NexGen Burner for Seat Cushion Fire Testing

International Aircraft Materials Fire Test Working Group

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Köln, Germany

Outline

- Background
- Objective
- NexGen Burner Configuration
- Results
- Future Work

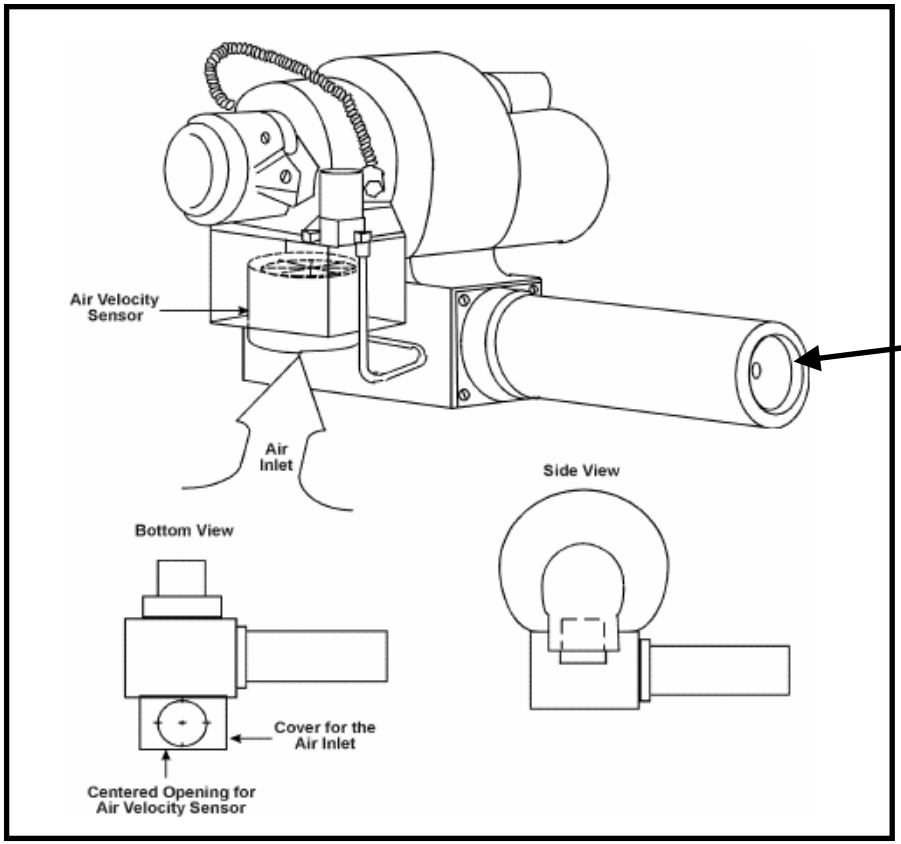
Background

- **Lack of availability of burners for seat cushion fire testing has resulted in the need for a readily available, equivalent burner**
- **The NexGen burner has already been found to provide equivalent results to the Park burner for thermal acoustic insulation burnthrough testing**

Objective

- **Configure a NexGen burner to achieve the calibration standards set in chapter 7 of the Aircraft Materials Fire Test Handbook**
  - Fuel flow rate of 2.0 gph ± 0.1 gph
  - Equivalent to an inlet air flow of 67 ± 4 cfm
  - 30-second average heat flux of at least 10 BTU/ft^{2}s
  - Flame temperatures of at least 1800°F on 5 of 7 thermocouples and at least 1750°F on at most 2 thermocouples
  - 30-second average of 7 thermocouples at least 1800°F

