International Aircraft Materials Fire Test Working Group Meeting

Seat Cushion Oil Burner Update

Presented to: International Aircraft Materials Fire Test Working Group

By: Tim Salter, FAA Technical Center

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Introduction

- **Update to Chapter 7 of the Handbook**
  - Incorporation of the NexGen sonic burner to the seat test method
- **Handbook vs. Work book Test Method**
  - What are the differences?
- **Recent Additions for the NexGen Sonic Burner**

Handbook Update

- **The test procedure for the chapter 7 seat cushion test method is currently being updated**
- **Major addition includes the incorporation of NexGen sonic burner to be used for the test method**
- **The test method involves the use of a flame "temperature check" which is unique to the use of the NexGen burner**

NexGen Burner Background

- **The original concept was to retain the same internals from the Park burner for use in the NexGen burner in order to keep burner performance similar**
- **After trialing numerous stator/turbulator configurations with little success, other options were considered**
- **Oil burners on the market today no longer use stators and turbulators**
- **Flame retentions heads (FRH) are now used in their place**
  - Generate a more efficient and complete combustion
  - Simpler in design
  - Relatively easier to produce

Turbulator

Flame Retention Head

Stator

Static Plate

FRH vs. Stator and Turbulator

Flame Retention Head

Stator and Turbulator

NexGen Sonic Burner Summary

- **The stator and turbulator inside the Park burner can be adjusted to compensate for any irregularities in burner performance**
- **NexGen burner designed to be setup only in one standardized configuration**
- **No adjustments on the NexGen burner to manipulate flame**
- **1/8” diameter thermocouples are used for the NexGen burner, compared to the smaller 1/16” thermocouples used for the Park calibration procedure**

Flame Temperature Check

- **Larger TC's do not register peak temperatures as high as the smaller 1/16" TC's**
- **NexGen burner is unable to consistently meet the Park calibration requirement**
- **Park relies on flame temperature measurement, while the NexGen burner designed to rely on a specified configuration to ensure similar test results among labs**
- **Specific calibration requirement not well suited for the NexGen burner**

Flame Temperature Check

- **Conforming to a specific flame temperature calibration requires adjustability**
- **This leads to each lab having there own unique burner configuration**
- **Calibration temperatures alone do not necessarily correlate with test results**
- **The NexGen burner relies on a flame temperature check, rather than a calibration**

Flame Temperature Check

- **A flame temperature check is used to help determine if the burner is functioning properly**
- **It is recommended that all 1/8” TC’s measure a flame temperature above 1600 F**
- **Should any TC’s read below this temperature, the burner should be inspected to ensure it has been properly configured to the specified settings**
- **Proper fuel flow and air pressure should also be confirmed**

Flame Temperature Check

- **Low temperatures may also indicate worn thermocouples**
- **Replace low reading TC's after confirming proper burner configuration and operation**
- **It is considered acceptable to continue testing in certain cases where TC's read slightly below the 1600 F temperature level only after the previous steps have been performed**

Additional Items

- **Fuel and air pressure gauges are required to be NIST approved and have an accuracy of +/-2% or less**

- **The operational pressure range of the gauge should be matched appropriately to the fuel and air pressures of the burner**

Additional Items

- **A 3” diameter by 12” long reticulated foam cylinder is required to be used in the burner muffler**
- **Originally suggested for the purpose of noise reduction**
- **Deleting the foam can potentially alter the performance of the burner**

Additional Items

- **Industry has suggested the FAA expand the current allowable fuel and air temperature ranges**
- **This is currently under consideration for inclusion in the NexGen burner test requirements**
- **Testing is currently underway to determine any potential issues**

Handbook vs. Workbook

Handbook

- The original Handbook describes the certification test method for materials used on aircraft currently in service
- The updated Handbook will allow labs to use the NexGen burner for these same tests

Workbook

- The new Workbook test method applies to new type designs and differs slightly compared to the Handbook test method
- However, the configuration of the NexGen burner and temperature check procedure will remain unchanged

