



**Federal Aviation
Administration**

International Aircraft Materials Fire Test Forum

Insulation Burner Testing and Updates, Insulation Burner Video Update

Presented to: International Aircraft Materials
Fire Test Forum

By: Tim Salter, FAA Technical Center

Date: April 19-20, 2021



Insulation Burnthrough Update



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Background

- **Continuing to rework and refine the Sonic burner for insulation burnthrough using the igniterless stator and updated fuel nozzle type to improve test repeatability**
- **Current burner setting utilizes the igniterless stator and an air pressure setting of 65 psi in conjunction with a Delevan type-B, 6.0 gal/hr fuel nozzle**
- **Recent testing has shown this configuration may not produce equivalent test results as previous burner configurations**



Initial Testing

- **Configure Sonic burner to original style using internal igniters on stator and Monarch 5.5 gal/hr fuel nozzle at 60 psi air pressure**
- **Test to develop new baseline data created using new insulation blanket material from Triumph Insulation to measure heat flux on backside of the test sample**
- **TexTech burnthrough samples also tested for burnthrough times**



Initial Testing

- **Baseline data will be used as the bench mark for the updated igniterless burner configuration**
- **Removing the igniters and wires from inside the draft tube makes for a less turbulent airflow emitted from the burner**
- **Multiple combinations of air pressure settings and fuel nozzle types will be test to best match the baseline test results to maintain equivalency of the test method**



Initial Testing

- **Original air pressure setting of 60 psi used as starting point**
- **Test burner air pressures at 55, 60 and 65 psi**
- **Three different Delevan fuel nozzles tested**
 - Type B (solid spray pattern)
 - Type A (hollow spray pattern)
 - Type W (general/combo spray pattern)
- **Delevan fuel nozzles selected for quality and uniform spray pattern consistency**
 - More uniform flame, more repeatable test results



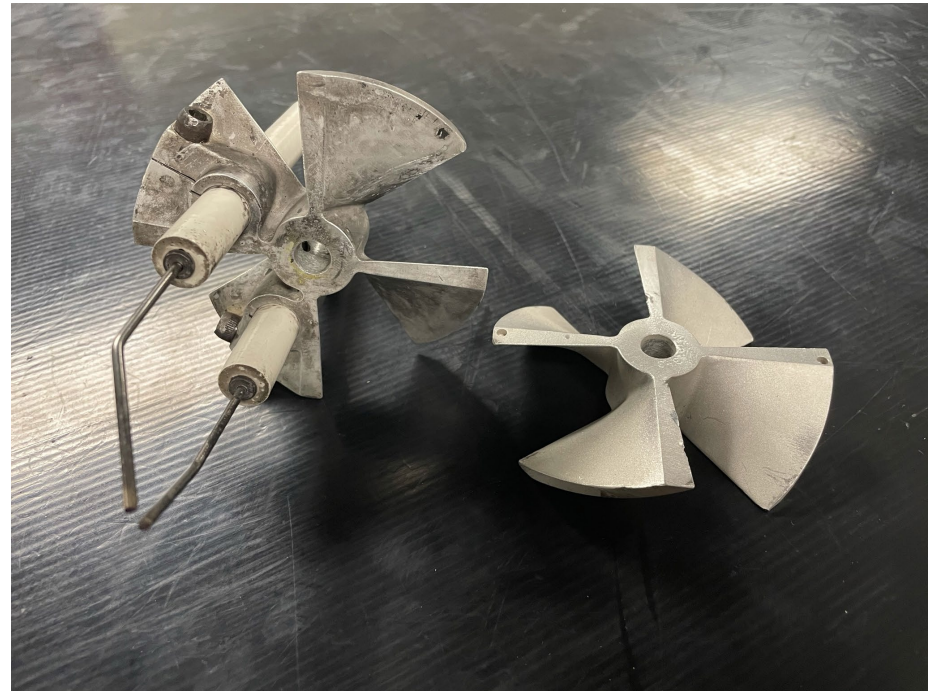
Initial Testing

- **A total of 9 different possible combinations of air pressure and fuel nozzles were tested**
- **Comparison of flame validation temperatures**
 - Old vs. new configuration
- **TexTech felt material tested for burnthrough time**
 - 3 samples of the TexTech 8759 tested per configuration
- **Compare average burnthrough times for each configuration to baseline test data for equivalency**

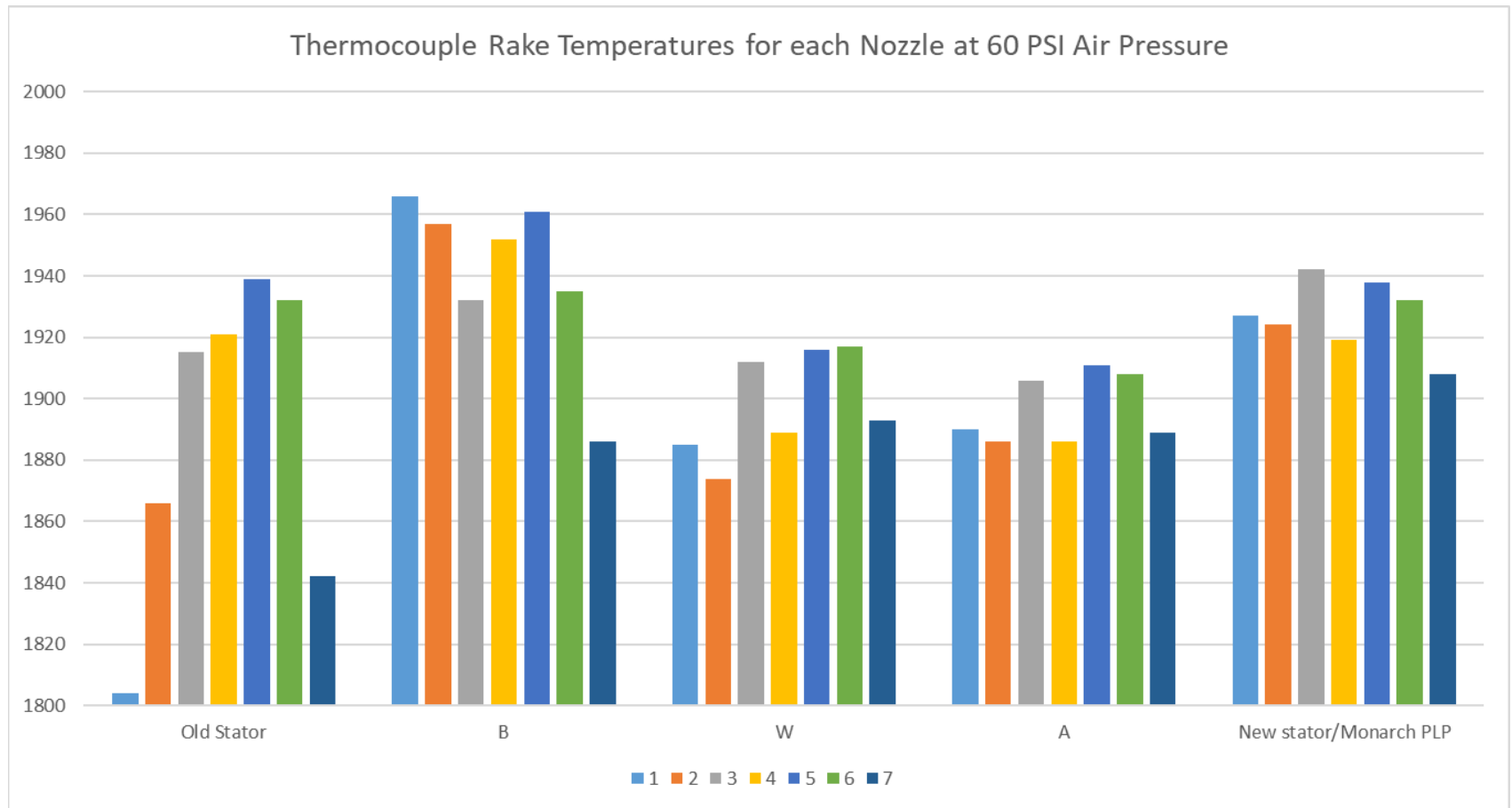


Igniterless Stator Side Note...