Equivalent Air Flow Rate

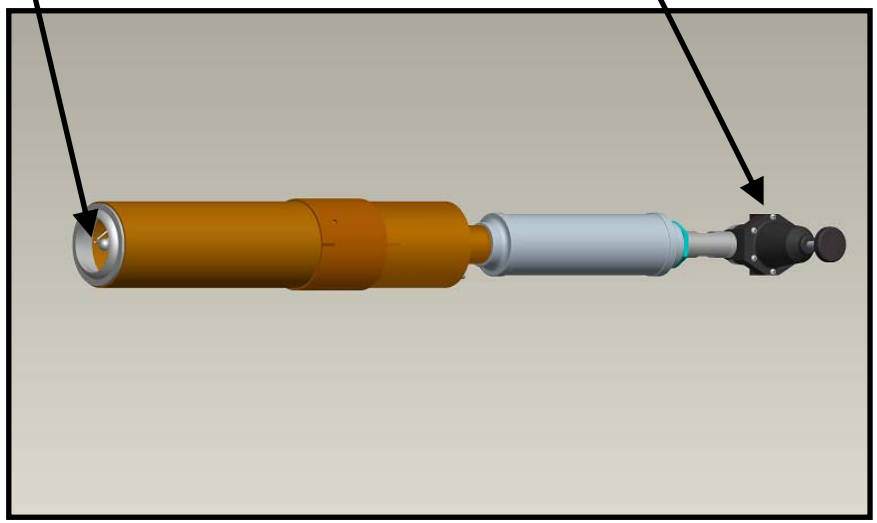


Inlet Air Flow:

67 cfm ≈ 1800 fpm in 2.625 in^2 air flow meter (HH30)

Exit Air Flow ~ 1600 fpm

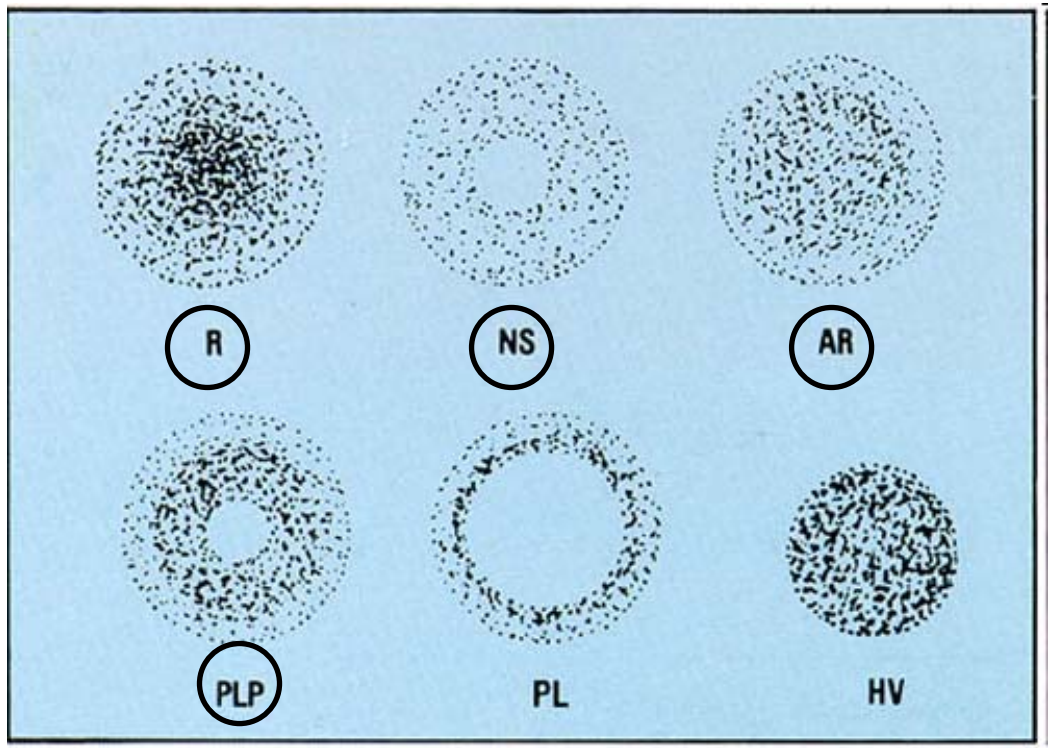
Resulting Sonic Choke Inlet Pressure:47 psig