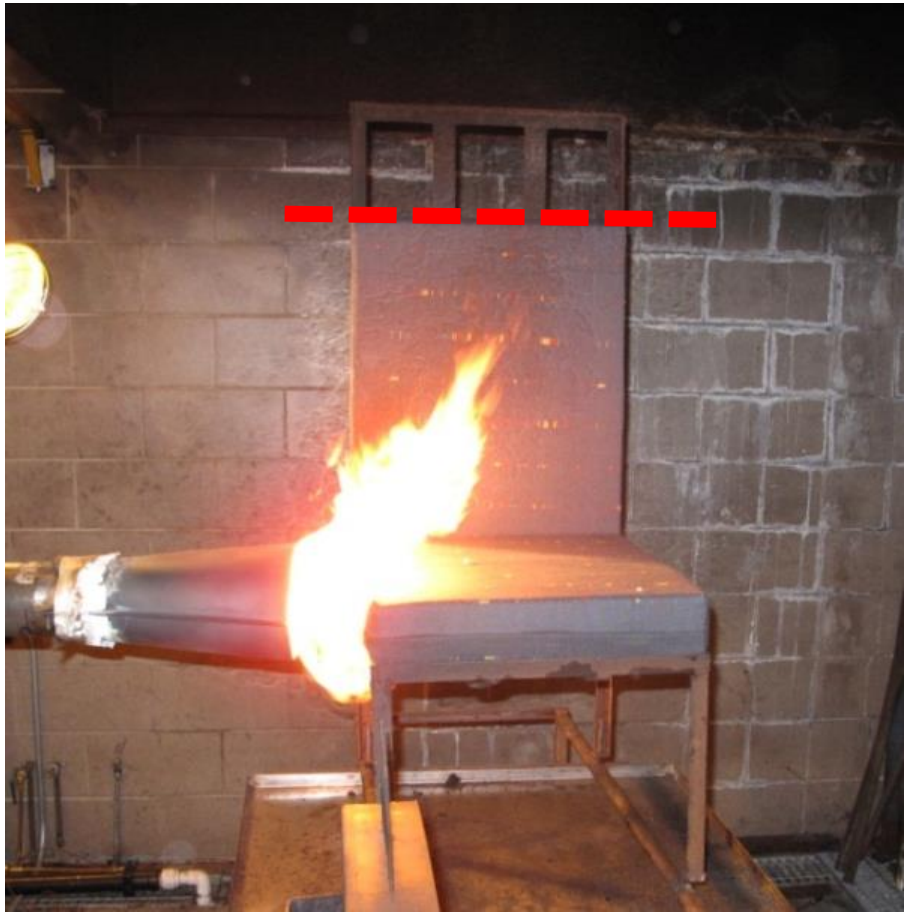
New Workbook Items

- **Seat rig modification**
- **Stationary mounting of the NexGen burner and translational motion of test sample**
- **Test cell airflow measurement**
- **Standardized leather cushion restraint method**

Seat Rig Modification

- **The modified design of the seat test rig will reduce the height of the vertical cushion frame from 33” tall down to 25” tall to correctly fit the back cushion sample**

- **The seat rig will be constructed from 316 alloy stainless steal to reduce corrosion damage leading to incorrect weight loss measurement**



