

Overview of Park Burner Used in Insulation Burnthrough Resistance Test

Typical Test Burner and Sample Holder



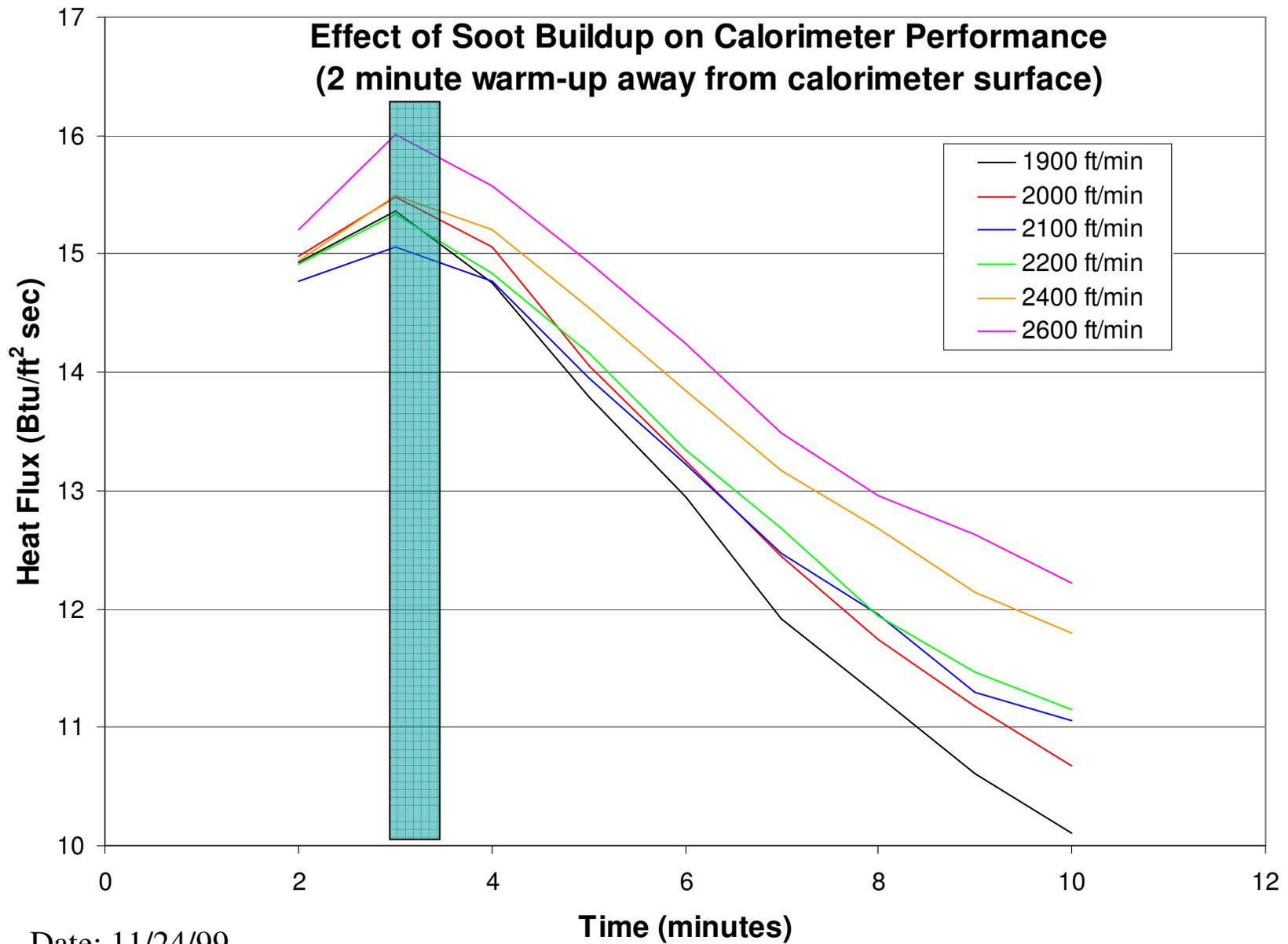
Typical Test Burner and Sample Holder



Development and Refinement of Burnthrough Test Method

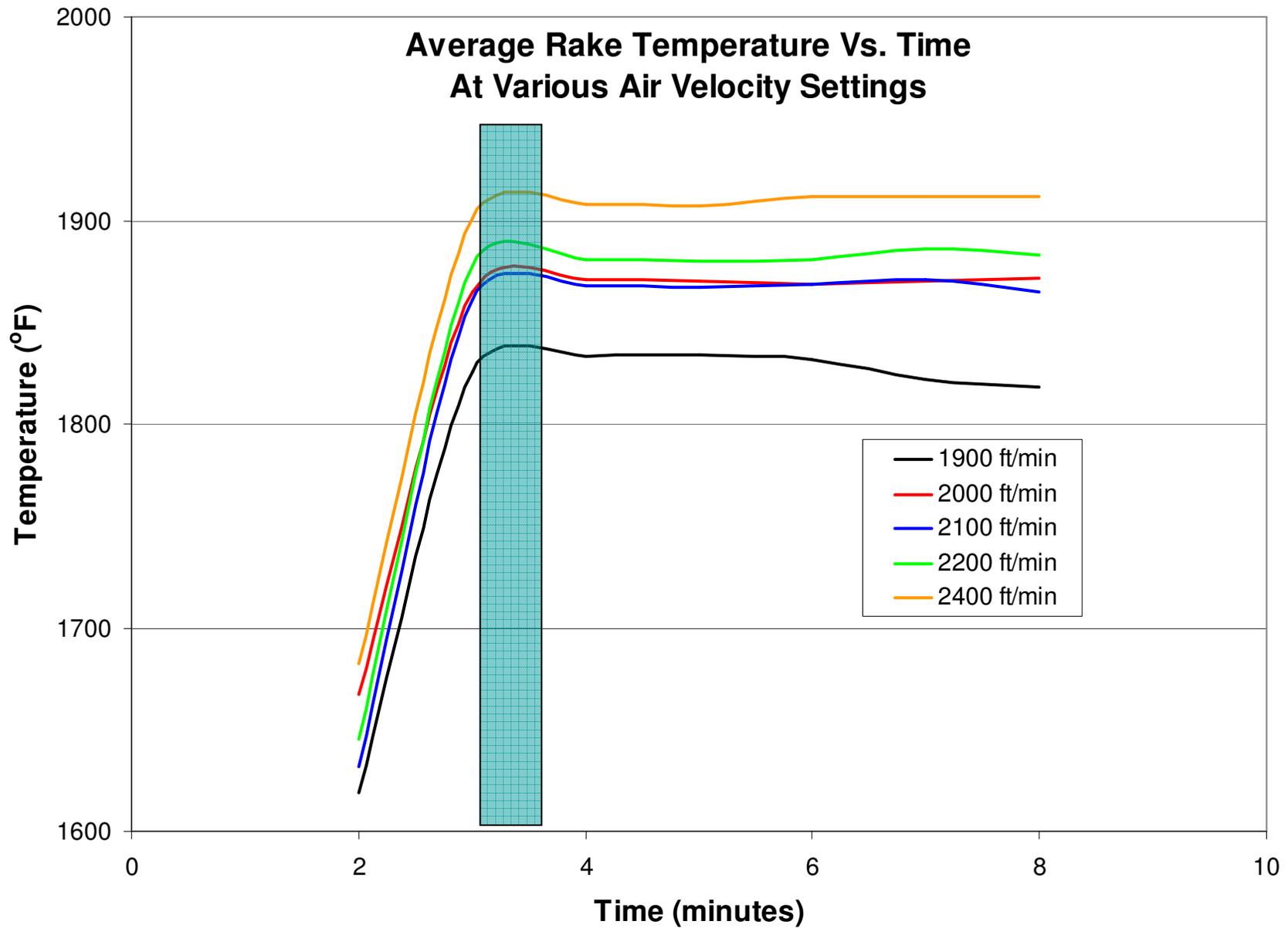
Examples of how and why test apparatus was modified over the years

Data Collection Procedure is Critical



Date: 11/24/99

Data Collection Procedure is Critical



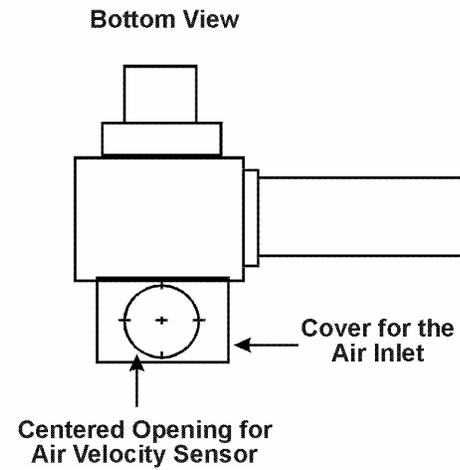
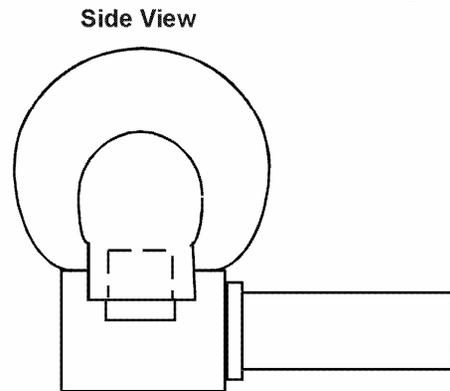
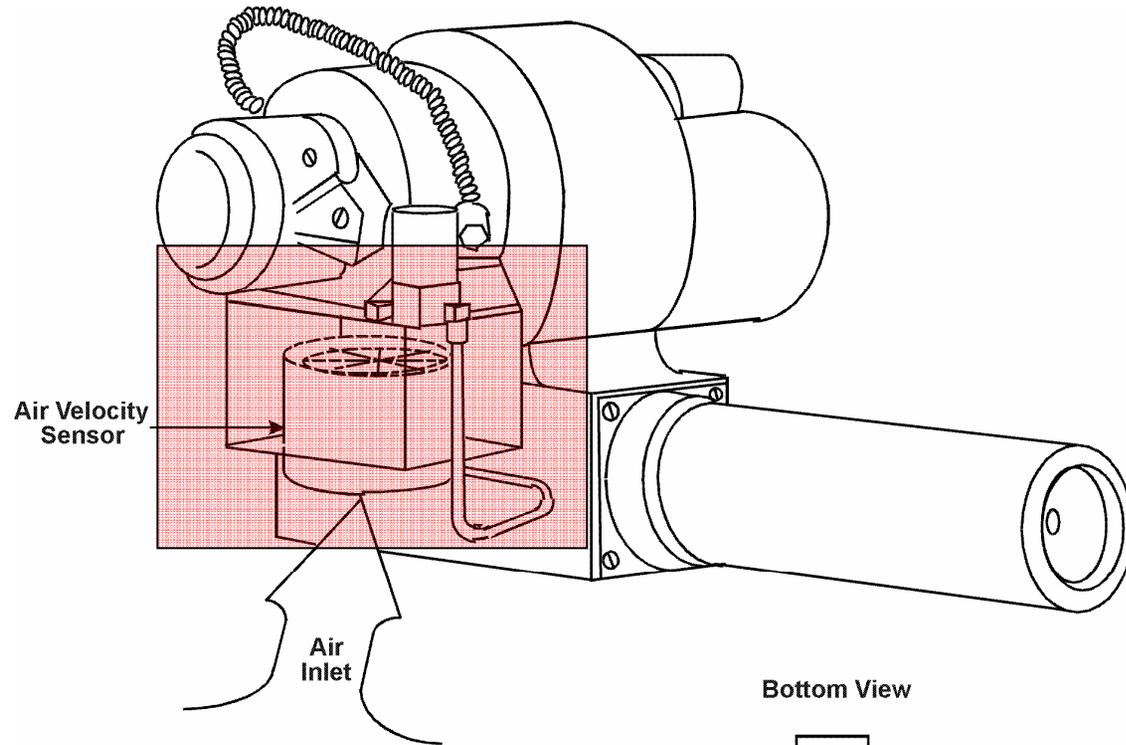
Intake Airbox Standardization



Purpose: Manufacture standard intake airbox devices for all participating burnthrough test labs to house the Omega HH-30A air velocity meter.