Note: Exit flow measurements taken with turbulator on

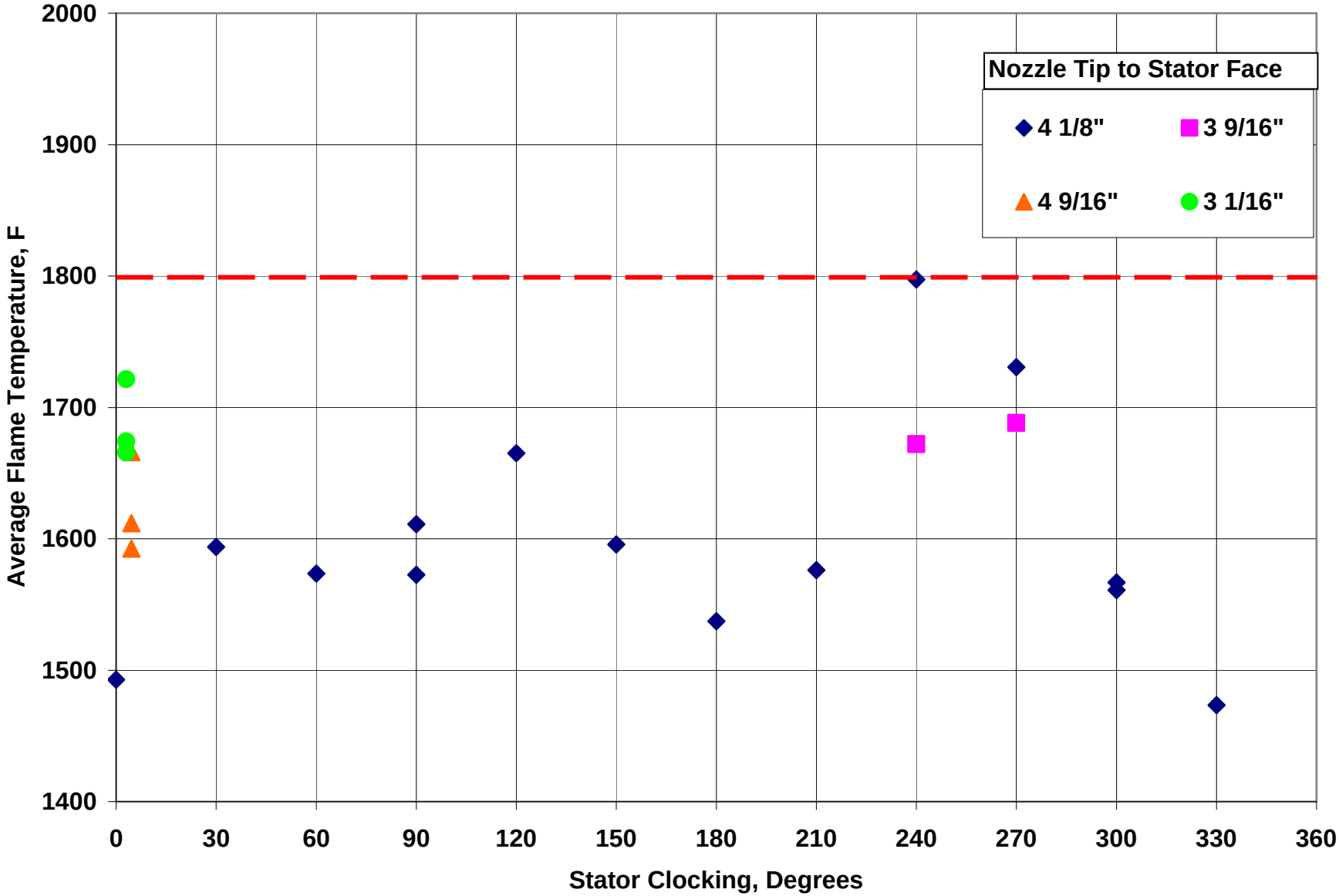
Fuel Flow Rate

- **Fuel flow rate is dictated by**
  - Specific nozzle used
  - Inlet fuel pressure
  - Fuel viscosity
- **Several nozzle types were attempted**
  - R: Solid
  - NS: Hollow
  - AR: Special Solid
  - PLP: Semi Solid