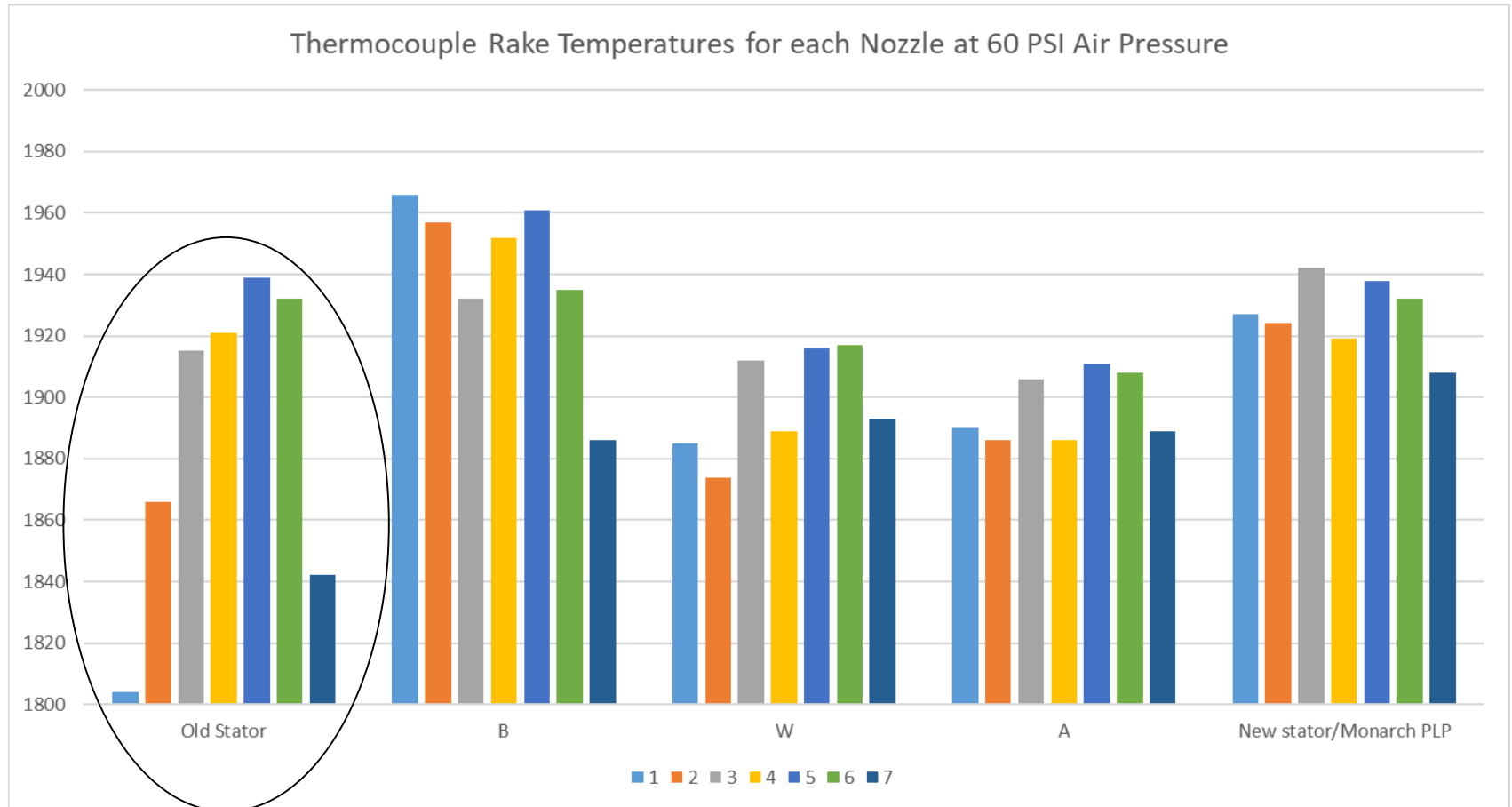
- Reusing the original monarch fuel nozzle with the new igniterless stator resulted in both an increased flame temperature and longer burnthrough time as compared to the stator with the internal igniters
- It is likely that the turbulent airflow created by the internal igniters and wires with the original stator configuration creates a more turbulent airflow emitted from the burner and results in a mechanical working of the sample material leading to a reduced burnthrough time