Standardizing the methodology of measuring intake air velocity could minimize the potential for interlab data fluctuations.

Irregular Shape of Park Burner Intake Area



Intake Airbox Mass Production



Aluminum Intake Airbox



Intake Airbox Holding Air Velocity Meter



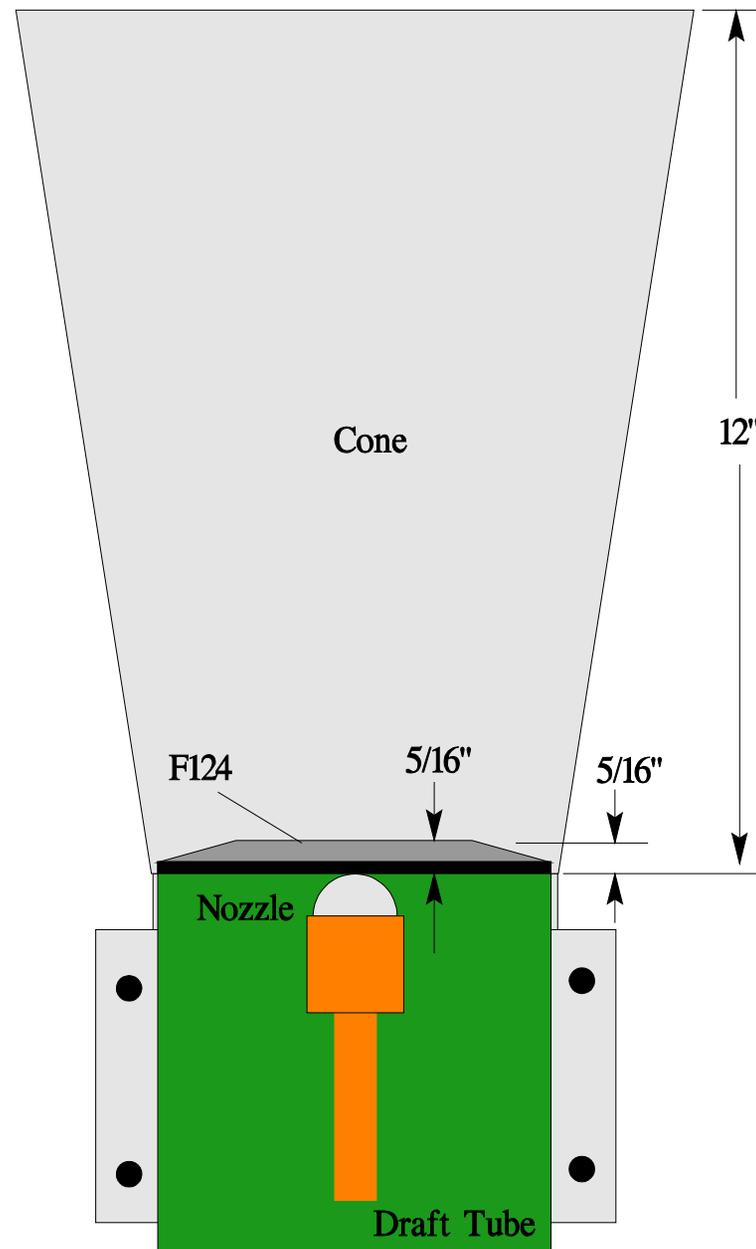
Standardized Air Intake System



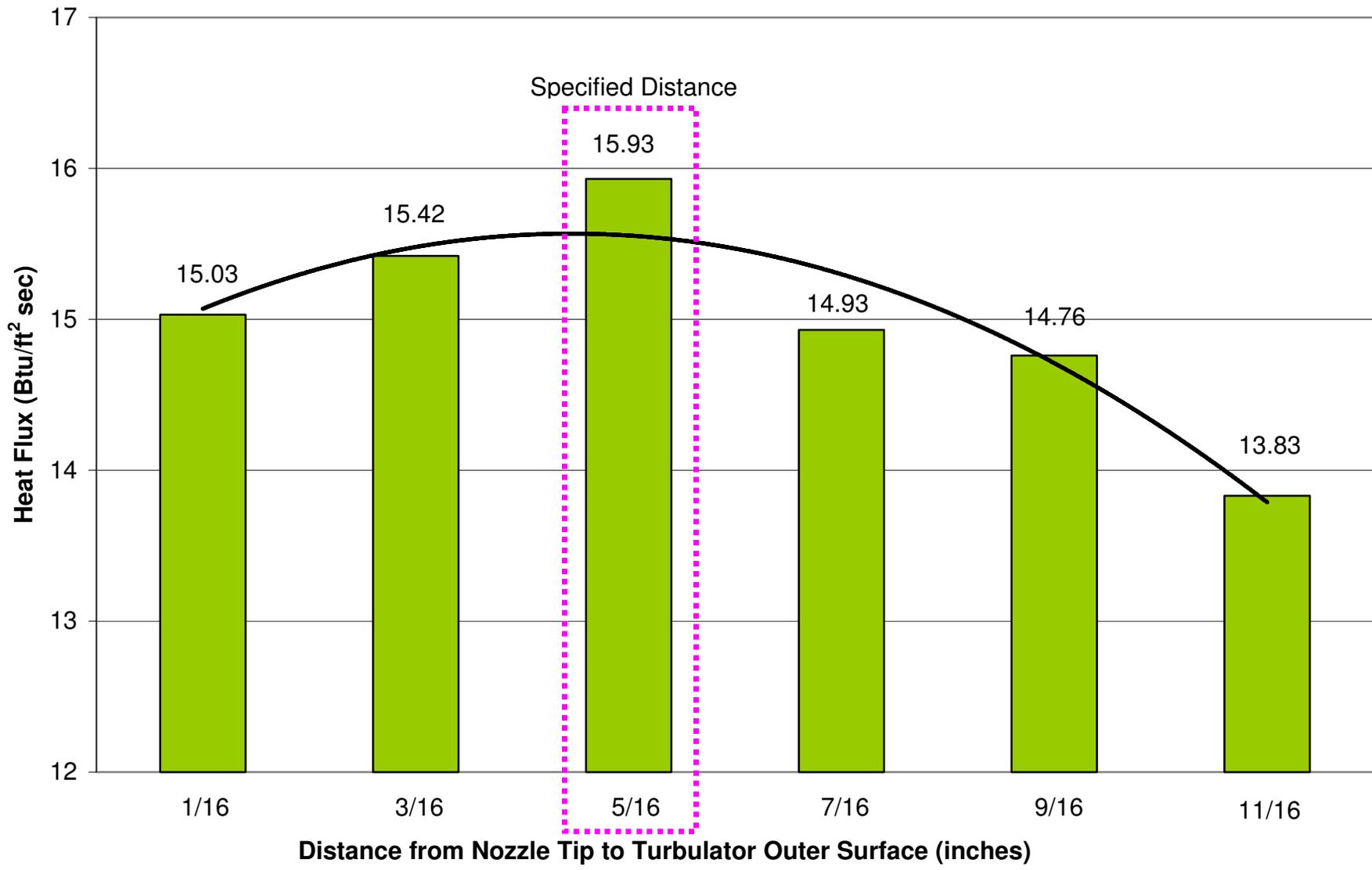
Development and Refinement of Burnthrough Test Method