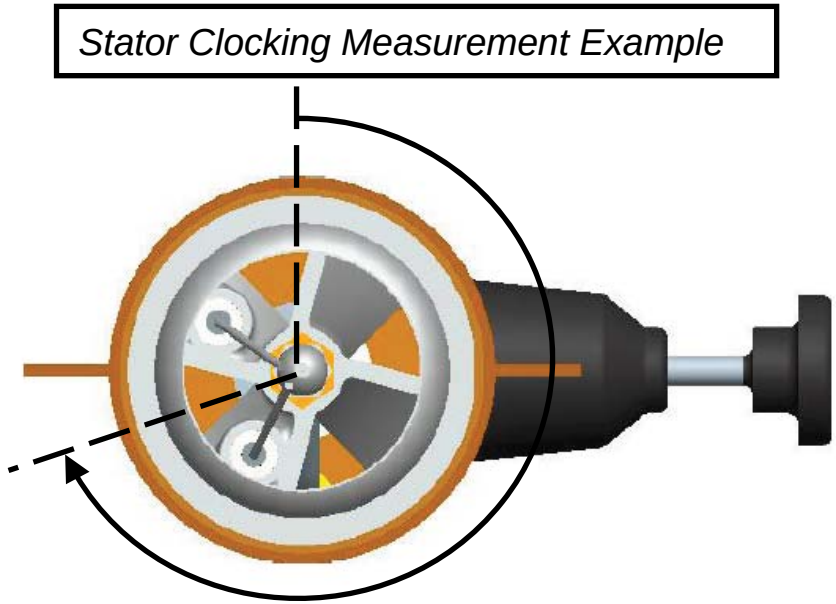
www.monarchnozzles.com

Average Flame Temperature – 2.25 80° PLP

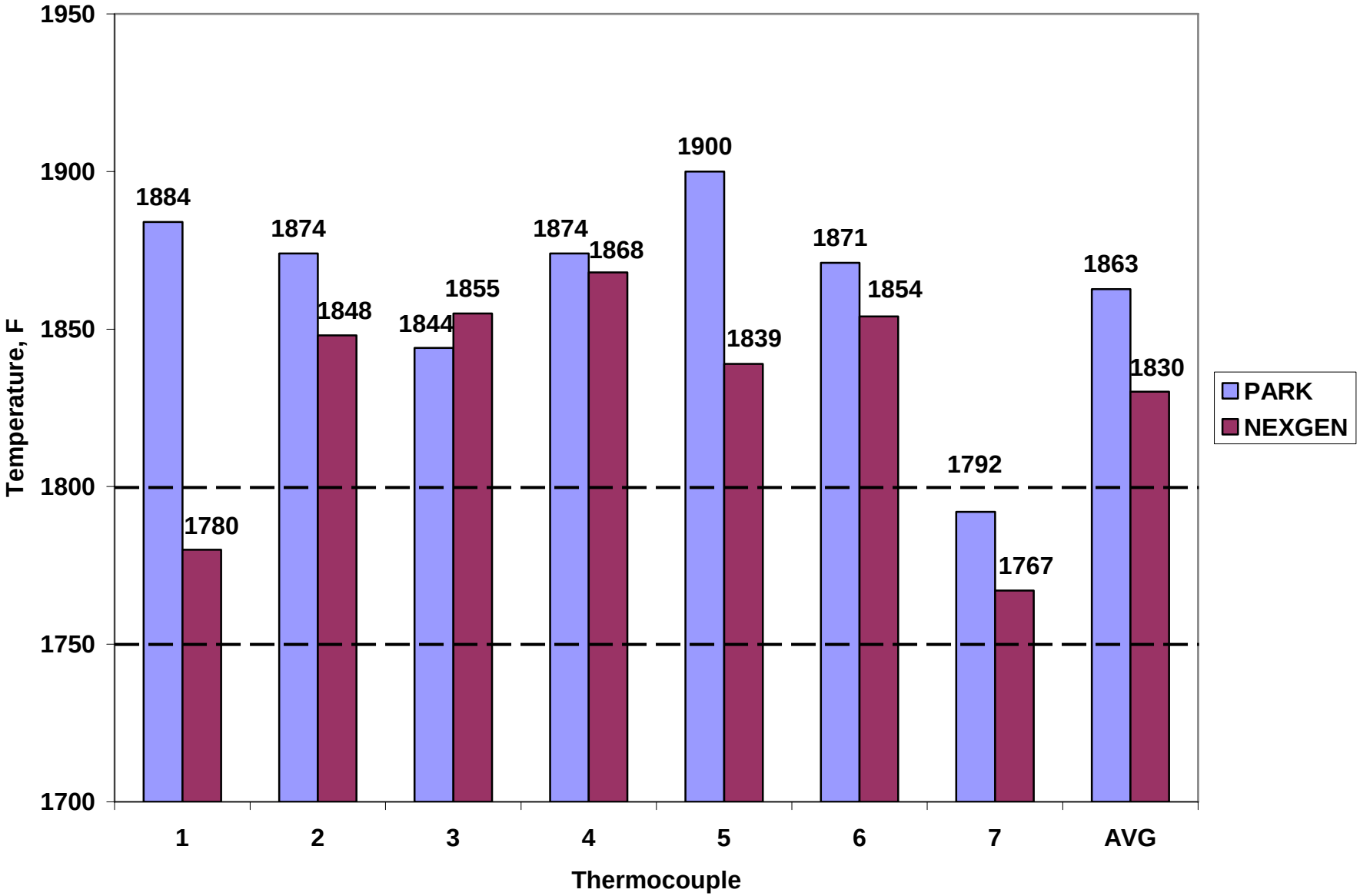


Final NexGen Burner Settings

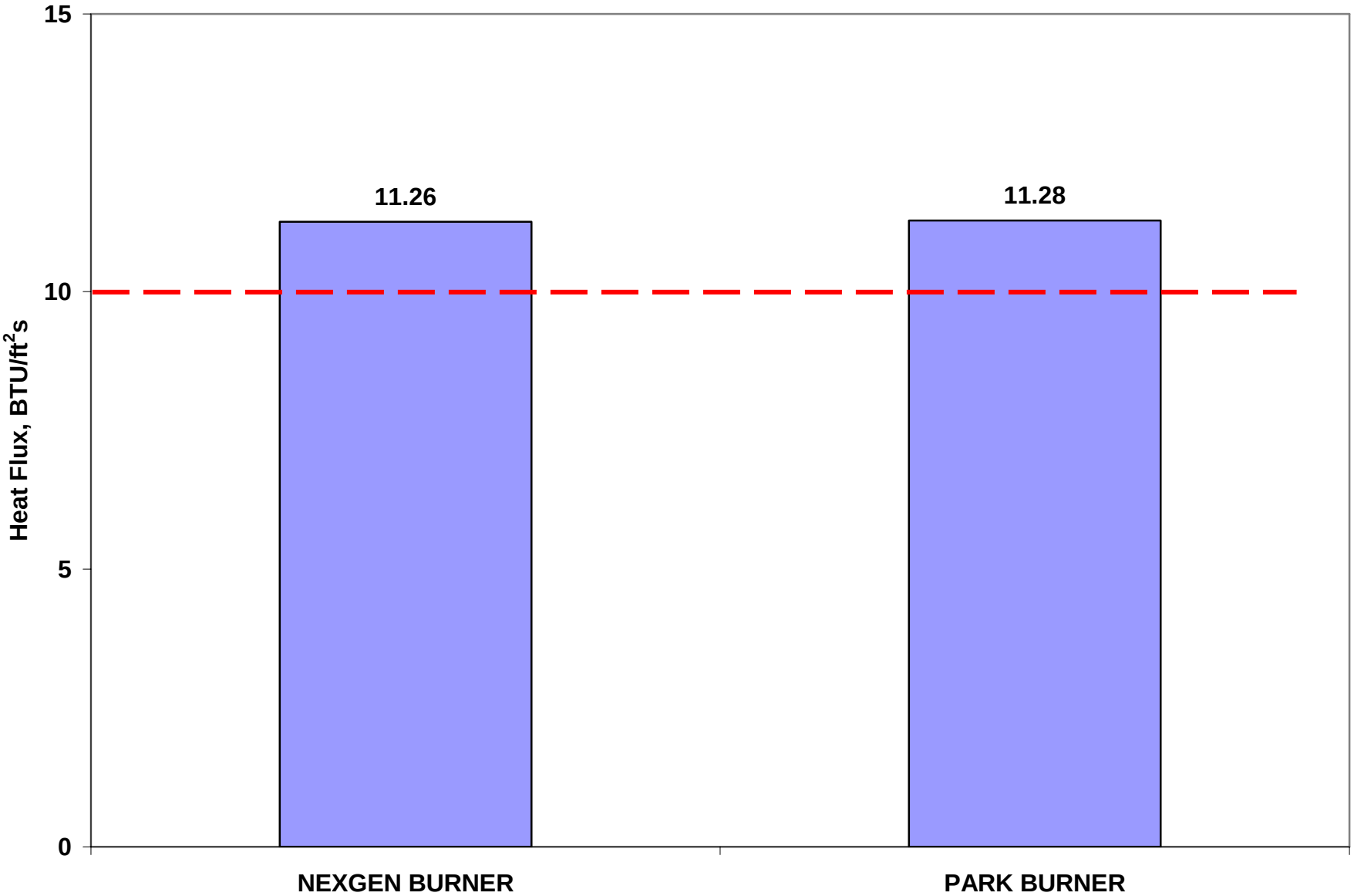
- **Fuel Nozzle**
  - 2.25 gph-rated 80° AR @ 114 psig → 2.04 gph
- **Stator Distance**
  - 3 1/16” back from nozzle tip
- **Stator Clocking**
  - Approximately 262° from vertical
- **Air Flow**
  - Sonic choke inlet pressure = 47 psig → 1600 fpm exit velocity