Burner and Sample Rig Mounting

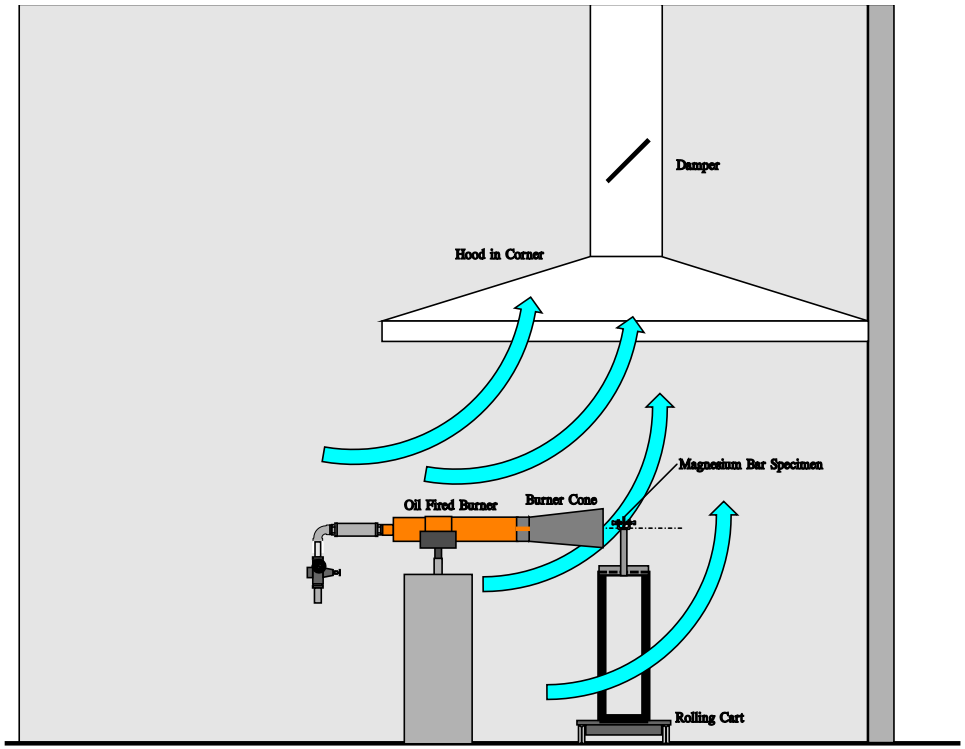
- **The Workbook will require the burner be mounted stationary, and the sample be able to translate into the test position after burner warm-up**

- **Test results tend to be more consistent when moving the sample relative to a stationary burner**

Test Cell Airflow

- **The workbook will allow for test cell ventilation airflow up to 100 ft/min in the vertical direction, and up to 50 ft/min in the horizontal direction**

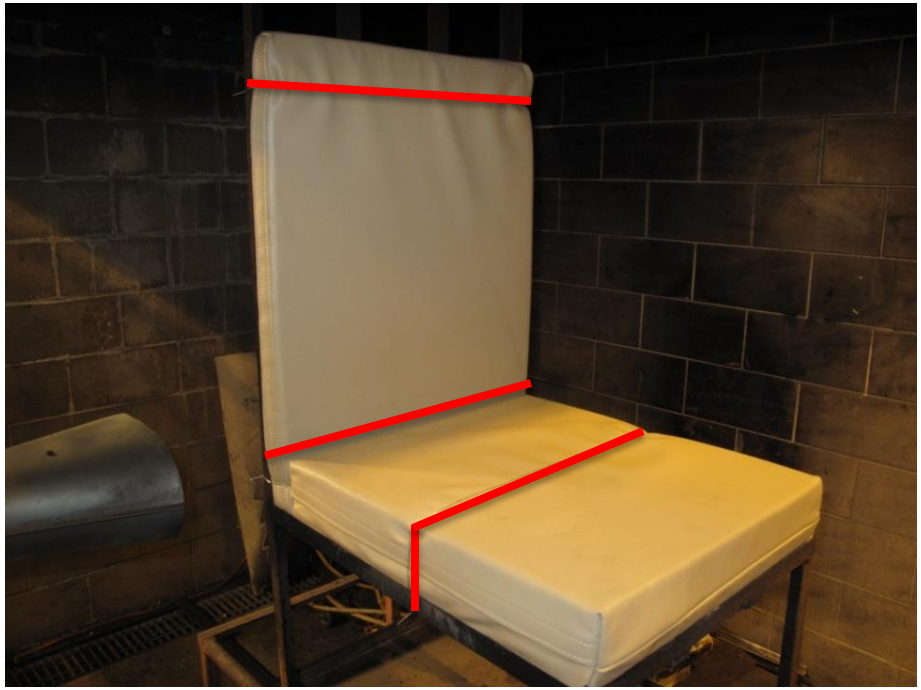
- **This criteria is less stringent compared to the Handbook, but has shown not to impact test results**



