Update for Oil Burner Testing of Powerplant Components

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http://www.fire.tc.faa.gov
Current Status/Plan

1. SAE Thermocouple Round Robin Testing
2. Composite material testing round robin
3. Conduct internal comparative testing of Park vs Sonic
4. Heat flux comparison testing of propane vs oil burner
TC Round Robin

• **Objective is to investigate effect on temperature readings caused by:**
  - Sheath diameter and wire gauge
  - Exposed junction vs sheathed
  - Thermocouple age

• **Four T/C types to be evaluated**
  - 1/8” exposed junction
  - 1/8” Grounded/Sheathed
  - 1/16” exposed junction
  - 1/16” Grounded/Sheathed
TC Round Robin

• Park burner was used for testing and calibrated to AC 20-135 requirements
  – 2000 F and 4500 Btu/hr

• TC’s were exposed to flame for 20 cycles
  – 6 minutes per cycle (flame exposure)

• Data shown for #3 TC only to simplify graph
T/C Round Robin

Temperature Measured by #3 Thermocouple

Delta T between Initial and Final Flame Exposure for each Thermocouple Type

- 1/8" Exposed
- 1/8" Sheathed
- 1/16" Exposed
- 1/16" Sheathed
TC Round Robin Summary

- 1/8” sheathed showed the largest drop in temperatures after cycling
- 1/16” sheathed showed the smallest drop in temperature after cycling
- Smaller diameter TC’s read higher temperatures compared to larger TC’s
- Unsheathed TC’s read higher temperatures compared to sheathed TC’s of the same diameter
Composite Material Evaluation (Spirit Aero)

- Investigate to determine if this test may be used as a means of comparing burner flame intensity from lab to lab
- Attempt to improve test result reproducibility
- Utilizes a cantilevered weight mounted to the back of the composite panel
- Burnthrough occurs at the time of weight detachment
- More precise method of indicating burnthrough rather than visually determining burnthrough which is more subjective

(Images and graphics from Spirit AeroSystems)
Spirit Aero Composite Test Panel
Comparative Testing with Park Burner

- Purpose is to develop FAA recommended settings and configuration for Sonic burner for use in powerplant testing applications.
- FAA’s Park oil burner will be operated using current AC 20-135 calibration requirements and utilized the baseline.
- Temperature, heat flux, and material testing will be the basis for comparing the two burners.

| TexTech PAN Felt | 0.125” 2024-T3 Aluminum |
Comparative Testing with Park Burner

- Sonic burner operating parameters will be adjusted such that it will be equivalent to the Park burner
- Internal configuration of Sonic burner will utilize the same parts and setup as all other Sonic burner material test methods
- Sonic burner will then be added to the chapters in the Fire Test Handbook which pertain to powerplant testing
Propane vs. Oil Burner Heat Flux

• Industry is currently utilizing legacy oil and propane burners
• Propane burners have shown to be less severe than an engine flammable fluid flame
• FAA is recommending oil burners be used for all powerplant tests
• Plan to perform comparative testing of heat flux for propane and oil burner
• Purpose is to demonstrate propane is not equivalent to oil burner flame
Questions?

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