Configuration of Internal Components

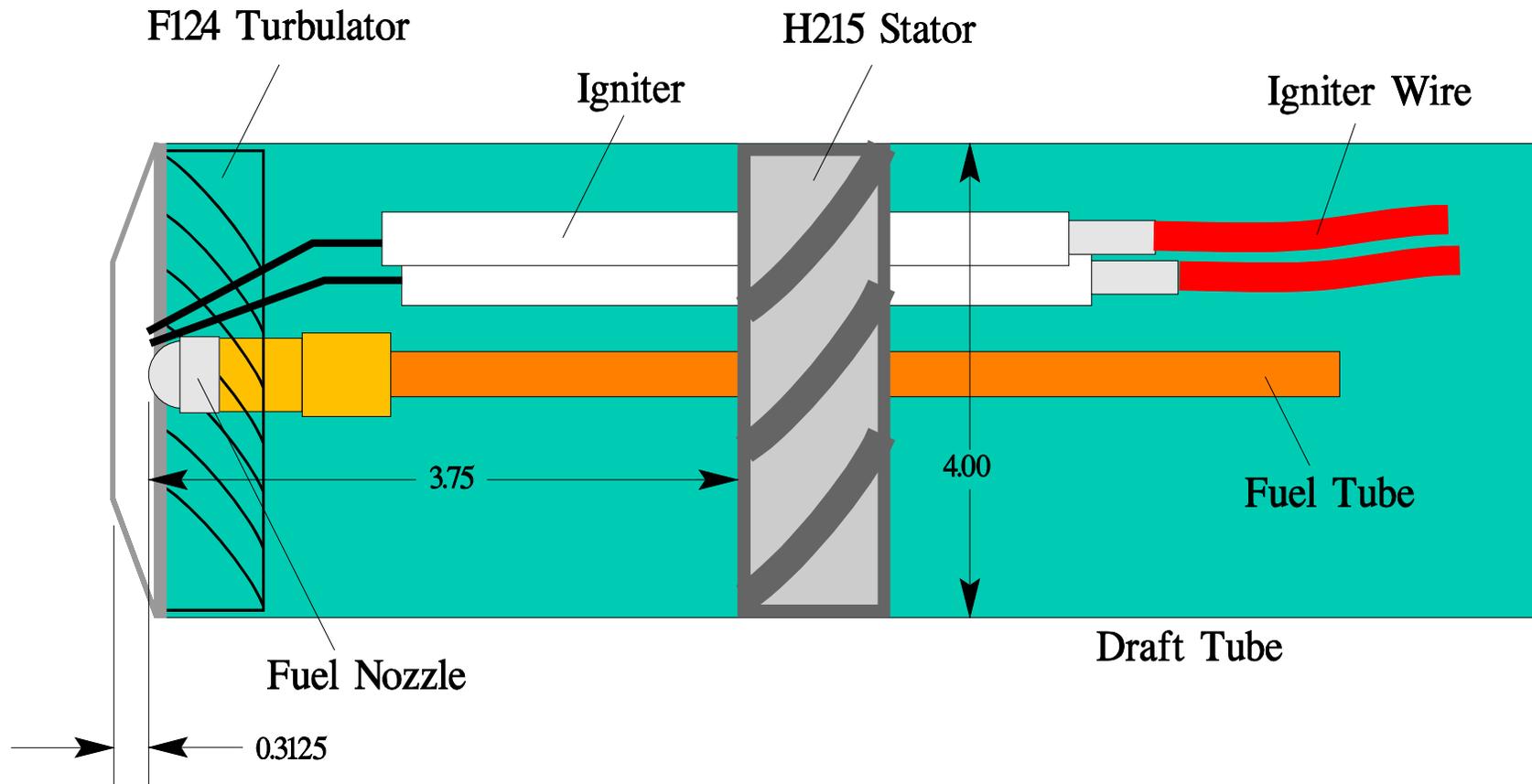
Current Specification for Nozzle Depth



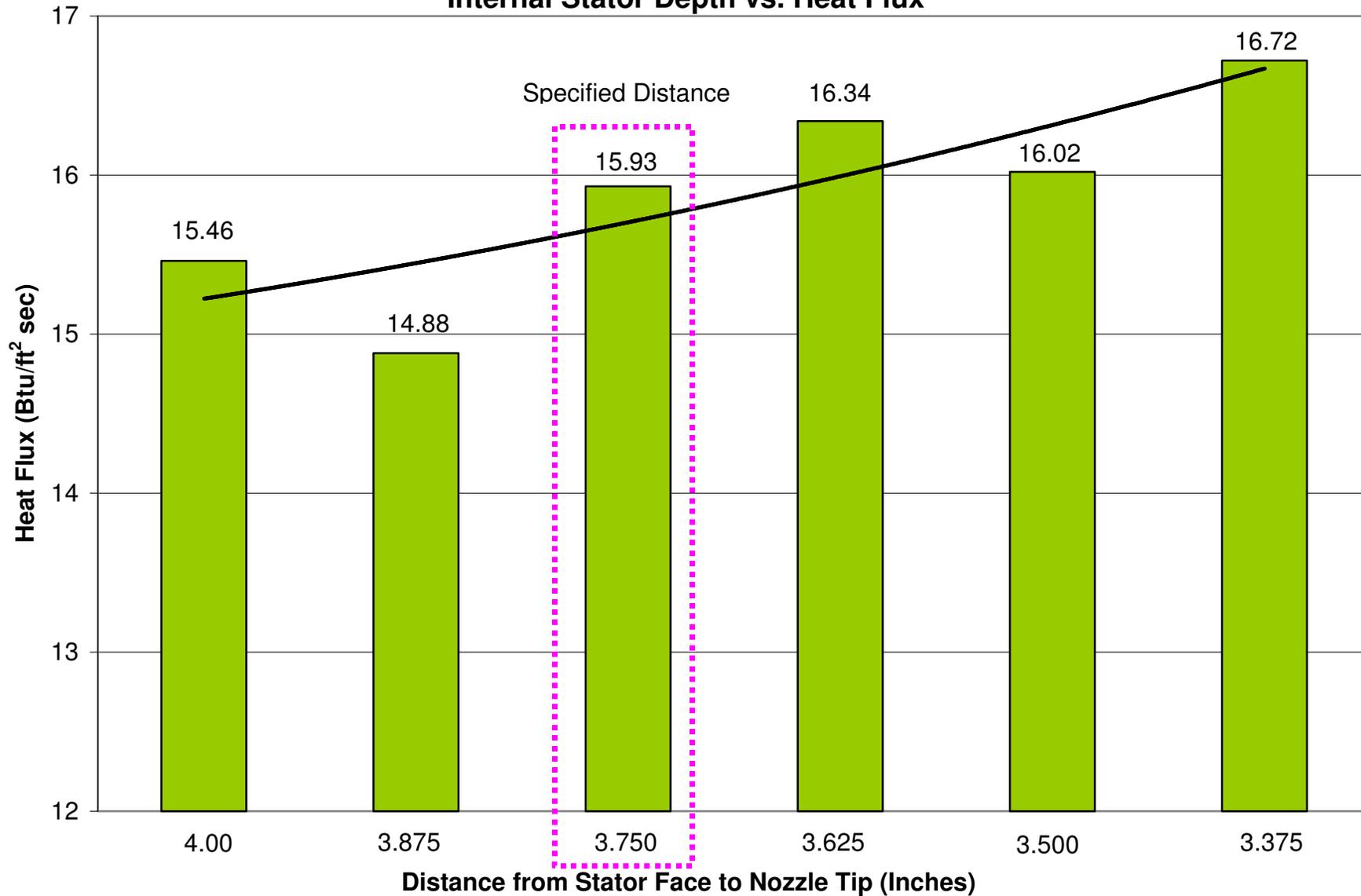
Nozzle Tip Depth vs. Heat Flux



Current Specification for Stator Position



Internal Stator Depth vs. Heat Flux



Development and Refinement of Burnthrough Test Method

Impact of Fuel Nozzle Type on Test Results

Boeing PL Nozzle



FAA PL Nozzle



Boeing PL Nozzle



FAA PL Nozzle



Boeing PL Nozzle

FAA PL Nozzle



Discussion with Monarch

Early nozzles inscribed with “F-80” (generic drawing description)



Discussion with Monarch

Late 1980's, change from "F-80" to "MTD-92" (material tolerance description)



Discussion with Monarch

Early 1990's no inscription, but rather a production number (for example "9 7")



Nozzle Rotation Tests

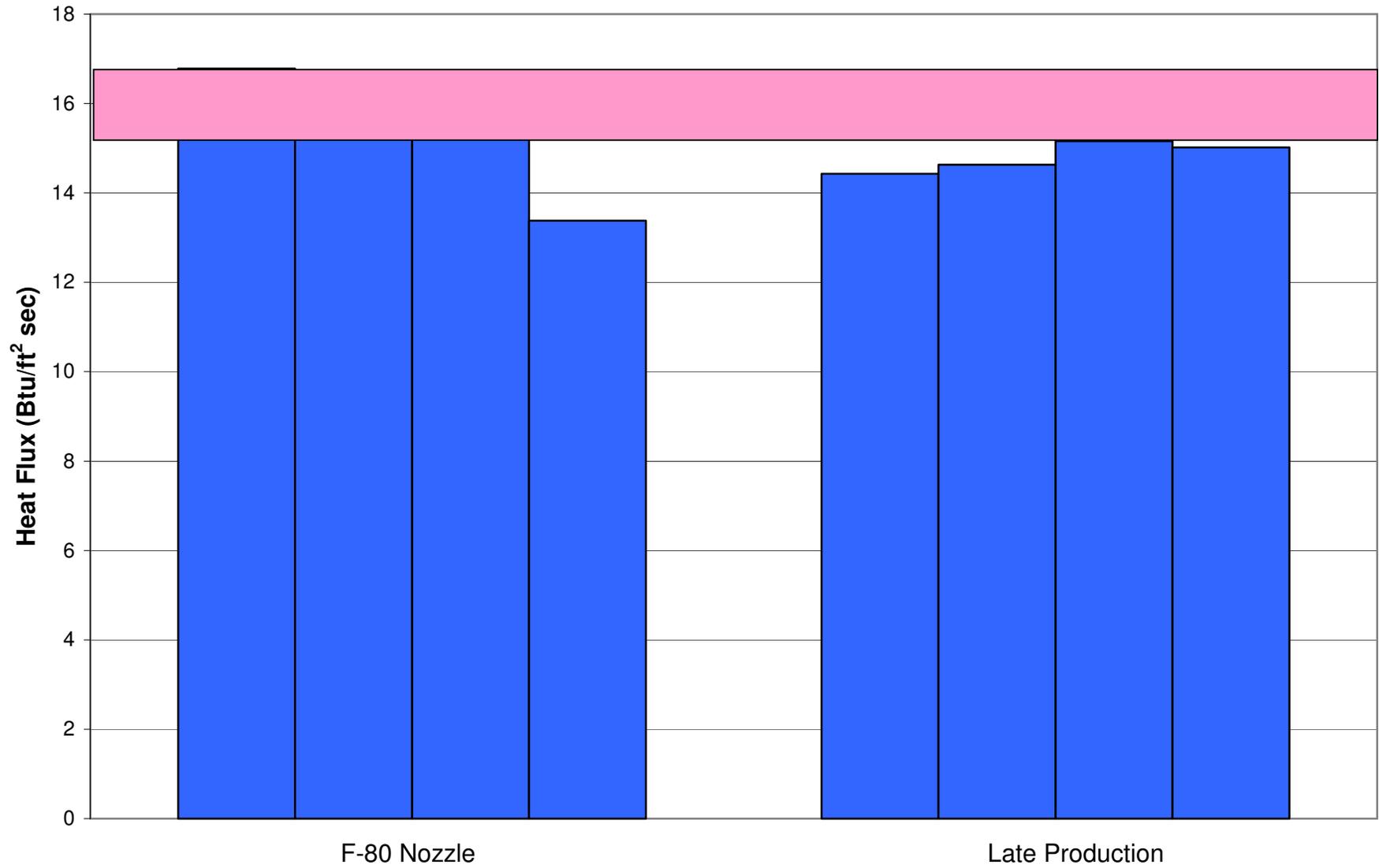
Old Style

| Test # | Nozzle Type | Monarch Letter Orientation | Heat Flux (Btu/ft ² sec) | Heat Flux Average |
|--------|-------------|----------------------------|-------------------------------------|-------------------|
| 1 | F-80 | 3 o'clock | 16.56 | 16.78 |
| 2 | F-80 | 3 o'clock | 16.62 | |
| 3 | F-80 | 3 o'clock | 17.16 | |
| 4 | F-80 | 6 o'clock | 15.52 | 15.71 |
| 5 | F-80 | 6 o'clock | 15.88 | |
| 6 | F-80 | 6 o'clock | 15.74 | |
| 7 | F-80 | 9 o'clock | 15.08 | 15.47 |
| 8 | F-80 | 9 o'clock | 15.55 | |
| 9 | F-80 | 9 o'clock | 15.79 | |
| 10 | F-80 | 12 o'clock | 13.37 | 13.38 |
| 11 | F-80 | 12 o'clock | 13.51 | |
| 12 | F-80 | 12 o'clock | 13.26 | |

New Style

| Test # | Nozzle Type | Monarch Letter Orientation | Heat Flux (Btu/ft ² sec) | Heat Flux Average |
|--------|-----------------|----------------------------|-------------------------------------|-------------------|
| 13 | Late Production | 3 o'clock | 14.17 | 14.43 |
| 14 | Late Production | 3 o'clock | 14.43 | |
| 15 | Late Production | 3 o'clock | 14.69 | |
| 16 | Late Production | 6 o'clock | 14.29 | 14.63 |
| 17 | Late Production | 6 o'clock | 14.69 | |
| 18 | Late Production | 6 o'clock | 14.92 | |
| 19 | Late Production | 9 o'clock | 14.80 | 15.16 |
| 20 | Late Production | 9 o'clock | 15.35 | |
| 21 | Late Production | 9 o'clock | 15.34 | |
| 22 | Late Production | 12 o'clock | 14.77 | 15.02 |
| 23 | Late Production | 12 o'clock | 15.05 | |
| 24 | Late Production | 12 o'clock | 15.23 | |

