

Cargo Liner Flame Penetration and Insulation Burnthrough Test Hierarchy Study

Presented to: IAMFTWG

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**Federal Aviation
Administration**

Objective

- Determine the difference in test method severity between Cargo Liner Burnthrough Test (25.855) and Insulation Burnthrough Test (25.856b)
- Results will be used to help develop test method hierarchy for new rule

Parameter	Cargo Liner Test	Insulation Burnthrough Test
Fuel Flow Rate (GPH)	2.0 ± 0.1	6.0 ± 0.1
Air Mass Flow Rate (SCFM)	52	65
Burner Orientation	Vertical	30° from horizontal
Flame Temperature (°F)	1600	1900
Thermocouple Distance (in.)	8 ± 0.125	4 ± 0.125
Test Sample Distance (in.)	8 ± 0.125	4 ± 0.125
Backside Heat Measurement	Thermocouple	Gardon Gauge
Backside Measurement Distance (in.)	4 ± 0.125	12



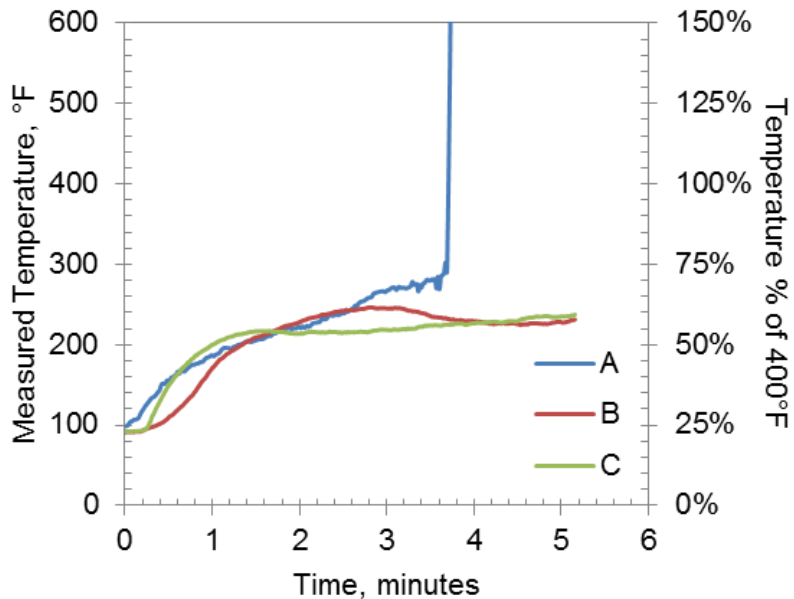
Test Details

- **Three materials were chosen for this evaluation**
 - Material A: Non-cargo liner composite
 - Materials B,C: Cargo liner materials
- **Tests were performed in accordance with Fire Test Handbook**
 - Cargo Liner Test Chapter 8 Supplement
 - Insulation Burnthrough Test AC25.856-2A with igniterless stator and picture frame

Test Sample	Reinforcement	Resin	Thickness (in.)
Material A	Cotton fabric	Phenolic	0.25
Material B	Glass fiber	Polyester	0.035
Material C	Glass fiber	Phenolic	0.013

