to Clean
- Resistance to Moisture Permeance

## PET Covering Film



- Scrim
  - Tear Resistance
  - Burst Strength
- Adhesive
  - Bond Scrim to Film
  - Heat Sealing
  - FR Carrier

## Problem With PET Covering Films

- They Burn
  - PET Not Inherently Flame Resistant
  - May Change Chemically With Time
  - FAR 25.853 & FAR 25.855 Appear to be Inadequate in Predicting In Service Flame Resistance

#### Aircraft Fires

"...there are between three and five in-flight fires causing serious damage on part 121 aircraft in the U.S per year. Most of those occurrences included the spread of fire on the thermal/acoustic film.

Federal Register/Vol. 68, No. 147/Thursday, 7/31/03/Rules and Regulations, pg. 45056

## Inadequacies of Current Standards

#### Swissair 111

"The TSB believes that the use of material, regardless of its location, type or quantity that sustains or propagates fire when subjected to realistic ignition scenarios, constitutes an unacceptable risk, and that,

#### Swissair 111

as a minimum, material used in the manufacture of any aeronautical product should not propagate or sustain a fire in any realistic operating environment."

(TSB, SR 111 final report, p. 280, as reported in "Air Safety Week," 3/03

## Covering Film Flammability Standards

## Covering Film Flammability Standards



#### Final Rule

Department of Transportation Federal Aviation Administration

14 CFR Parts 25, 91, et al.

Improved Flammability Standards for Thermal/Acoustic Insulation Materials Used in Transportation Category Airplanes; Final Rule

### Final Rule

- PET Films
  - Generally Non-Compliant
- PVF Films
  - Generally Compliant
- Polyimide Films
  - Generally Compliant



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#### **NPRM**

"...determined that some materials that would meet the proposed test requirements...weigh no more than materials currently being installed in newly-produce airplanes."

Federal Register/Vol 65, No. 183/Wednesday, 9/20/00/Proposed Rules, Pg 56997

## Weight Penalty

### Weight Penalty

PET Covering Films\*

**PVF Covering Films** 

17 g/m<sup>2</sup> (0.5 oz/yd<sup>2</sup>) to 47.6 g/m<sup>2</sup> (1.4 oz/yd<sup>2</sup>)

30 g/m<sup>2</sup> (0.9 oz/yd<sup>2</sup>) to 47.6 g/m<sup>2</sup> (1.4 oz/yd<sup>2</sup>)

\* Vast majority in the 17-30 g/m<sup>2</sup> range

## Weight Penalty

#### Additional Aircraft

Weight Penalty

Aircraft #1

Aircraft #2

Aircraft #3

Aircraft #4

32 kg (70#)

64 kg (140#)

68 kg (150#)

91 kg (200#)

## Comparison #1

	<u>PVF</u>		<u>APK</u>	
	Ex. 1	Ex. 2	Ex. 1	Ex. 2
Flammability				
-Radiant panel	Pass		Pass	
-12 sec. Vertical	Pass		Pass	
Smoke Density	Pass		Pass	
Toxicity	Pass		Pass	

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## Comparison #2

	<u>PVF</u>		<u>APK</u>	
	<u>Ex. 1</u>	Ex. 2	Ex. 1	Ex. 2
Film				
Thickness (mm)	12.5	12.5	6.3	6.3
Weight (g/m <sup>2</sup> )	42.4	33.5	23.1	17.0
Puncture (N)	80.4	56.2	40.9	29.0
Burst (KN/ m <sup>2</sup> )	506.0	390.0	320.0	208.0

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## Conclusion

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