Nozzle Rotation Testing

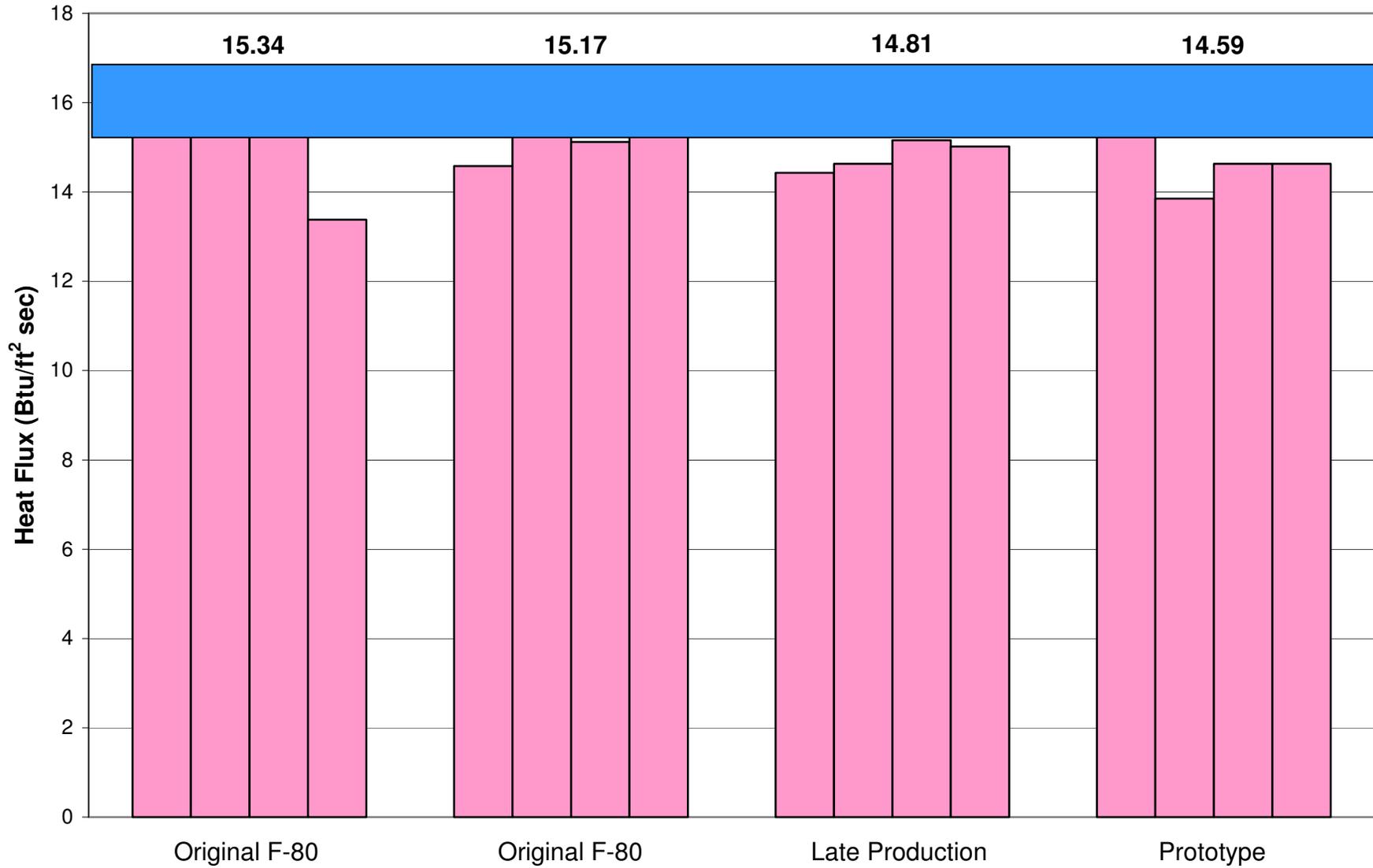


Prototype Nozzle Developed by Monarch



Heat Flux Comparison of Nozzles

Nozzle Comparison



6.5 GPH 80° PL “old style” F-80



Evaluation of Monarch 6.5 GPH 80° PL

| Nozzle | Std Flowrate @ 100 psi | Fuel Pressure | Adjusted Flowrate | Heat Flux (Btu/ft ² sec) |
|------------|---------------------------|---------------|----------------------|--|
| 6.0 80° PL | 6.0 | 107 | 6.02 | 15.60 |
| 6.5 80° PL | 6.5 | 107 | 6.52 | 16.03 |
| 6.5 80° PL | 6.5 | 97 | 6.04 | 15.26 |
| 6.5 80° PL | 6.5 | 97 | 6.04 | 15.59 |

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Evaluation of Monarch 6.5 GPH 80° PL

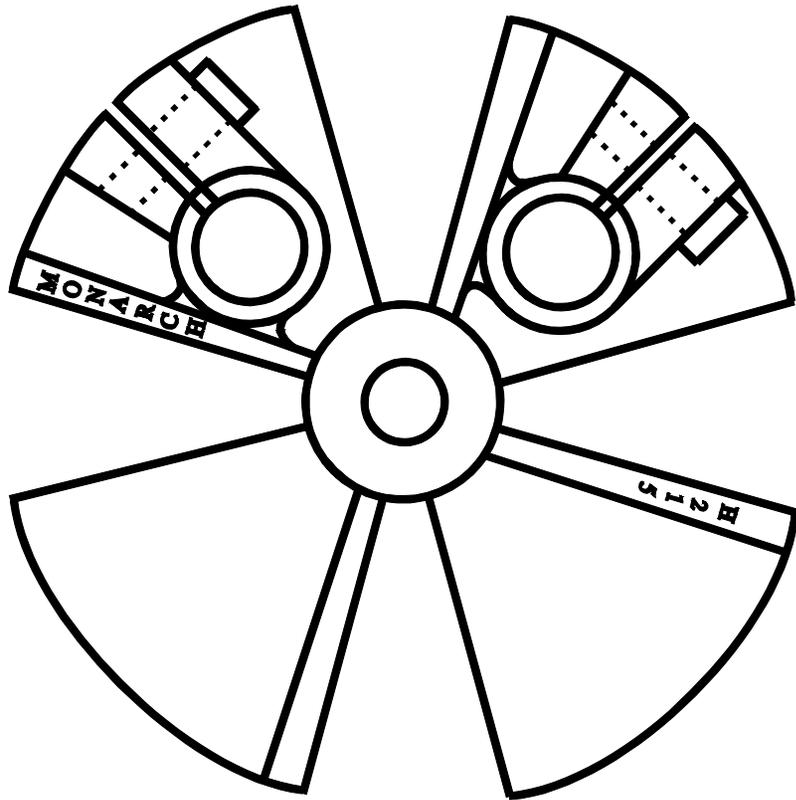
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1941 1981 1958 1958 1974 1992 1999 Avg 1972

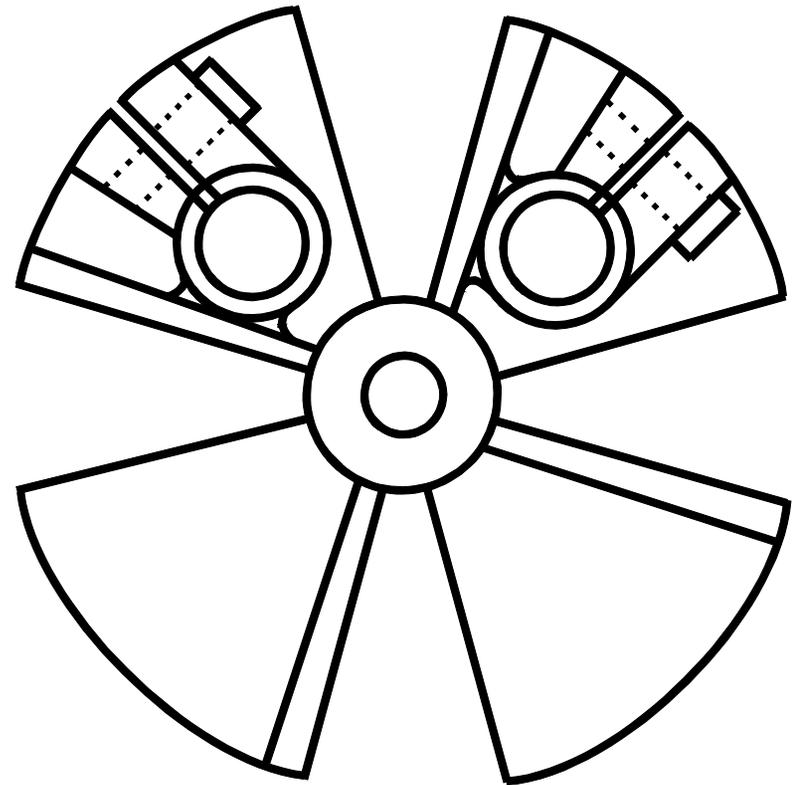
Development and Refinement of Burnthrough Test Method