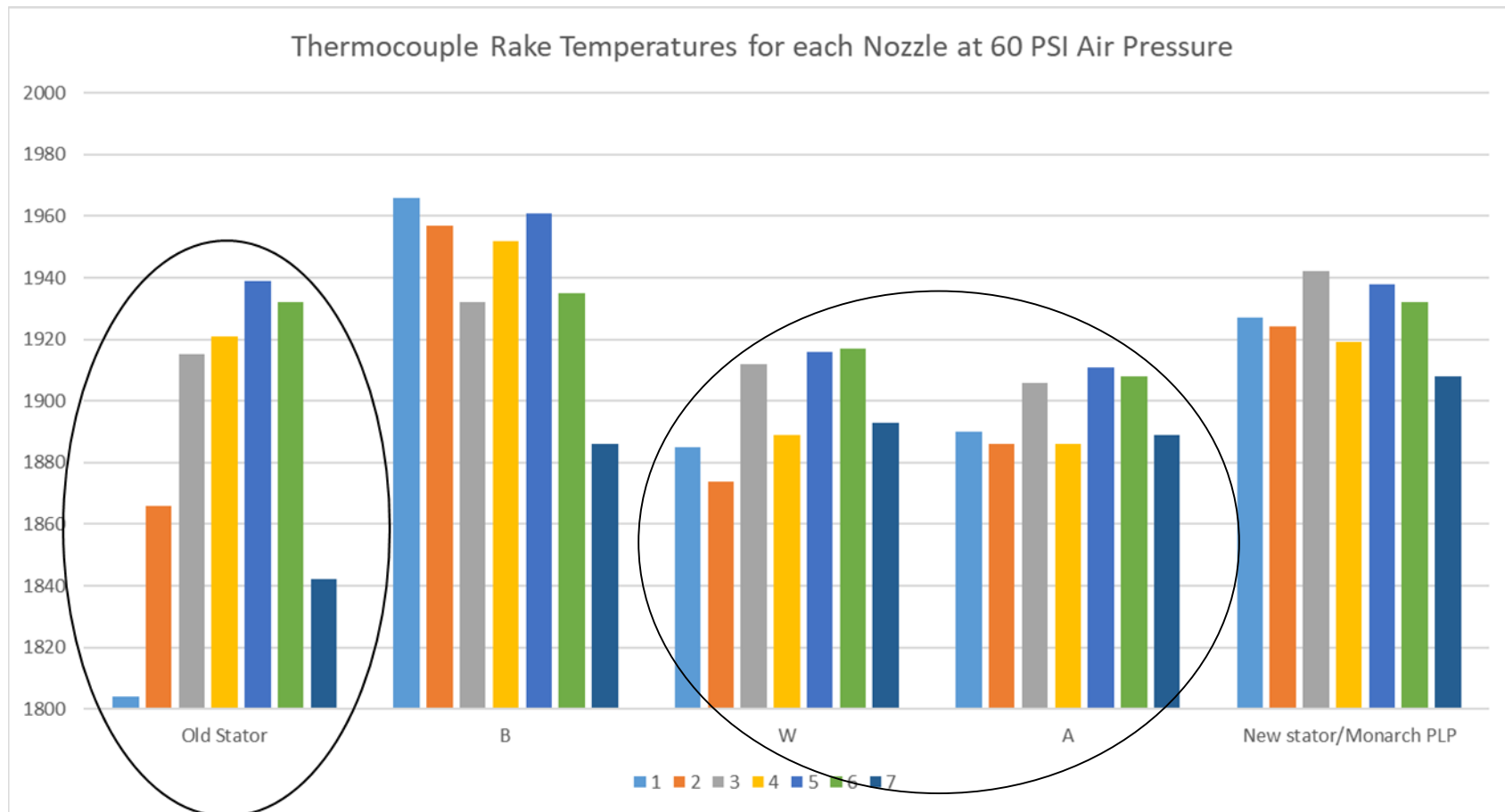
Flame Temperature



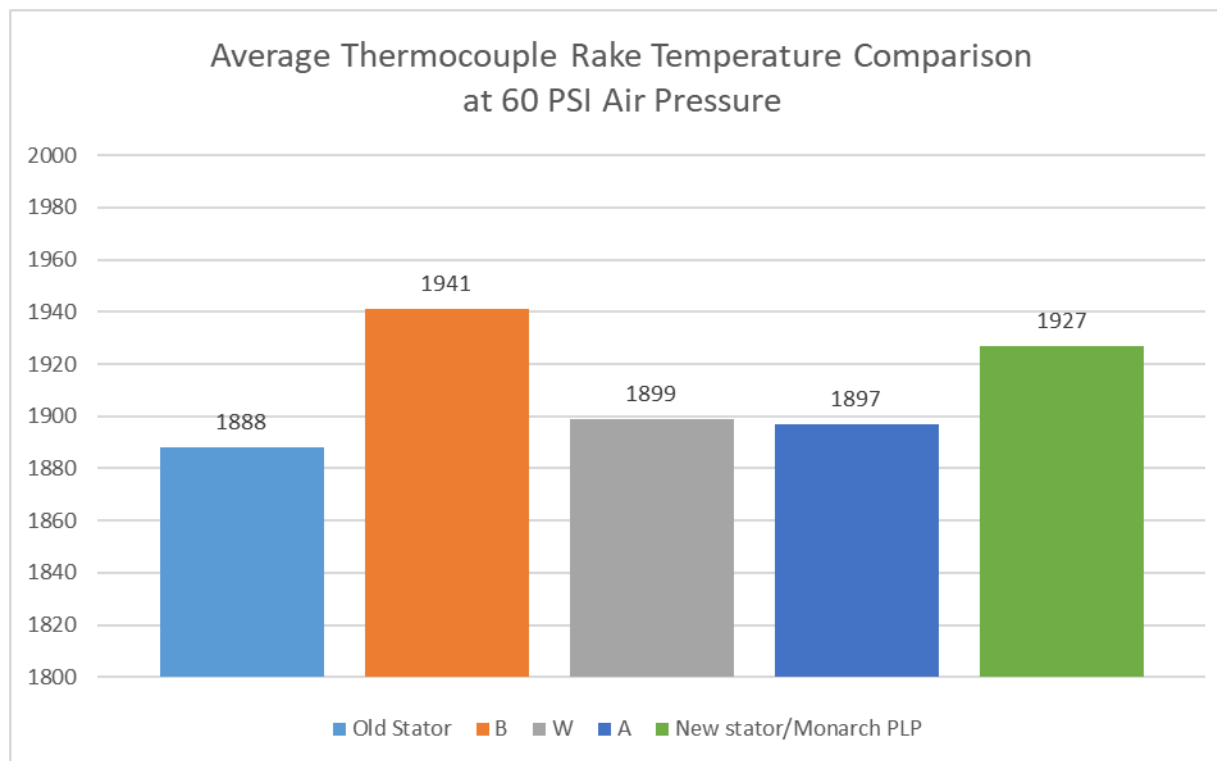
Flame Temperature



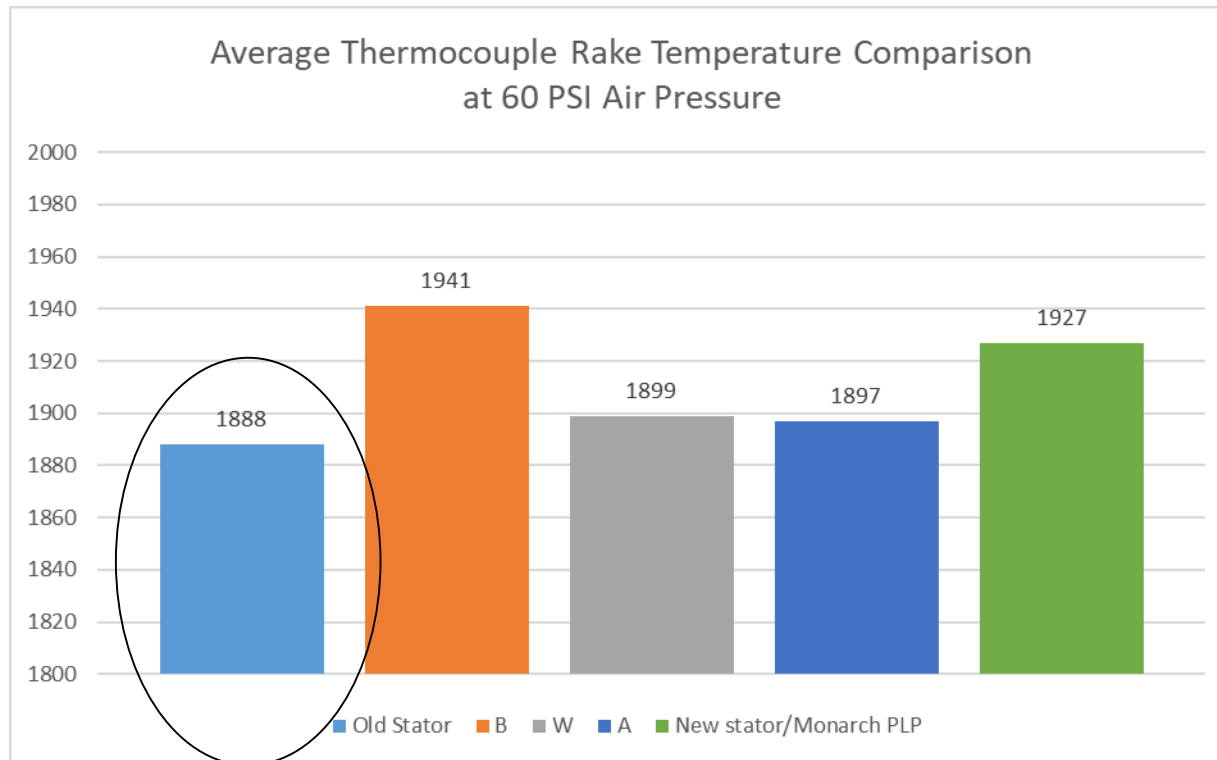
Flame Temperature



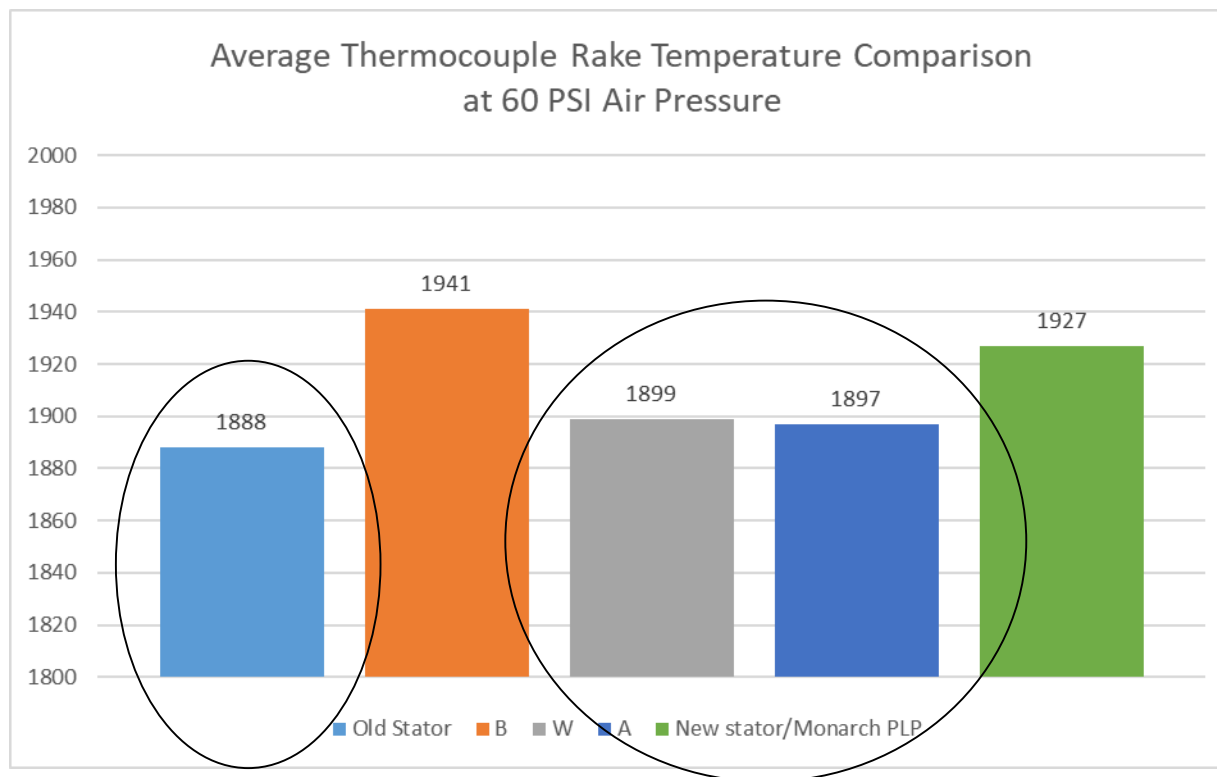
Flame Temperature



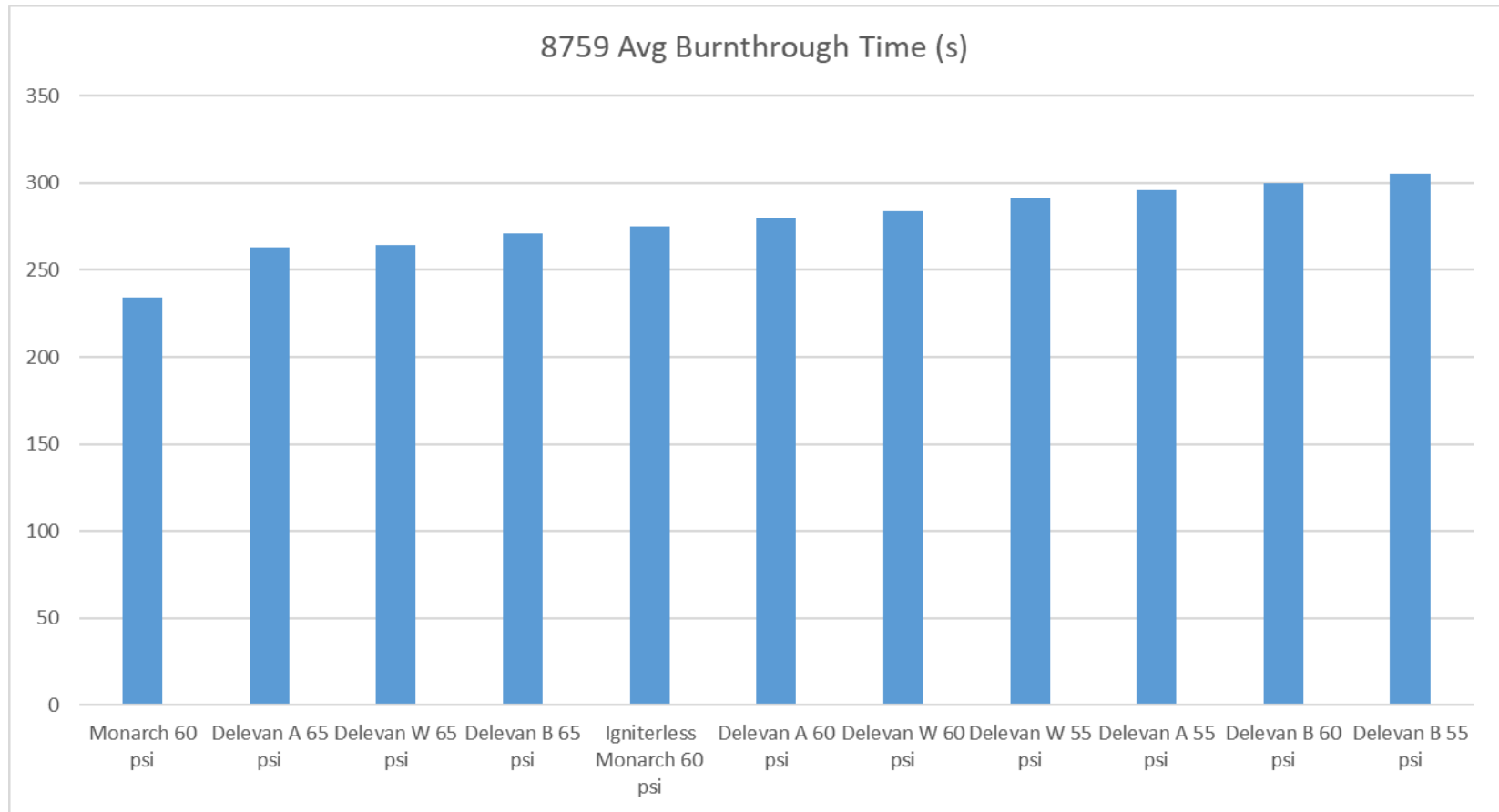
Flame Temperature



