Next Generation Fire Test Burner for Powerplant Fire Testing Applications

International Aircraft Systems Fire Protection Working Group
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Steve Summer
Steve Rehn
Federal Aviation Administration
Fire Safety Branch
http://www.fire.tc.faa.gov
Background

- Currently specified oil burners are no longer commercially available
- Industry is left with the propane burner, however this burner has been shown to be less severe than an engine flammable fluid flame
- FAA Tech Center Fire Safety Branch has been tasked by Transport Airplane Directorate to develop burner performance standards for the next-generation fire test burner for powerplant fire testing
  - New burner should be much easier to calibrate, provide more consistent results, and be readily available for industry use.
Current Status - Testing

• Searching for additional non-metallic materials to test in a round robin with objectives of
  – Utilizing results to ensure proper settings of sonic burner
  – Ensure consistency of testing within lab using sonic burner
  – Ensure repeatability across burners at various labs
Burner Settings

- Nozzle: 80° B 2.0 gph
- Flow-checked 2.00 gph @ 102 psi
- Air Pressure: 50 psi
- Copper Tube Heat Flux (3 test average): 5111.3 Btu/hr
- Temperature check (first 3 tests with brand new 1/8” exposed-bead thermocouples

![Temperature Check Chart]

<table>
<thead>
<tr>
<th>TC 1</th>
<th>TC 2</th>
<th>TC 3</th>
<th>TC 4</th>
<th>TC 5</th>
<th>TC 6</th>
<th>TC 7</th>
<th>TC Avg.</th>
</tr>
</thead>
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</tr>
</tbody>
</table>

- Conference Data
- Test 1
- Test 2
- Test 3
# 17” x 17” Test Samples

<table>
<thead>
<tr>
<th>Material</th>
<th>Burn Through Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>4872-18 1-Ply Carbon Fiber*</td>
<td>15:00, Did not burn through, Backside burning at beginning</td>
</tr>
<tr>
<td>4872-28 2-Ply Carbon Fiber*</td>
<td>15:00, Did not burn through, Backside burning at beginning</td>
</tr>
<tr>
<td>4872-38 3-Ply Carbon Fiber*</td>
<td>15:00, Did not burn through</td>
</tr>
<tr>
<td>4846-1B 1-Ply Fiberglass*</td>
<td>15:00, Did not burn through, Backside burning at beginning</td>
</tr>
<tr>
<td>4846-2B 2-Ply Fiberglass*</td>
<td>15:00, Did not burn through</td>
</tr>
<tr>
<td>4846-3B 3-Ply Fiberglass*</td>
<td>15:00, Did not burn through</td>
</tr>
<tr>
<td>10 Ply Carbon Composite (@2 in. burner distance)</td>
<td>15:00, Did not burn through</td>
</tr>
</tbody>
</table>

*Material also tested at NIAR (Carlin burner with vibration), producing similar results*
# 24” x 24” Test Samples

<table>
<thead>
<tr>
<th>Material</th>
<th>Burn Through Time</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-Ply Fiberglass cargo liner</td>
<td>15:00</td>
<td>Did not burn through</td>
</tr>
<tr>
<td>1-Ply Fiberglass cargo liner</td>
<td>15:00</td>
<td>Did not burn through</td>
</tr>
<tr>
<td>¼” Honeycomb panel</td>
<td>15:00</td>
<td>Did not burn through</td>
</tr>
</tbody>
</table>

• 2-Ply Fiberglass Cargo Liner

• ¼” Honeycomb Panel
10-Ply Carbon Composite Test
Start of Test
10-Ply Carbon Composite Test @ 5 Minutes
10-Ply Carbon Composite Test

Backside – 5 minutes

Backside – 10 minutes
10-Ply Carbon Composite Test @ 15 minutes
10-Ply Carbon Composite Test Post Test
Current Status - Testing

- Due to difficulty of finding non-metallic materials that will provide consistent burnthrough results, two proposed options moving forward:
  - Test with pressure on the sample
    - This will likely yield failures, however also introduces an additional test variable into the round robin testing
  - Test varying thicknesses of aluminum
Current Status - Regulatory

- Industry-led group has been meeting regularly
- Decided on a list of ‘top-10’ items that need to be addressed in rewrite of AC20-135

1. Burner, Flame Temperature
2. Flame Calibration, Method
3. Post-test Burning / Backside Ignition
4. TC’s (size, type, number)
5. Test Pass/Fail Criteria, including TSO hoses
6. Definition: Fireproof; Fire resistant; Heat Flux
7. Environ / Op conditions
8. Panel Size
9. Vertical Propane Burner
10. Harmonize with Other Specs/References
Current Status - Regulatory

• Authorities group held face-to-face meeting March 28-30
  – Completed initial review of 65 industry comments
  – Moving forward will work to incorporate changes into a revision of AC20-135 with possible industry participation/assistance to be requested
  – Draft policy memo regarding the use of the Propane Burner is in the works
Questions?

Contact Information:

Steve Summer
609-485-4138
Steven.Summer@faa.gov

Steve Rehn
609-485-5587
Steven.Rehn@faa.gov