Impact of Internal Stator Diameter on Test Results

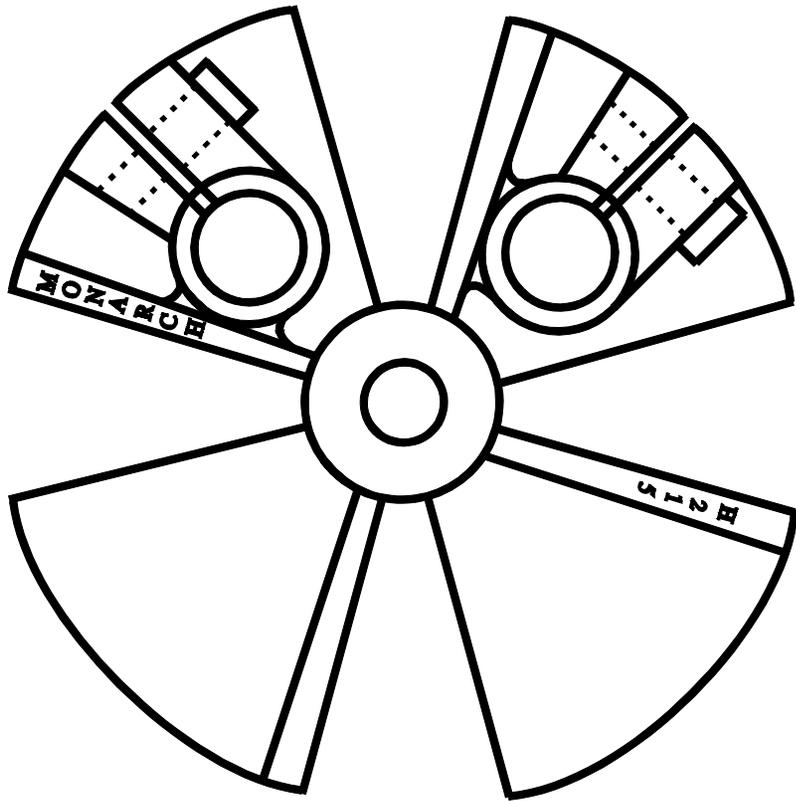
Original H215



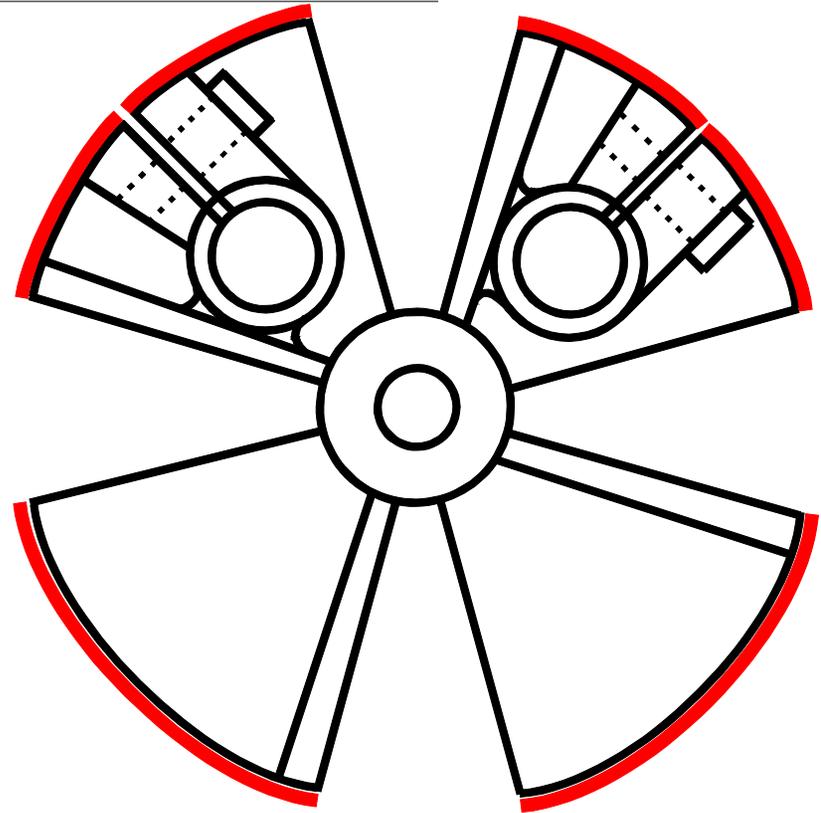
Casting Replicate
(3-5% Smaller)



Original H215

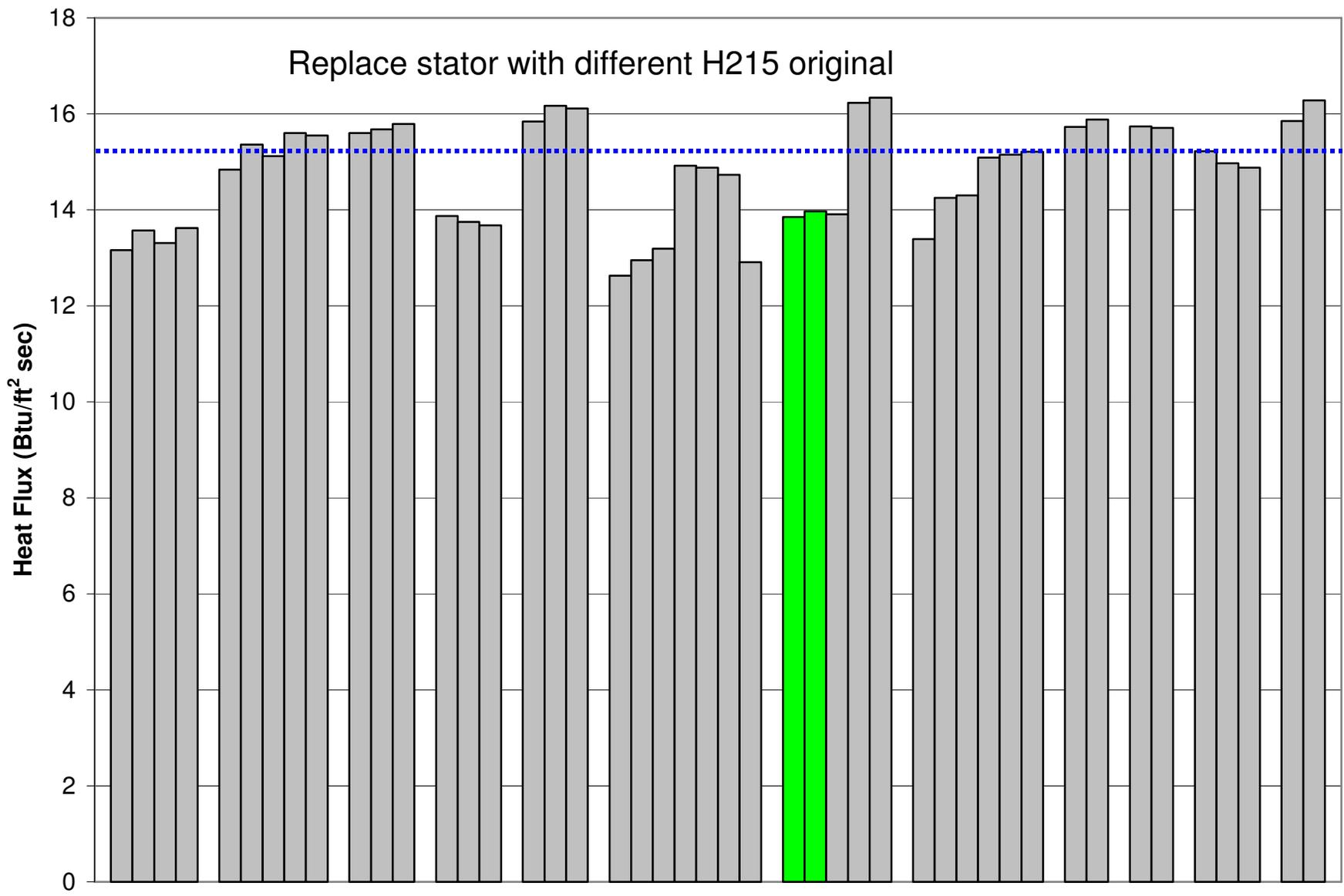


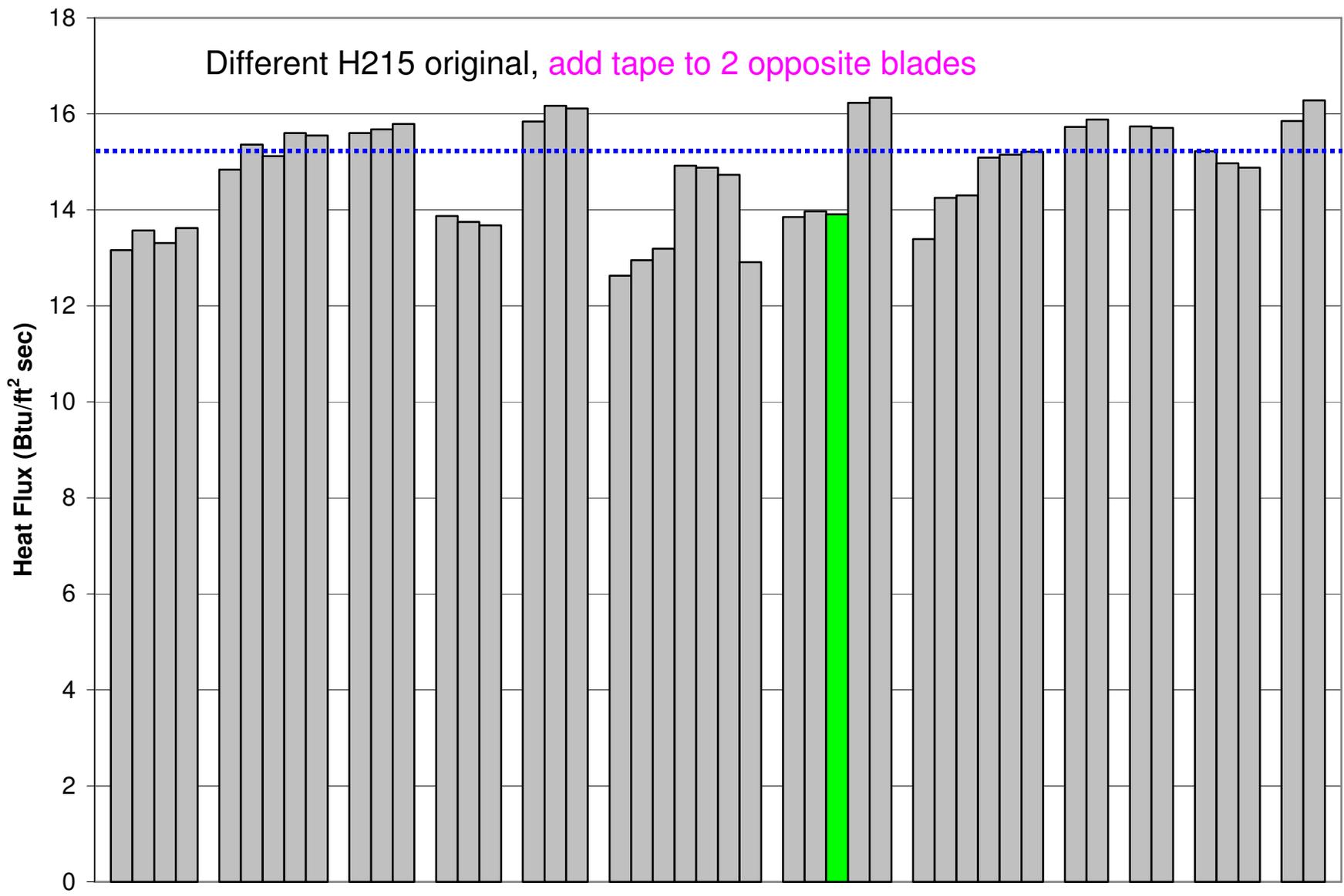
Modified Replicate
(Same Diameter)