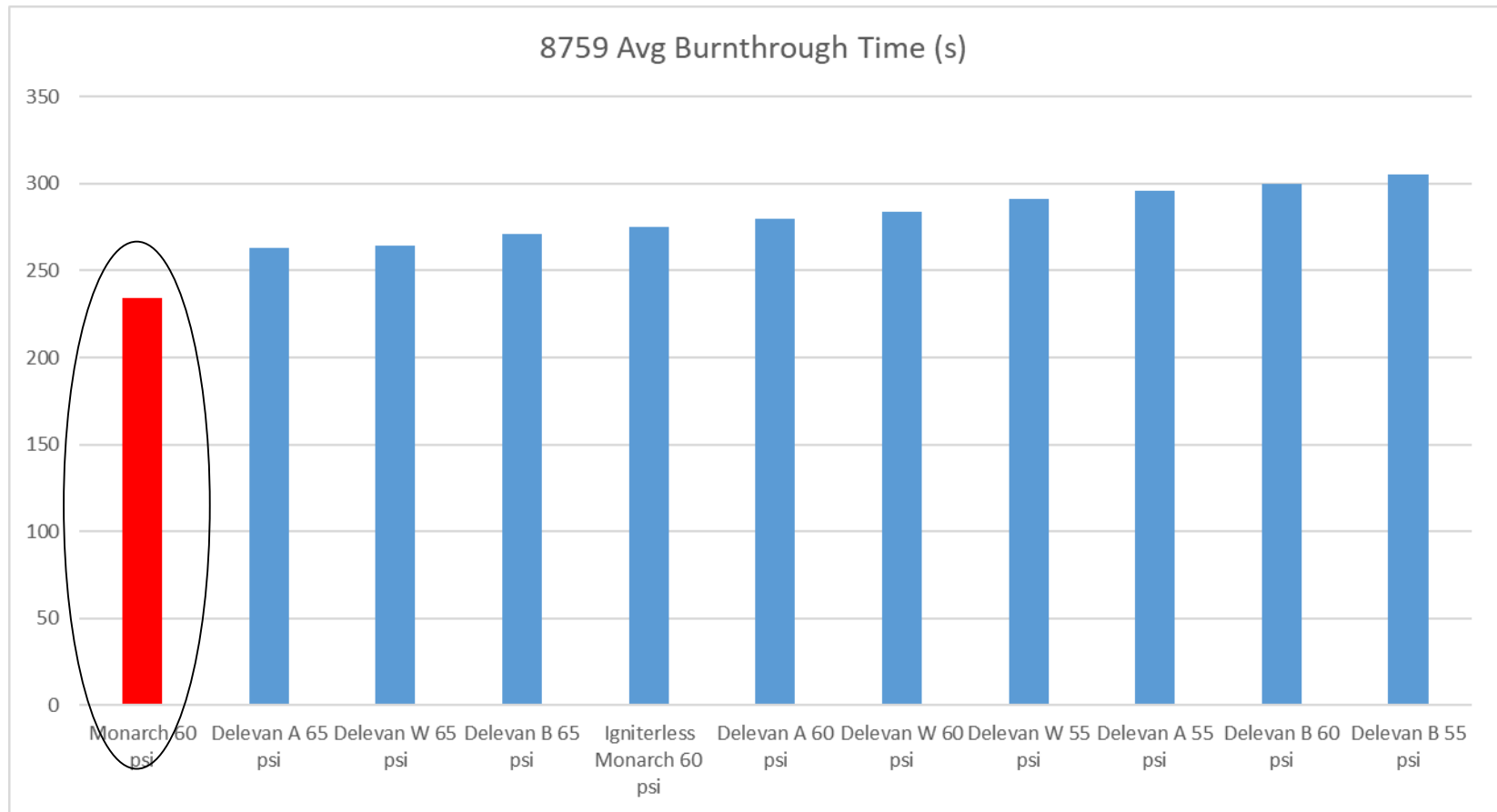
Flame Temperature



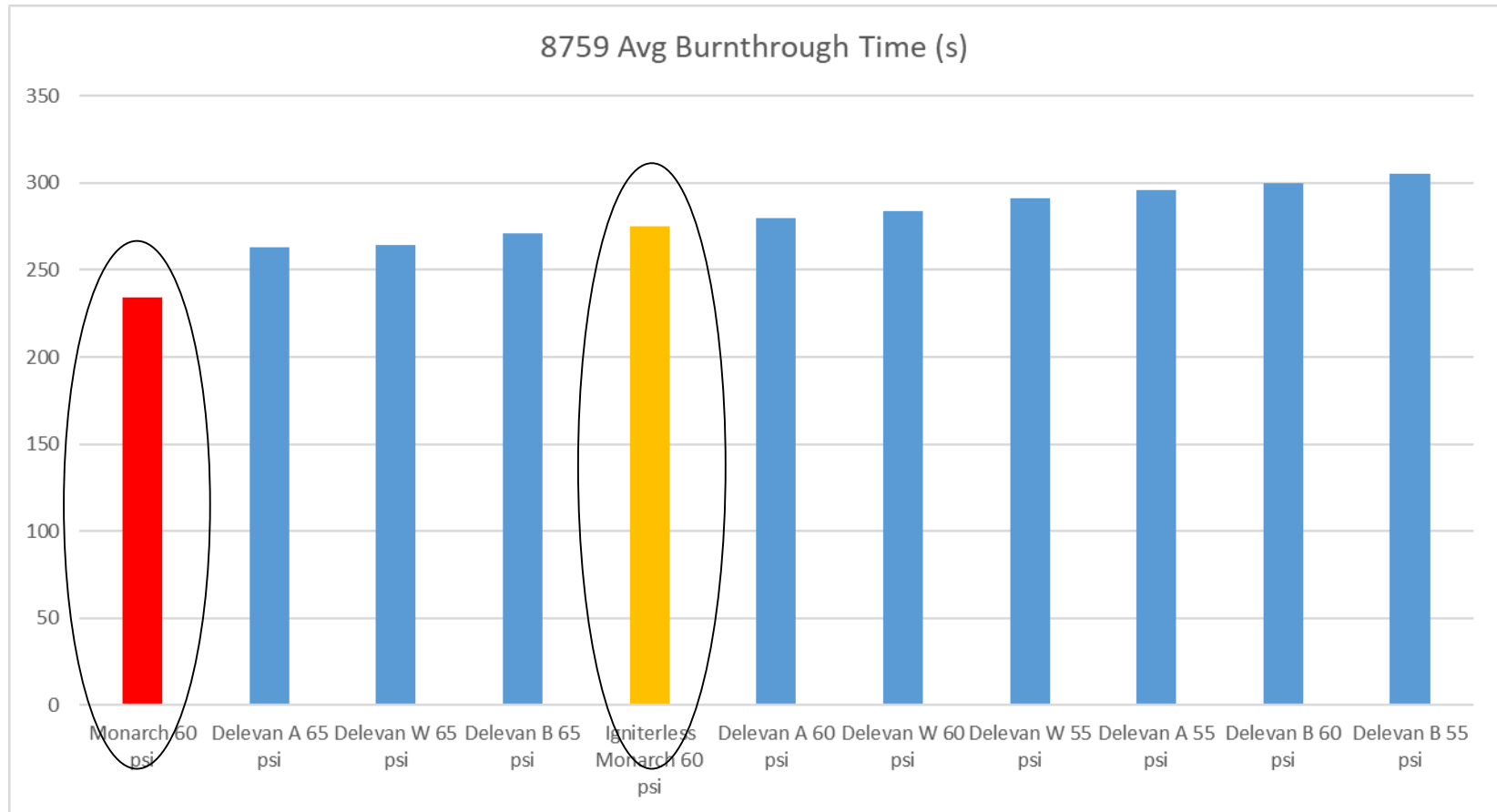
TexTech 8579 Burnthrough



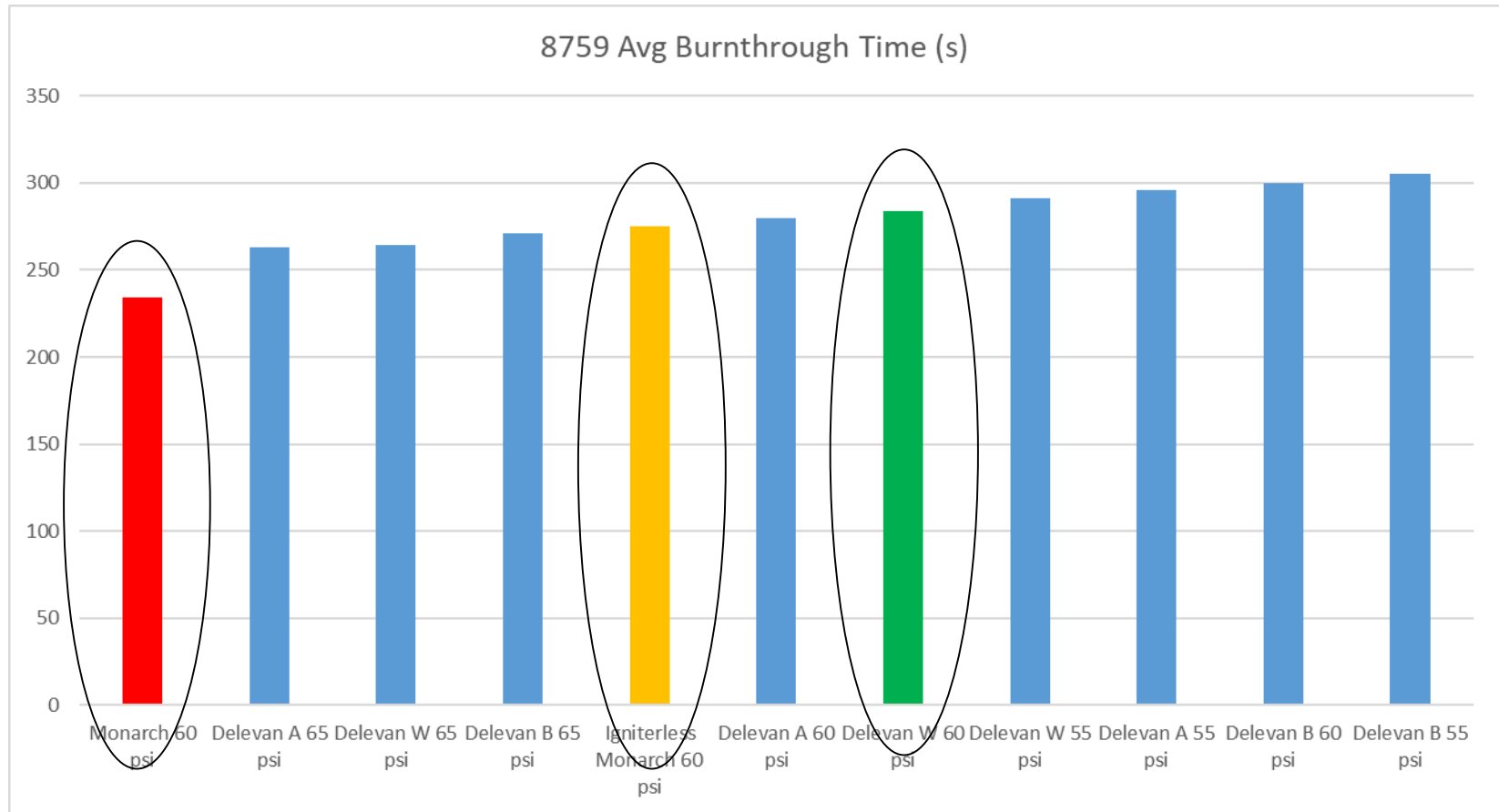
TexTech 8579 Burnthrough



TexTech 8579 Burnthrough



TexTech 8579 Burnthrough



Test Result Overview

- **Compare temperature and burnthrough test times**
 - Accuracy to baseline results, repeatability, etc.
- **TexTech testing leads up to actual insulation blanket testing based measuring heat flux and burnthrough time if applicable**
- **Burnthrough times are longer using igniterless stator regardless of air pressure setting or fuel nozzle type**