Measured Flame Temperatures



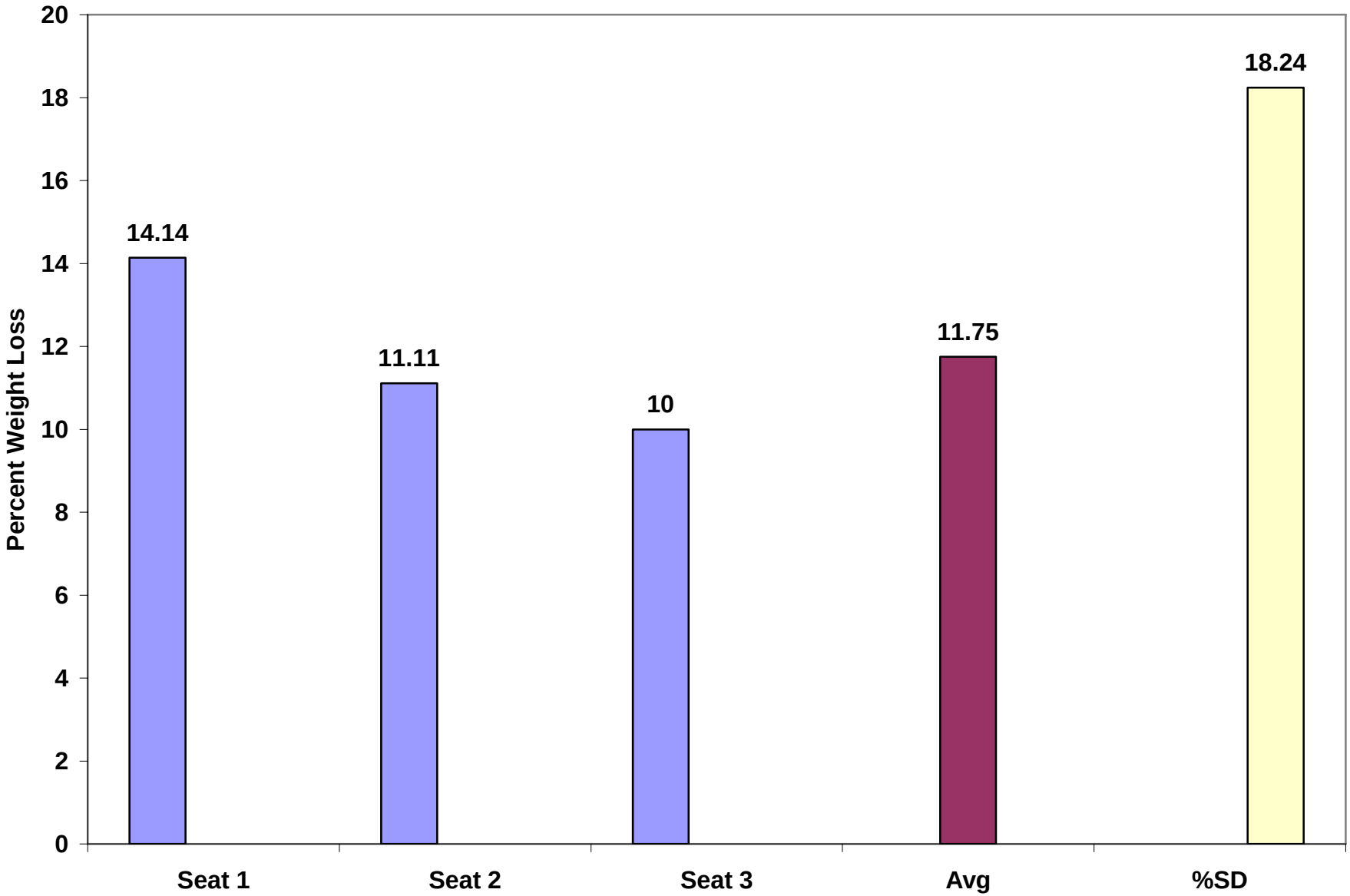
Measured Heat Flux



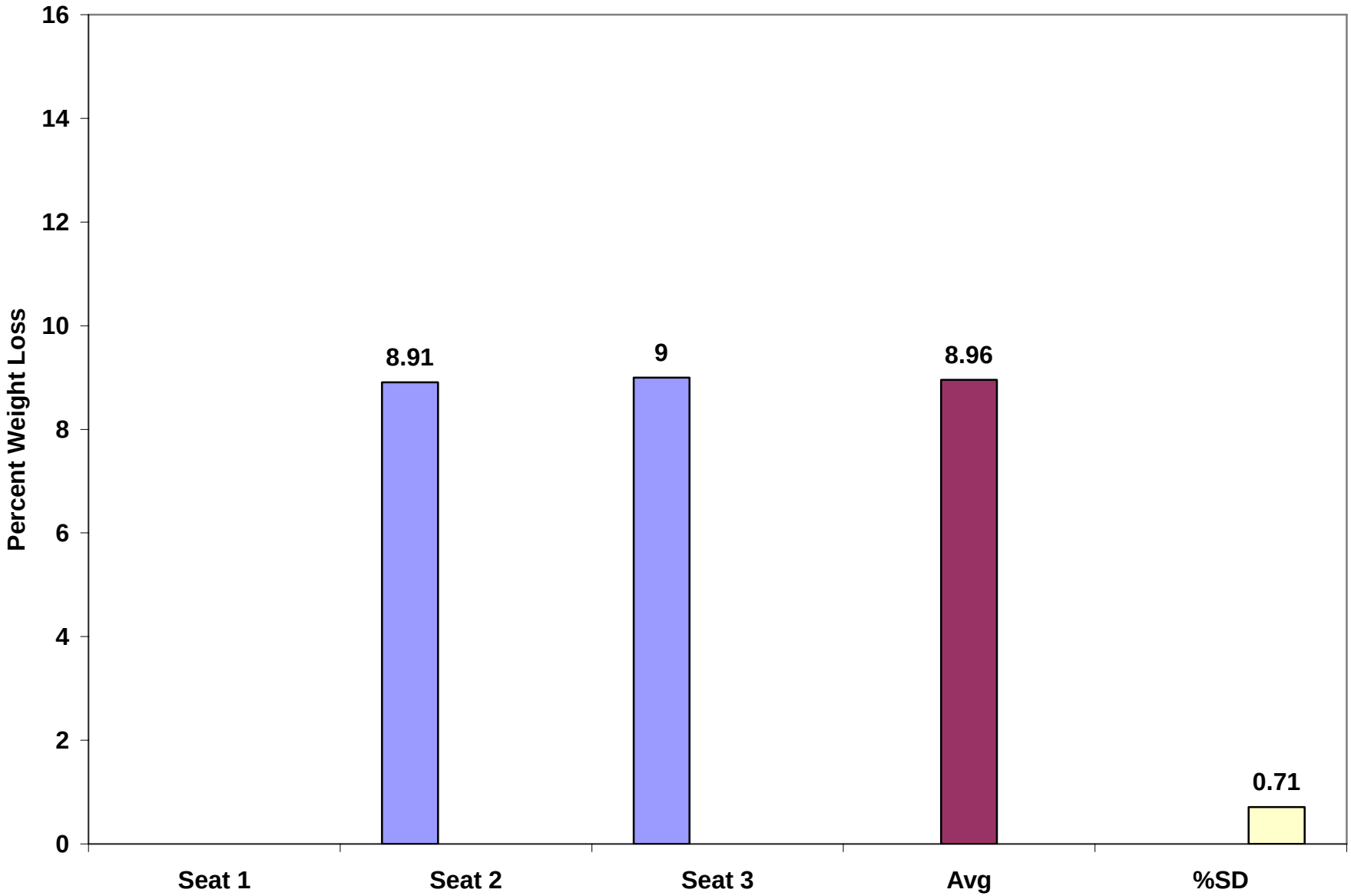
Seat Testing

- **Sample sets were obtained from the conditioning chamber**
  - 3 sets of bottoms and backs for each burner
  - Cushions had fire blocking layers