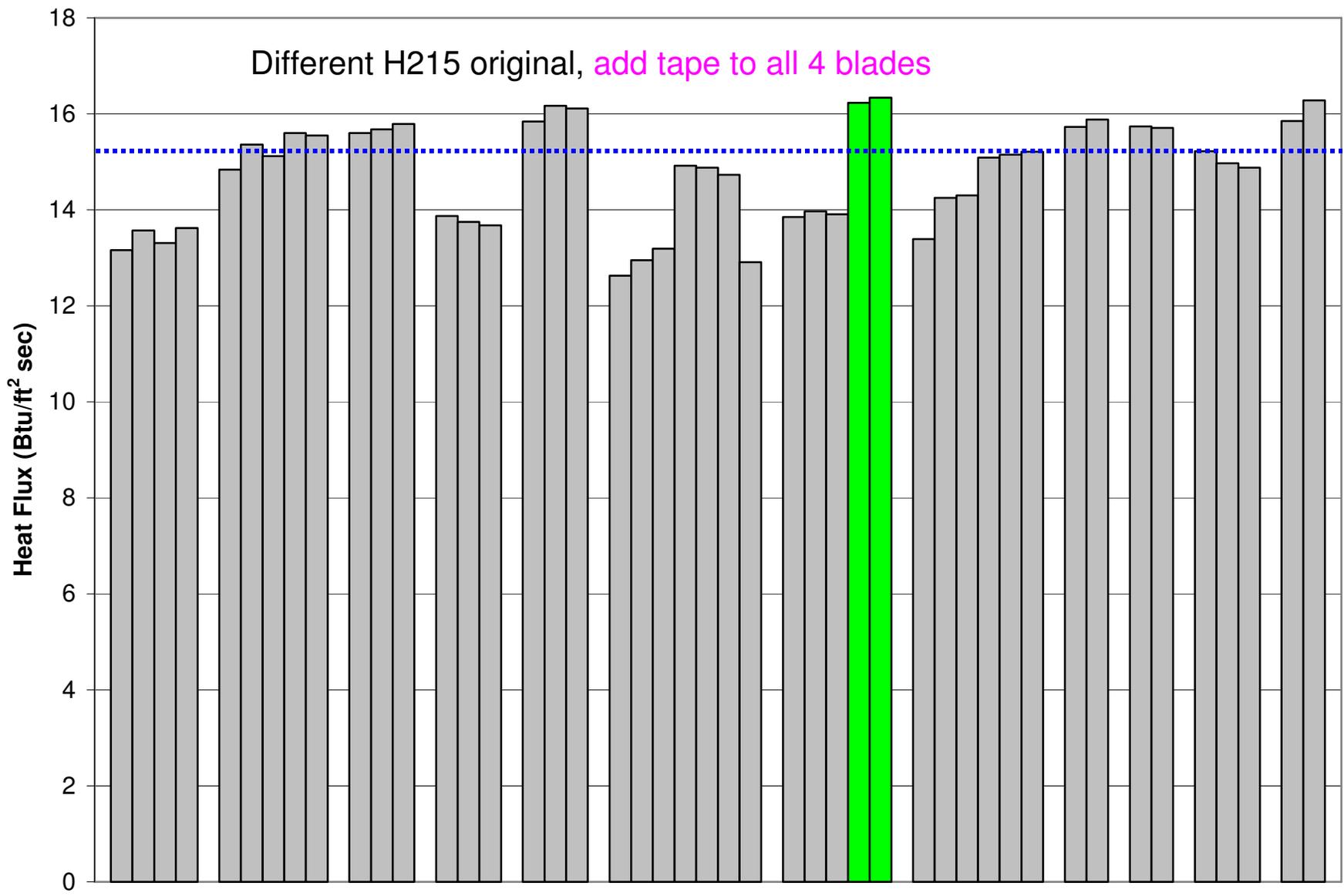


Fiberglass Tape Added to Blade Edge

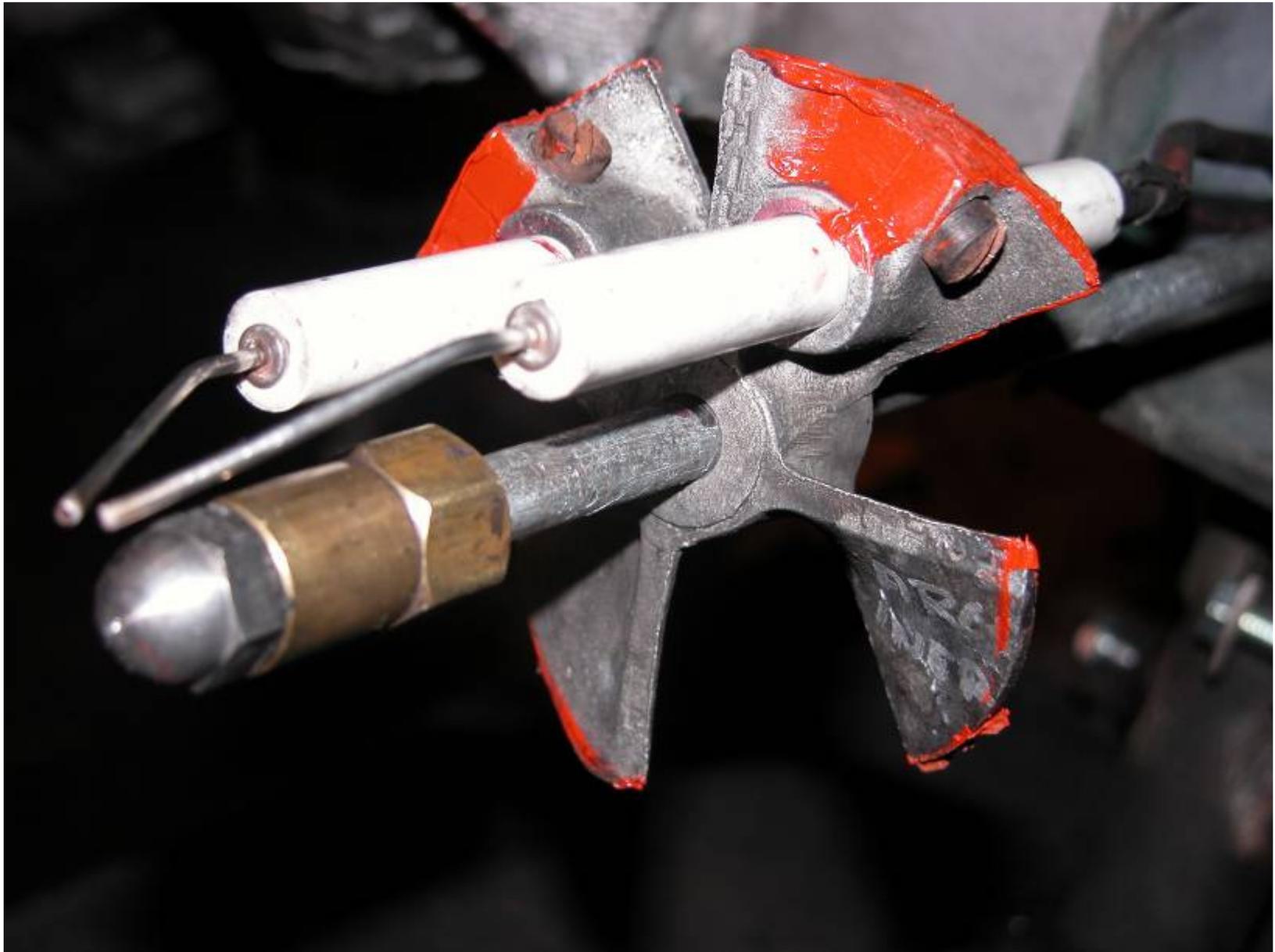


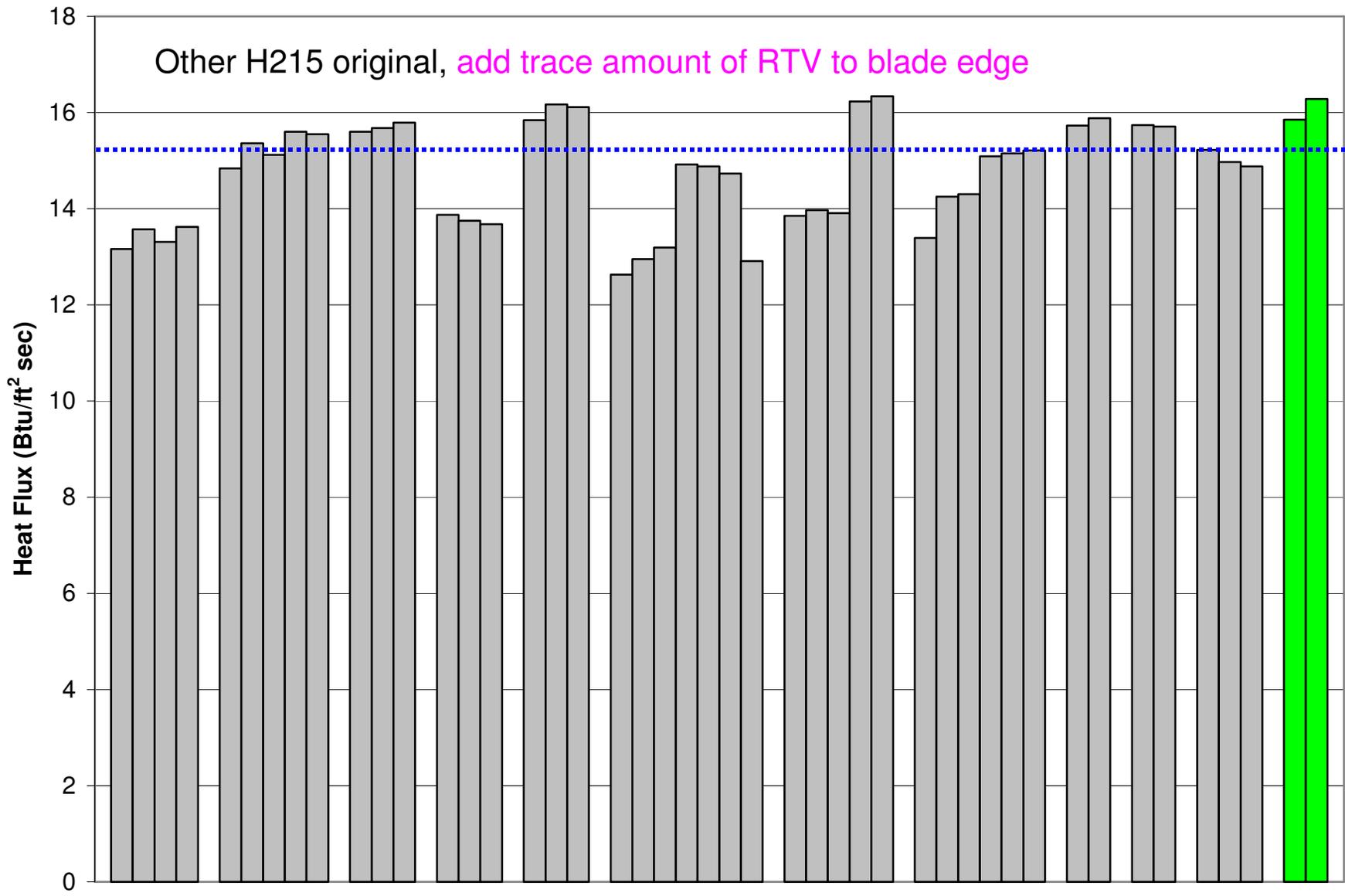






RTV Sealant Added to Blade Edge





Development and Refinement of Burnthrough Test Method