Test Result Overview

- **No clear choice for a new configuration based on TexTech burnthrough times**
- **Delevan W-type fuel nozzles produced similar burner flame temperatures as original igniterless stator/Monarch nozzle, so does Delevan Type-A**
- **Based on all collected data and previous testing results, it was decided to initially test the insulation blanket materials operating the burner at 60 psi air pressure and utilizing the Delevan type-W fuel nozzle**
 - Delevan type W nozzle has similar spray pattern to original Monarch fuel nozzle
- **The Delevan type-W is a hybrid/combination of the hollow A-type nozzle and the solid B-type nozzle**
- **Due to limited sample material supply, only two insulation blanket tests were possible at the time**

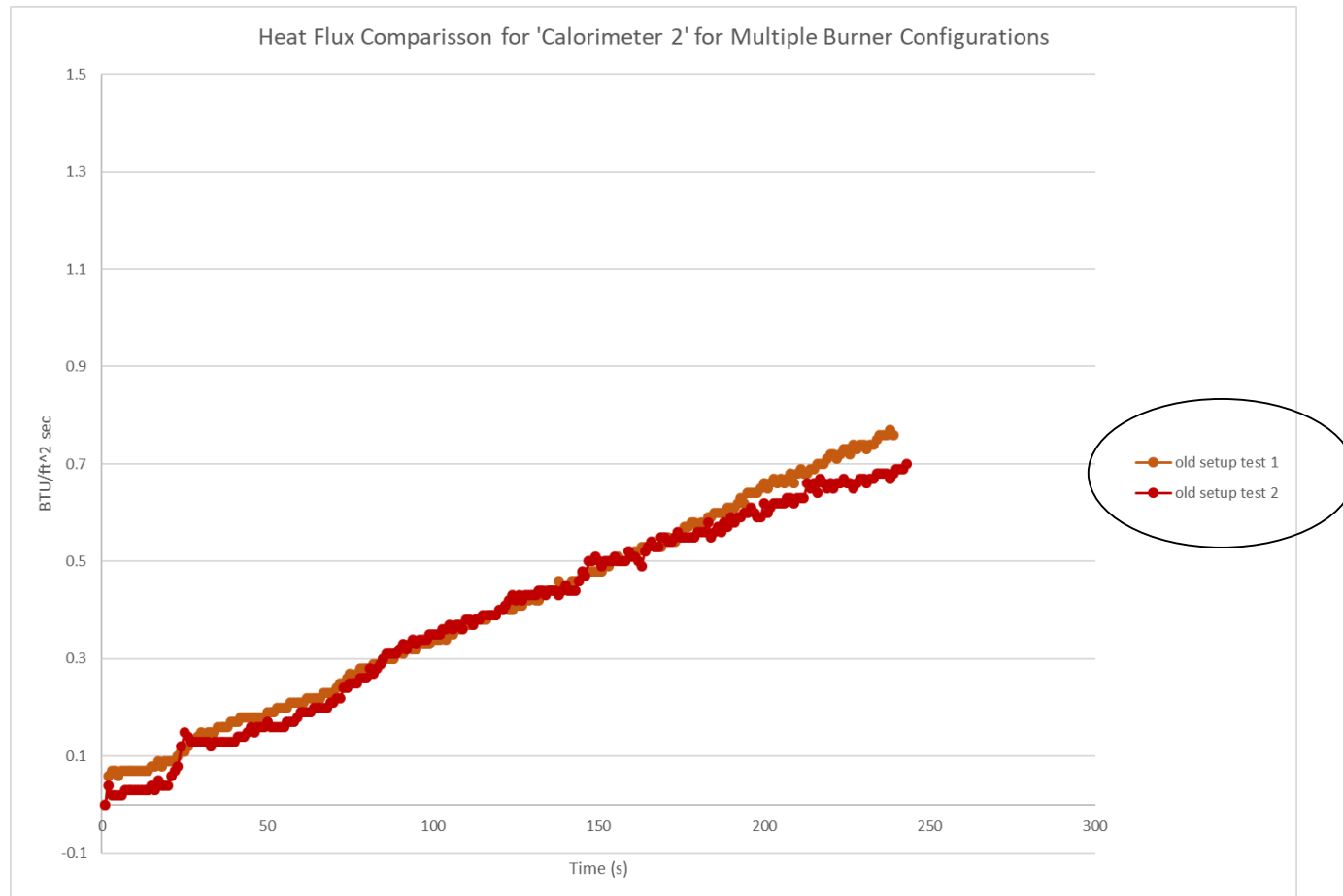


Test Result Overview

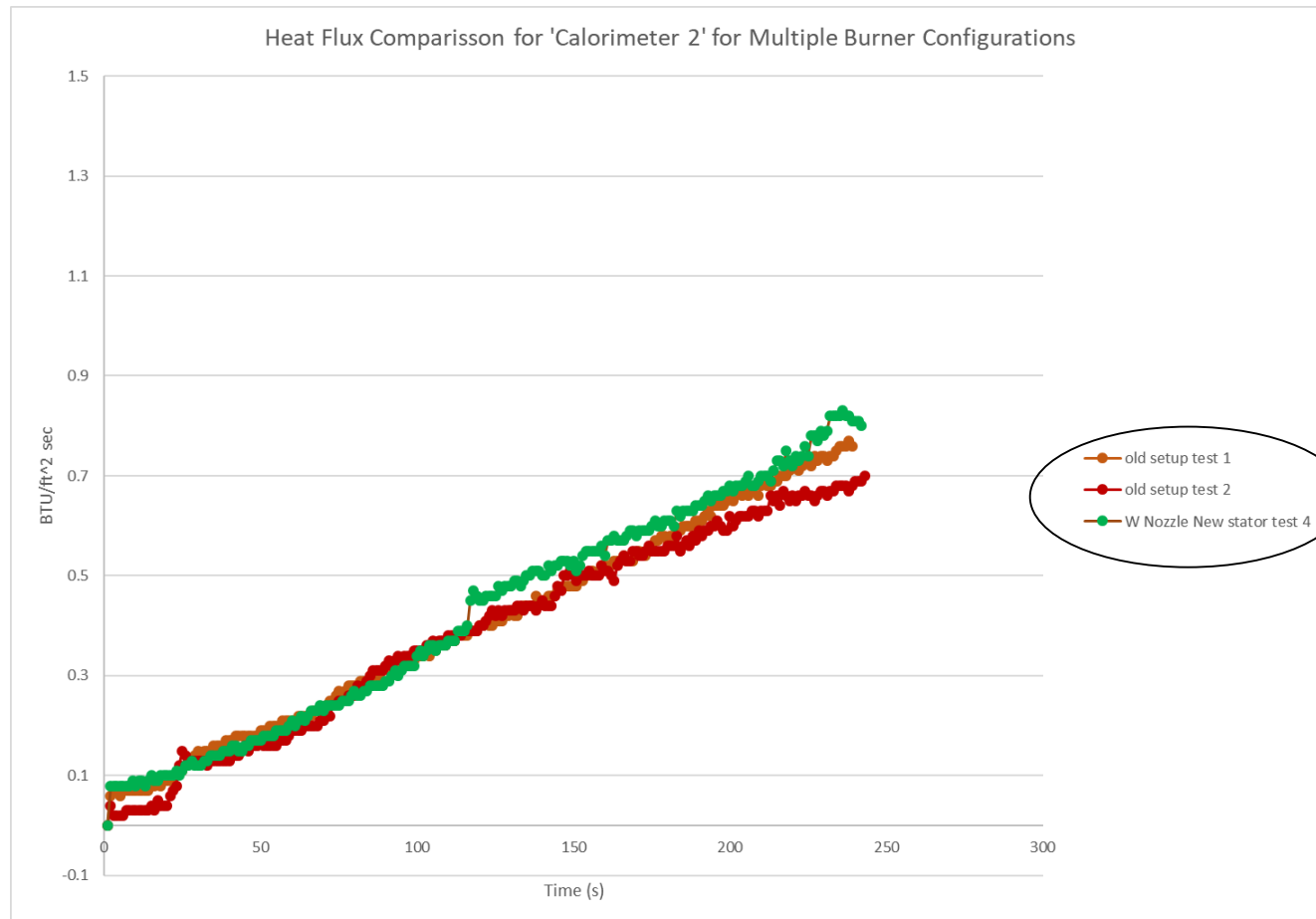
- **The same insulation blanket construction used in the original baseline testing was used with the updated igniterless Sonic burner configuration**
 - Delevan type-W fuel nozzle, 60 psi air pressure
- **As with the baseline, no burnthrough of the samples occurred**
- **The recorded heat flux measurements from the back face of the test sample was compared to the original baseline data**
- **The following graphs show heat flux on the back side of the sample isolated to ‘calorimeter 2’ for simplicity**