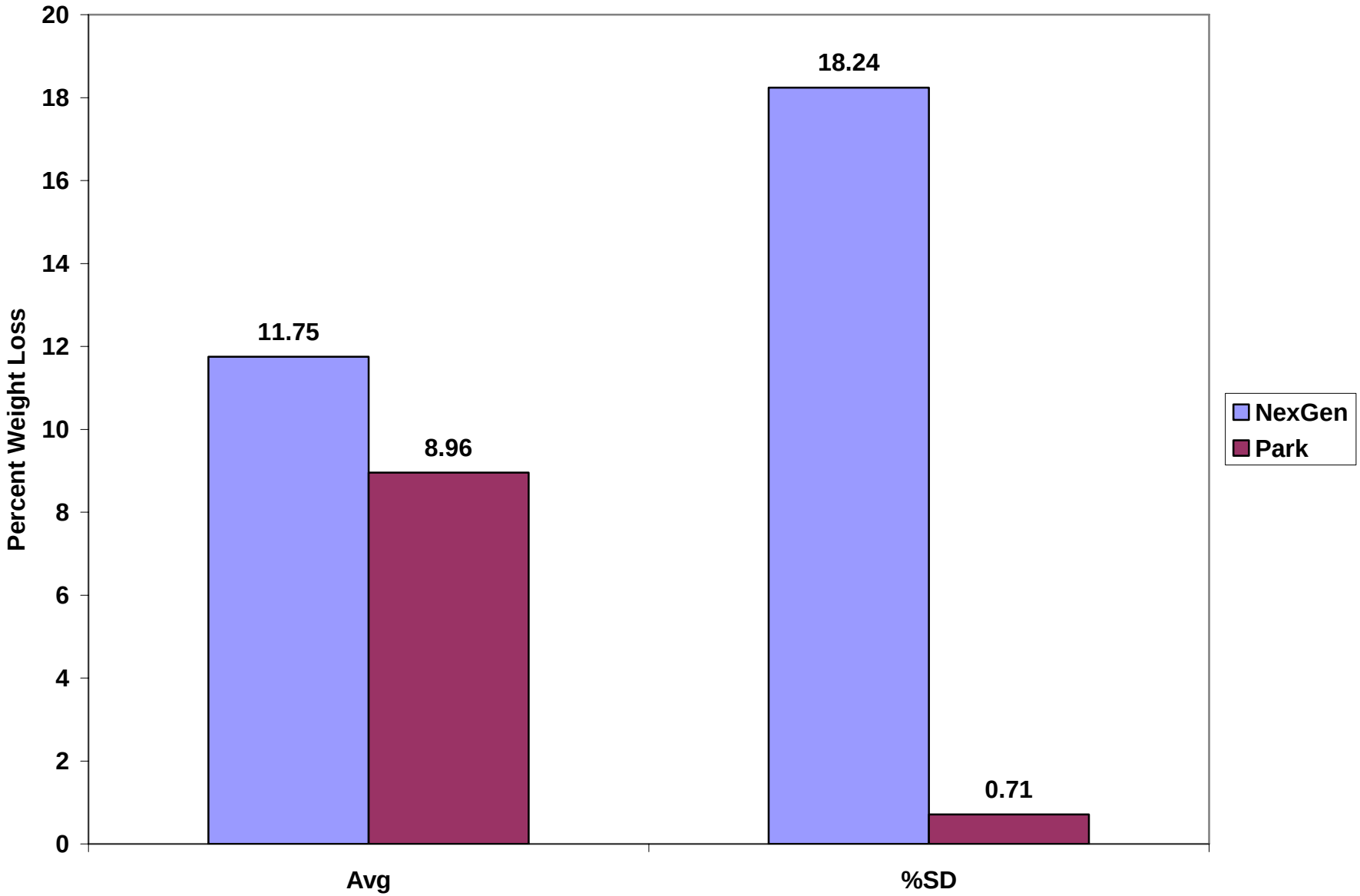
Seat Cushion Testing – NexGen



Seat Cushion Testing – Park



Comparison


20
18
16
14
12
10
8
6
4
2
0
Percent Weight Loss
11.75
8.96
18.24
0.71
Avg
%SD
NexGen
Park

Summary

- **After much trial and error testing, the NexGen burner was able to achieve burner calibration according to the specifications in chapter 7 of the Aircraft Materials Fire Test Handbook**
- **The NexGen burner results showed inconsistency when compared to the Park**
- **Despite having a slightly lower flame temperature, the NexGen burner consistenly produced higher % mass loss than the Park**

Future Work

- **Laboratory needs some work**
  - Fume hood velocity needs to be adjusted
  - Scale needs to be properly configured and more rigidly mounted
- **More comparative testing**
  - More testing needs to be done in order to determine burner performance