Impact of Main Housing Type on Test Results

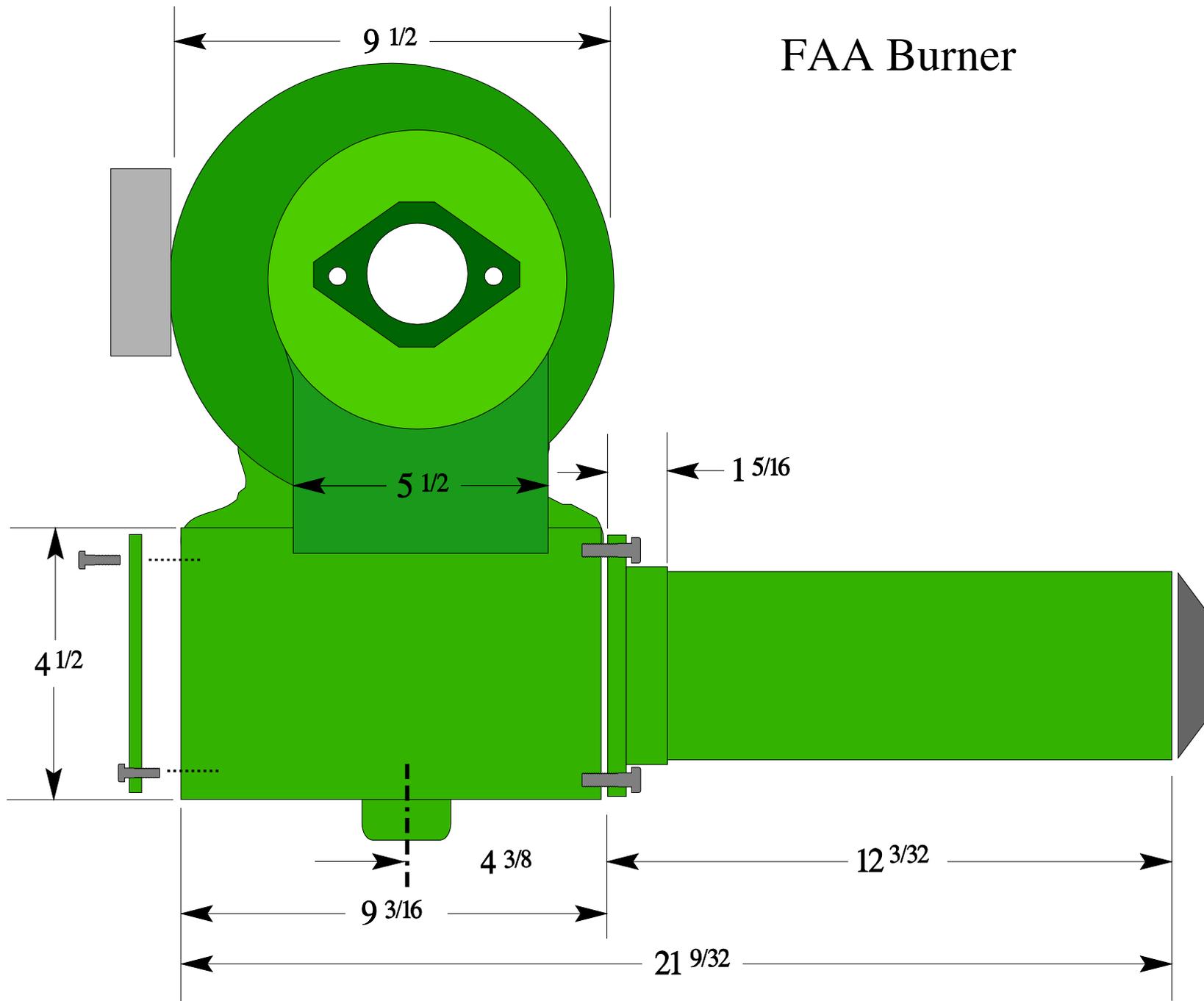
Flanged vs. Socket Type Housing



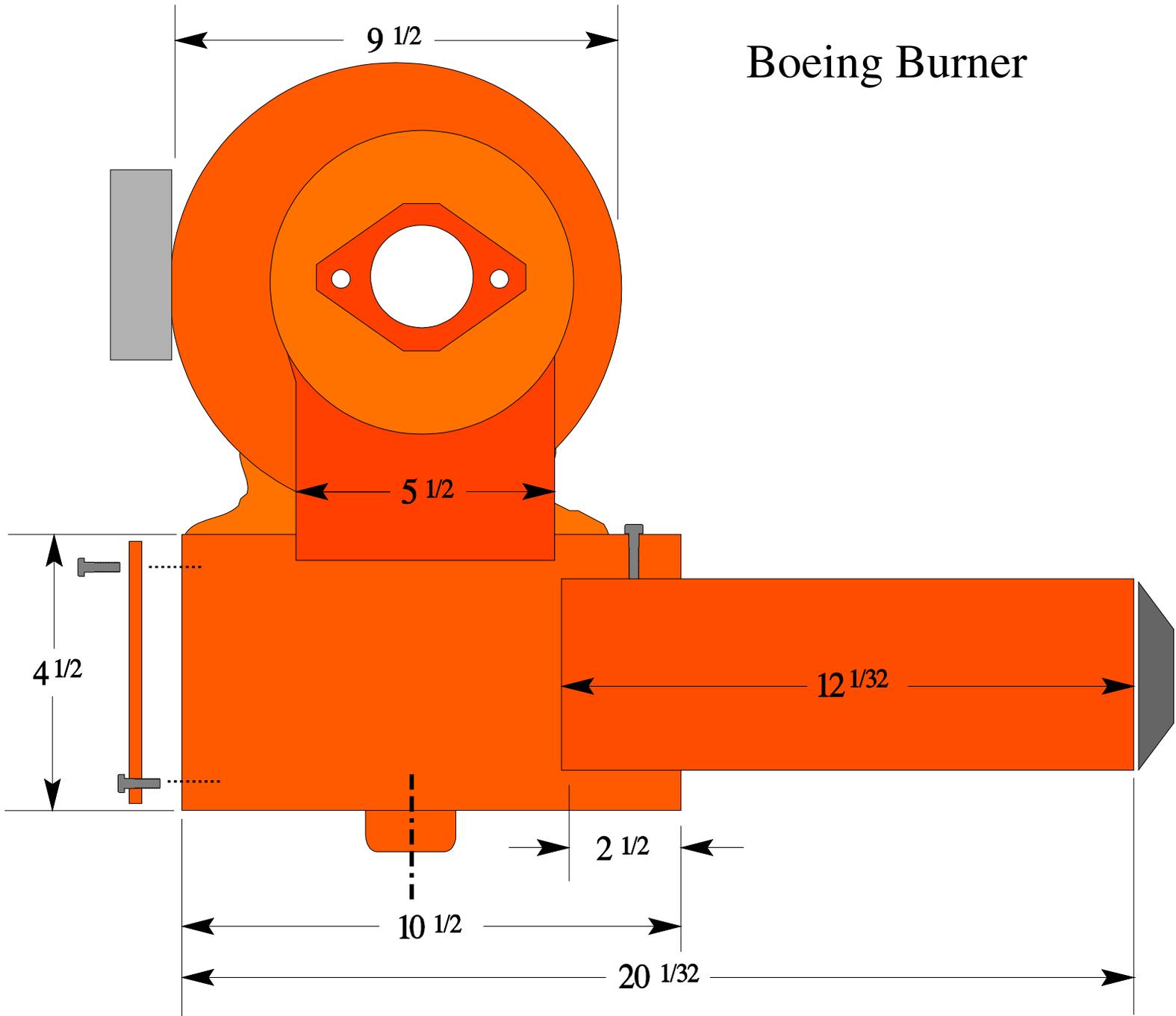
Different Draft Tubes for Each Housing Type