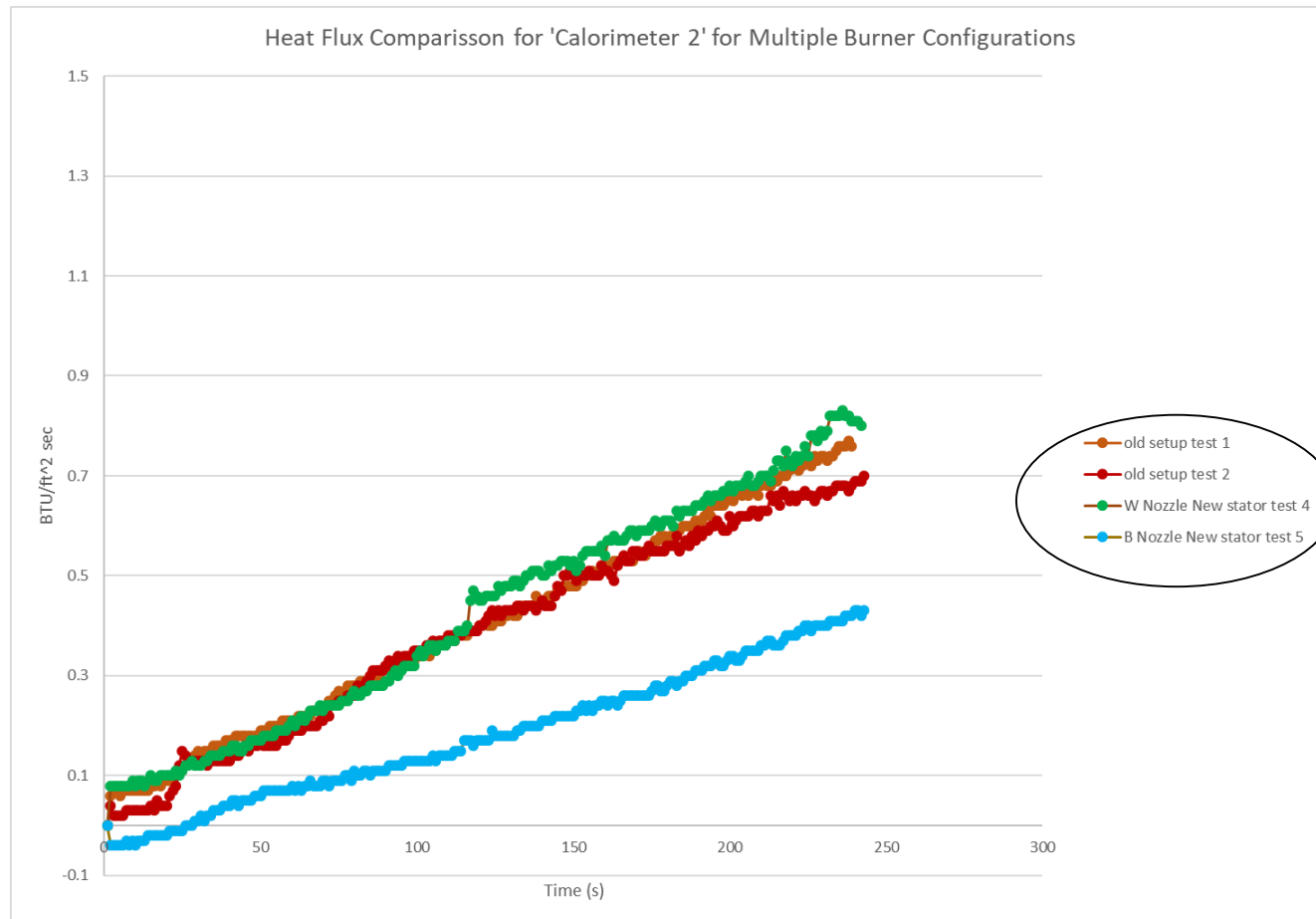
Heat Flux Comparison



Heat Flux Comparison



Heat Flux Comparison



Test Result Overview

- Heat flux with 60 psi air pressure setting and Delevan W-type nozzle results in nearly identical results to original baseline burner configuration test results
- Burner configuration utilizing Delevan nozzle type-B demonstrates clearly lower heat flux than baseline testing
- Limited material supply did not allow for testing with type-A nozzle at the time
- 60 psi air pressure and a Delevan type-W 6.0 gal/hr fuel nozzle configuration appear to be most equivalent to original Sonic burner test results based primarily on heat flux measurements on the backside of the sample



Interlab Study: Phase 4

- Ready to conduct 'Phase 4' of the igniterless Sonic burner study
- Primarily focused on labs using a Sonic burner with the igniterless stator
- Fuel nozzle, test samples, and detailed instructions provided
 - TexTech felt, Insulation blankets
- Seeking will labs to participate that are able to return test data in a timely manner
 - Some difficulty obtaining previous study results



Insulation Burnthrough Instructional Video Update



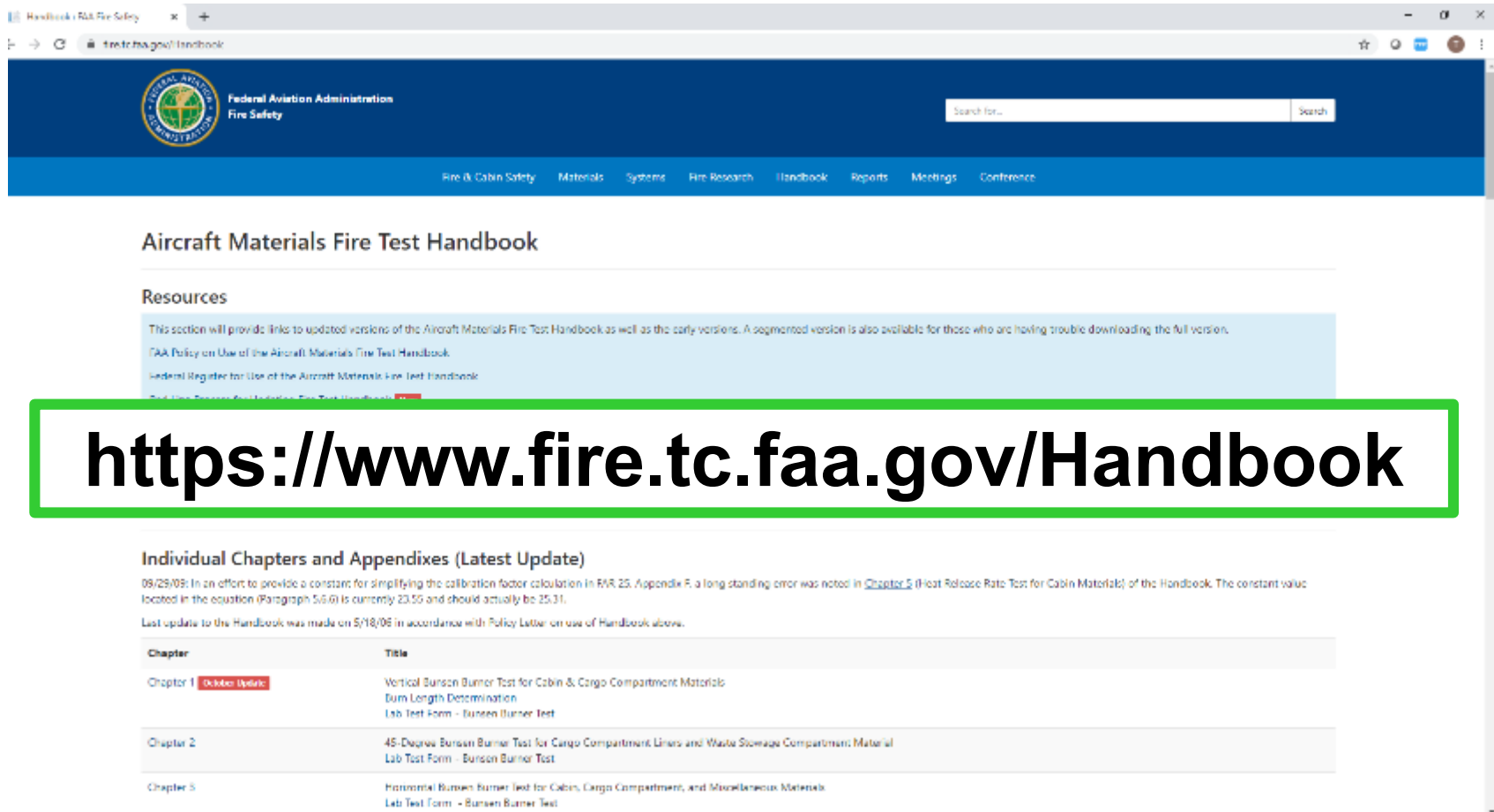
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Insulation Burnthrough Video