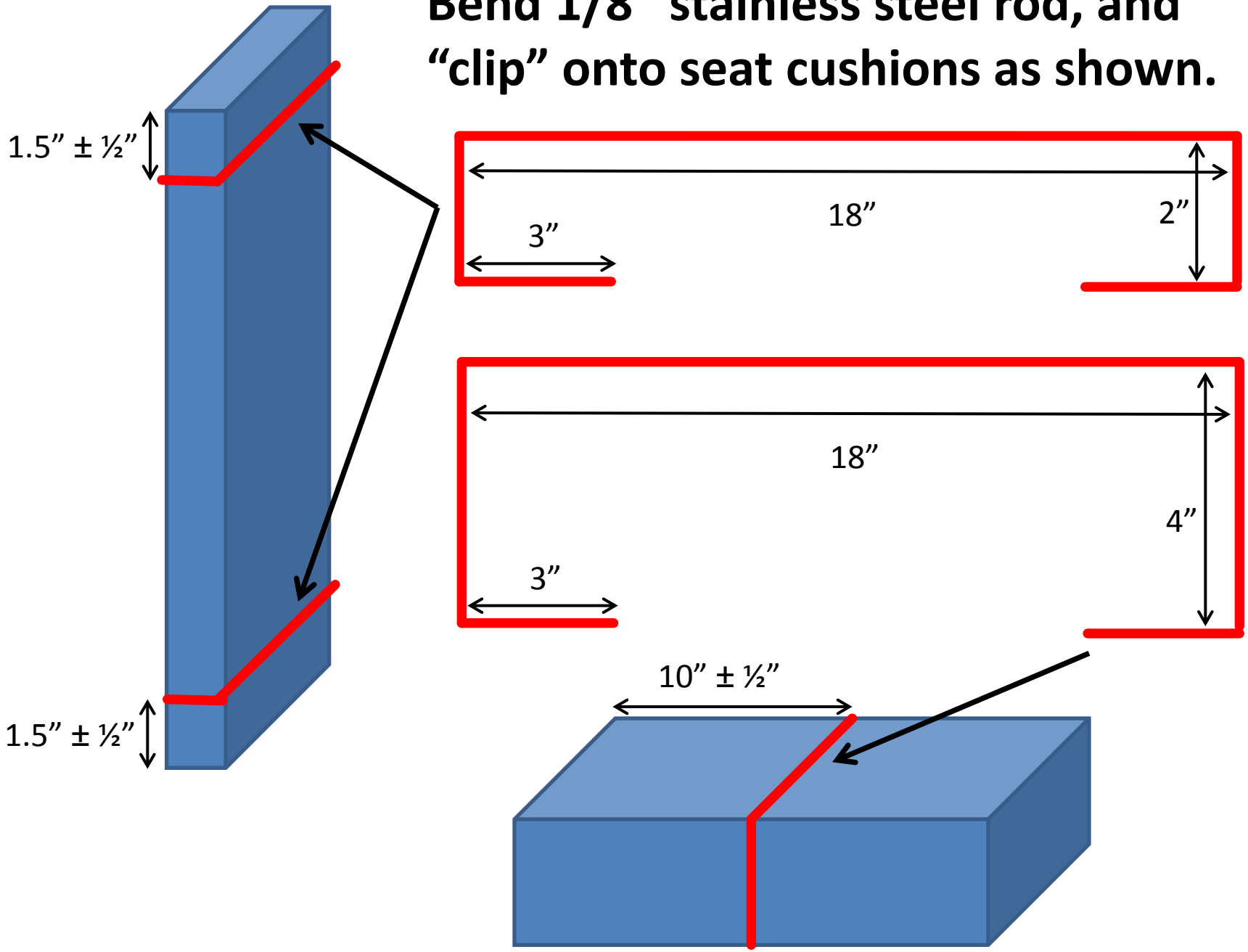
Standardized Leather Cushion Restraints

- **The Workbook specifies the use of 3 preformed 1/8” SS rods placed in specific locations**

- **Tests have shown this to be a suitable restraint method which can be used for multiple tests before needing replacement rods**



Bend 1/8” stainless steel rod, and “clip” onto seat cushions as shown.



Questions?