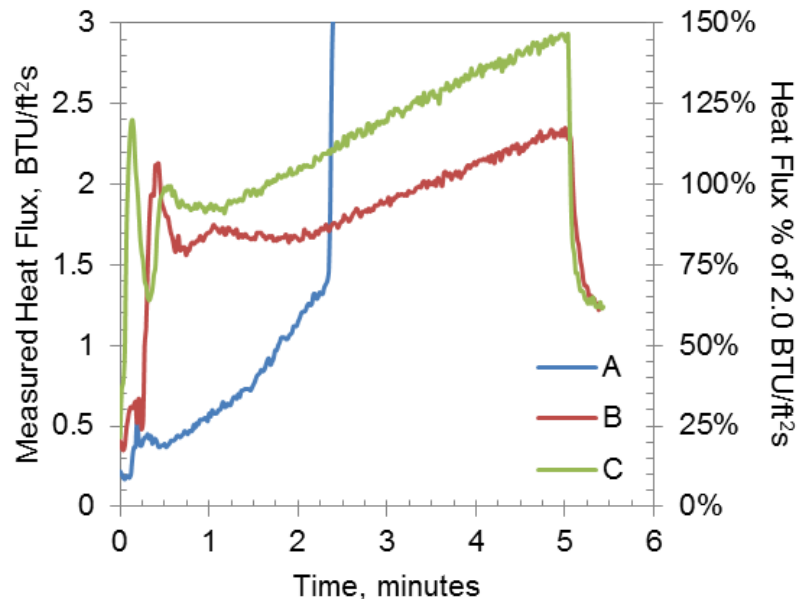


Cargo Test Results



A is a single test
B, C are average of 5 tests

Insulation Test Results (Picture Frame)



A, B, C all individual tests (non-averaged)



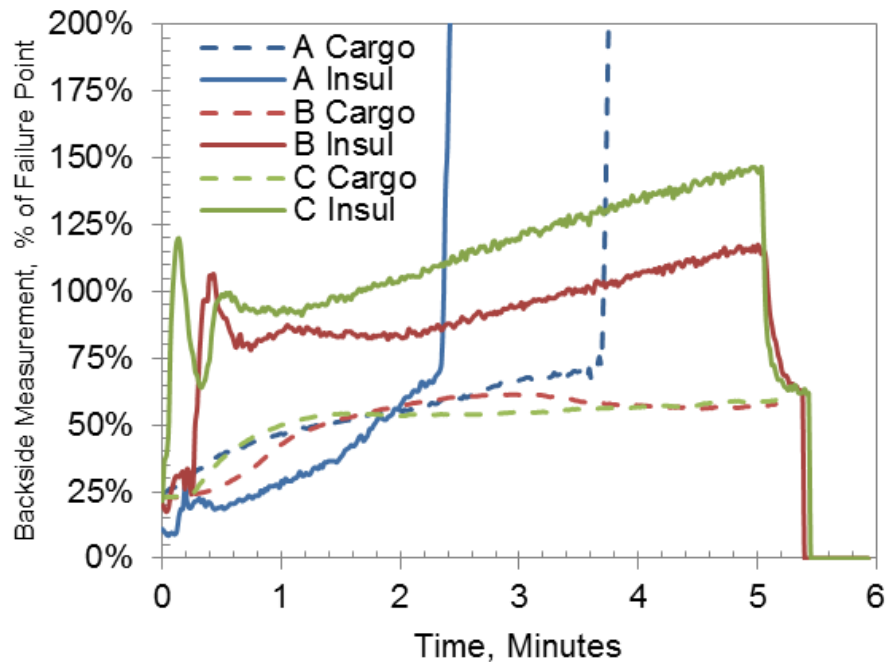
Insulation Burnthrough Test – Picture Frame

Material B



Material C

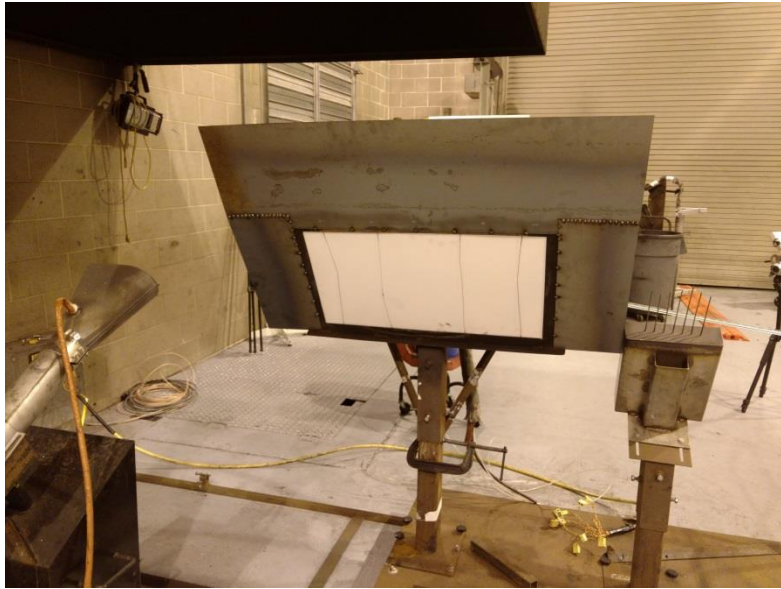




Test Sample	Failure Time Cargo, sec.	Failure Time Insulation, sec.	More Severe Test
Material A	222	138	Insulation
Material B	Pass	23	Insulation
Material C	Pass	5	Insulation