- Recently completed last of video filming
- In final stages of editing
- Adding closed captioning
- Will be available for viewing on Fire Safety website before summer of 2021



Sonic Burner Instructional Video



The screenshot shows the FAA Fire Safety Handbook website. The header includes the FAA logo and the text "Federal Aviation Administration Fire Safety". A search bar is located in the top right. The main navigation bar lists: Fire & Cabin Safety, Materials, Systems, Fire Research, Handbook, Reports, Meetings, and Conference. The page title is "Aircraft Materials Fire Test Handbook". Under the "Resources" section, there are links to updated versions of the handbook and a segmented version. A large green box highlights the URL: <https://www.fire.tc.faa.gov/Handbook>. Below this, the "Individual Chapters and Appendixes (Latest Update)" section provides a table of contents for Chapters 1, 2, and 3, each with a "Lab Test Form - Bunsen Burner Test" link.

Aircraft Materials Fire Test Handbook

Resources

This section will provide links to updated versions of the Aircraft Materials Fire Test Handbook as well as the early versions. A segmented version is also available for those who are having trouble downloading the full version.

[FAA Policy on Use of the Aircraft Materials Fire Test Handbook](#)

[Federal Register for Use of the Aircraft Materials Fire Test Handbook](#)

[Download Segmented Version of the Handbook](#)

https://www.fire.tc.faa.gov/Handbook

Individual Chapters and Appendixes (Latest Update)

09/29/09: In an effort to provide a constant for simplifying the calibration factor calculation in FAR 25, Appendix F, a long standing error was noted in [Chapter 3](#) (Heat Release Rate Test for Cabin Materials) of the Handbook. The constant value located in the equation (Paragraph 5.6.6) is currently 23.50 and should actually be 25.31.

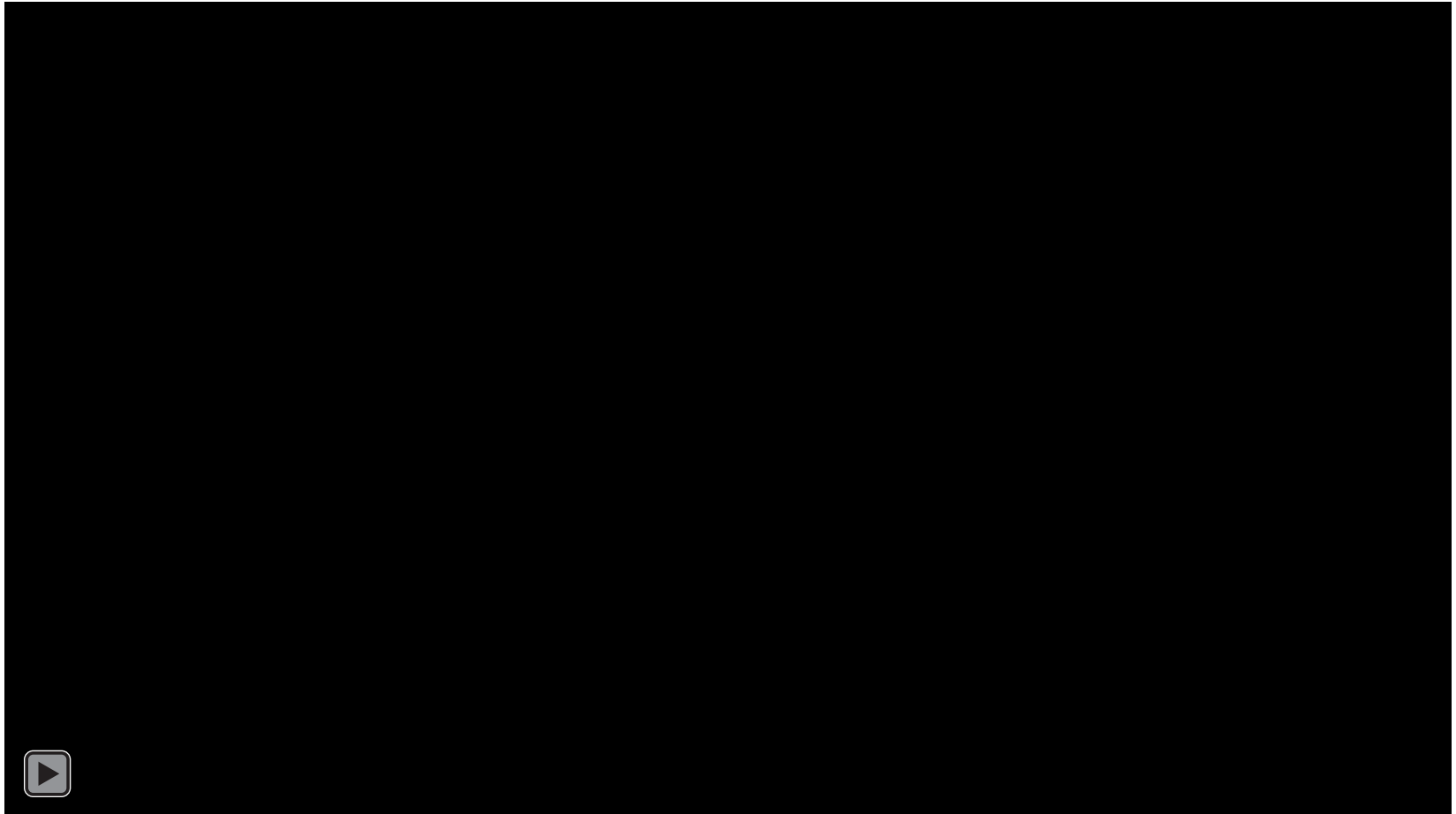
Last update to the Handbook was made on 5/18/06 in accordance with Policy Letter on use of Handbook above.

Chapter	Title
Chapter 1 Order Update	Vertical Bunsen Burner Test for Cabin & Cargo Compartment Materials Burn Length Determination Lab Test Form - Bunsen Burner Test
Chapter 2	45-Degree Bunsen Burner Test for Cargo Compartment Liners and Waste Storage Compartment Material Lab Test Form - Bunsen Burner Test
Chapter 3	Horizontal Bunsen Burner Test for Cabins, Cargo Compartment, and Miscellaneous Materials Lab Test Form - Bunsen Burner Test



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Insulation Burner Video Sample



Questions or interest in
participating with interlab studies

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