Picture Frame Shield



- Shield constructed to prevent flames from igniting vapors on back side
- 48 inches wide by 32 inches tall
- Insulated with ceramic fiber insulation to prevent metal surface from radiating towards heat flux gauge



Insulation Test – Picture Frame w/Shield

Material B

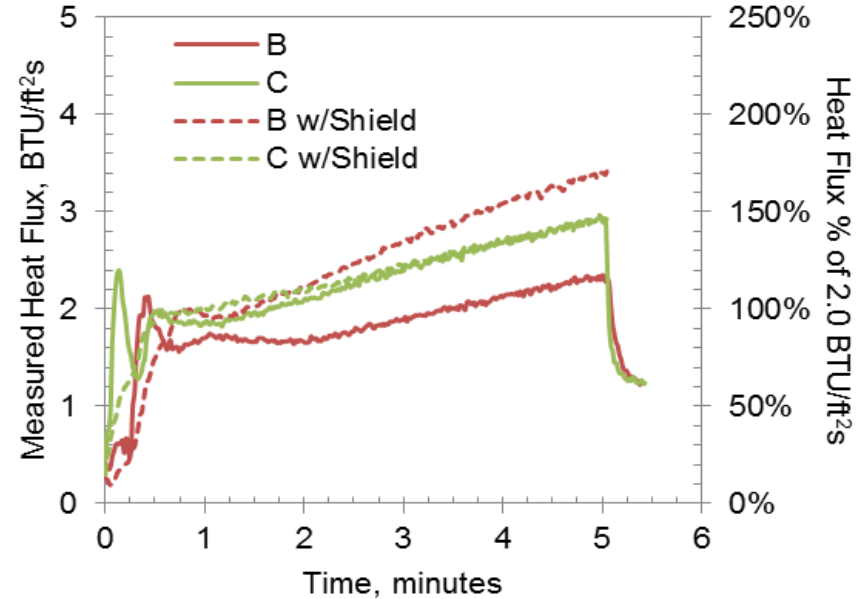


Material C

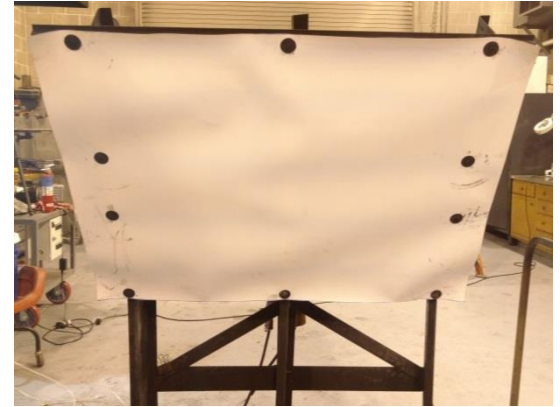
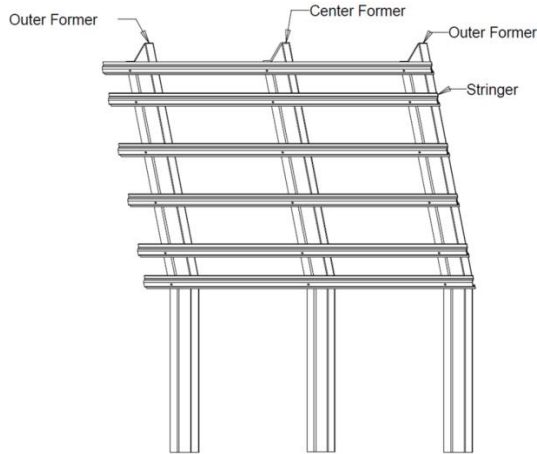
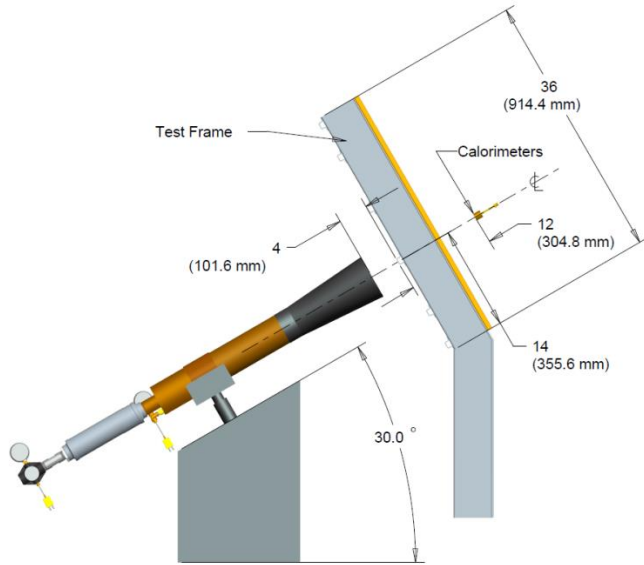


Picture Frame Shield Results

Test Sample	Failure Time, sec.	Failure Time w/Shield, sec.
Material B	23	45
Material C	5	46

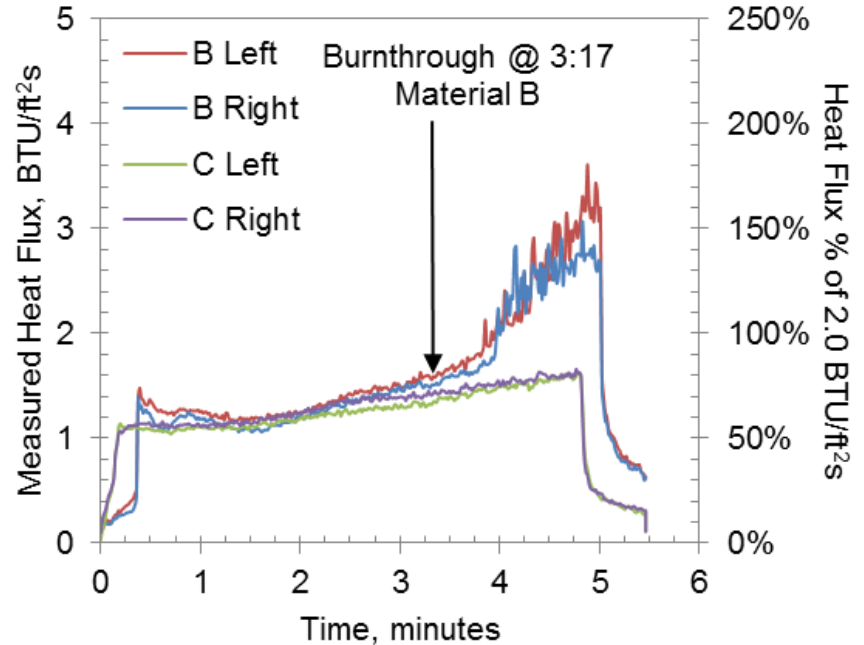


Insulation Burnthrough Test Rig



Burnthrough Rig Test Results

- **Material B** burned through at 3:17
- **Material C** passed for burnthrough and heat flux
- Influence of test rig significant on heat flux measurements



Insulation Test – Burnthrough Rig

Material B



Material C



Summary

- **Overall, insulation burnthrough test is more severe than cargo liner test**
- **Various configurations tested**
 - Picture frame adequate, but backside flashing can occur
 - Modified picture frame with shield can prevent backside flashing
 - Insulation BT Rig presented a more severe case for Material B and less severe case for Material C
- **Test results suggest that the insulation burnthrough test can be used to show compliance with the cargo liner test per the proposed hierarchy**
 - Conversely, the liner test is not as severe and should not be considered equivalent for demonstrating fuselage burnthrough protection