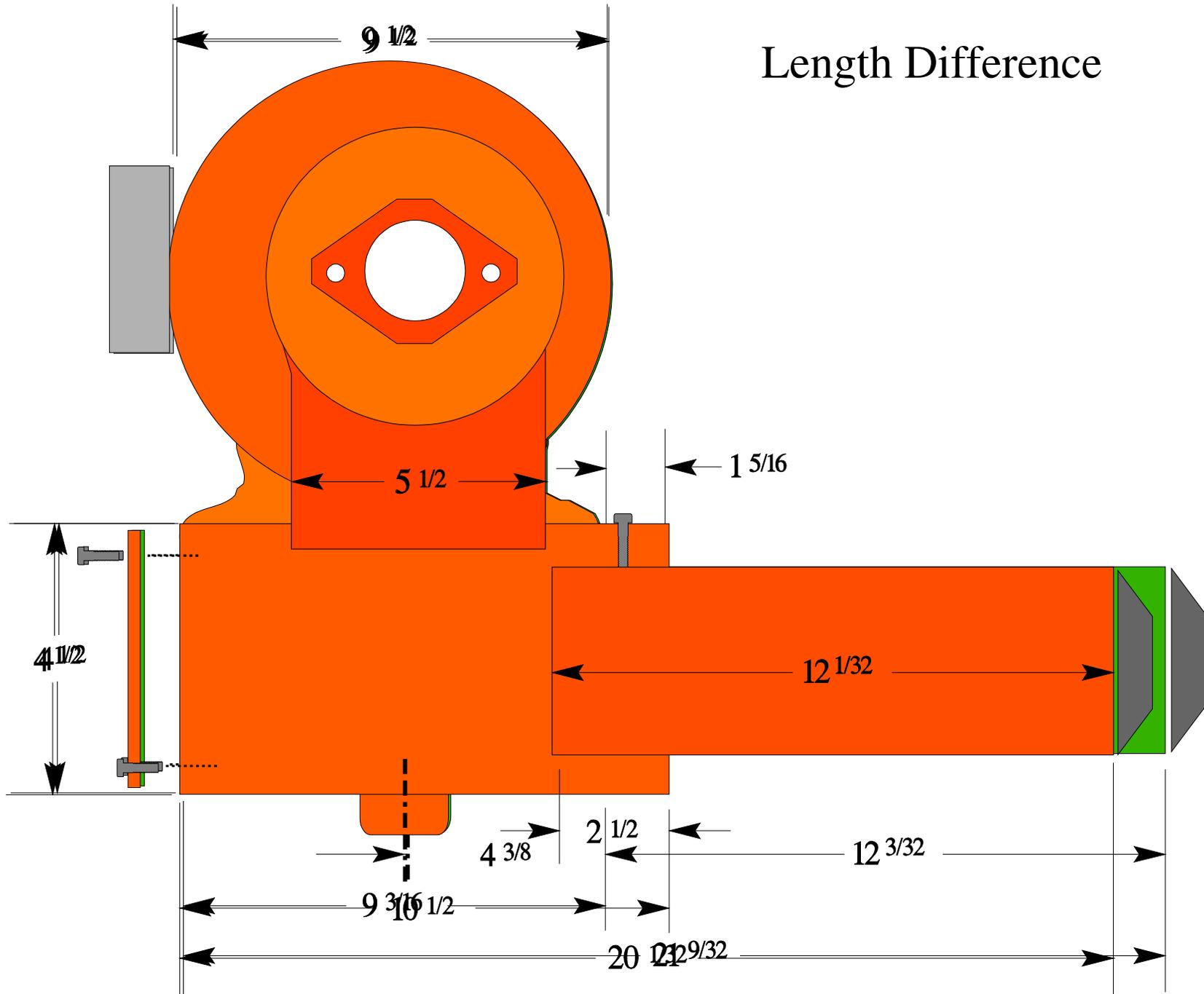
FAA Burner



Boeing Burner



Length Difference

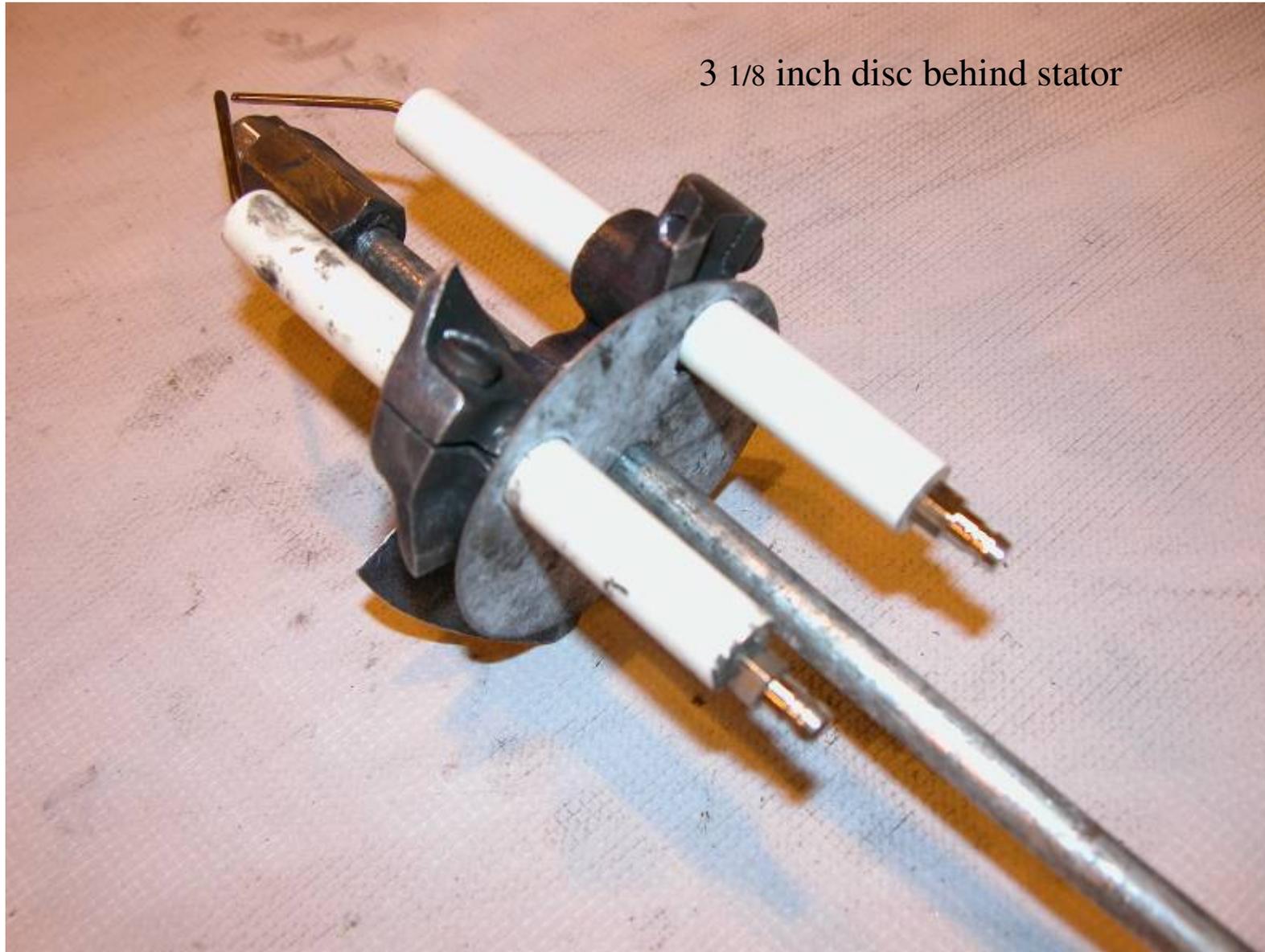


Possible Simple Modifications to Socket Burner

Objective: To develop a simple modification to the socket burner that would result in equivalent performance to the flanged burner (i.e., reduced exit air velocity while maintaining specified 2150 ft/min intake velocity).

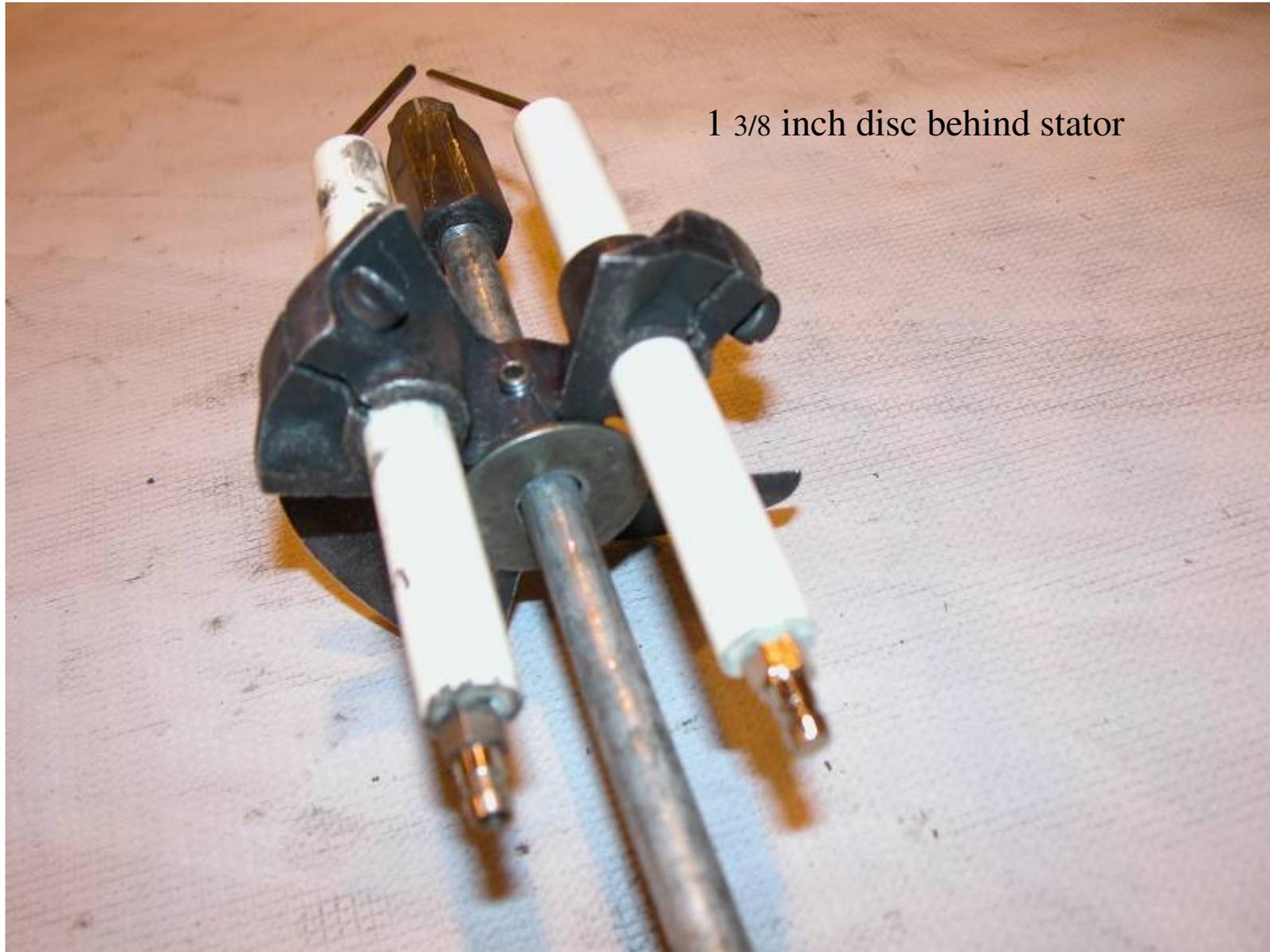
Methodology: Alter the flow of air in the draft tube using various deflectors, discs, and stators in order to reduce the output velocity.

Possible Simple Modifications to Socket Burner



3 1/8 inch disc behind stator

Possible Simple Modifications to Socket Burner



1 3/8 inch disc behind stator

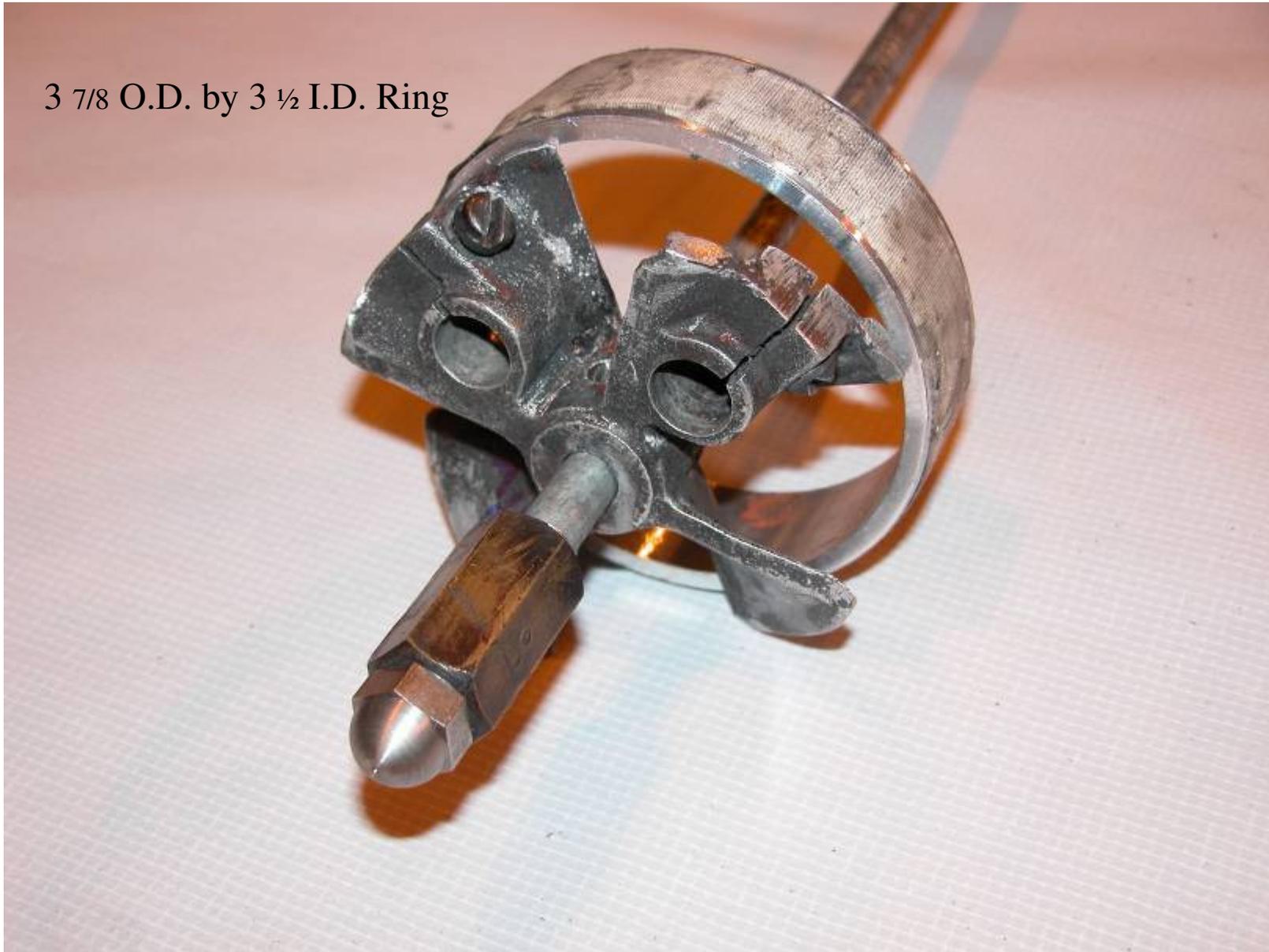
Possible Simple Modifications to Socket Burner



Half moon static disc behind stator

Possible Simple Modifications to Socket Burner

3 7/8 O.D. by 3 1/2 I.D. Ring

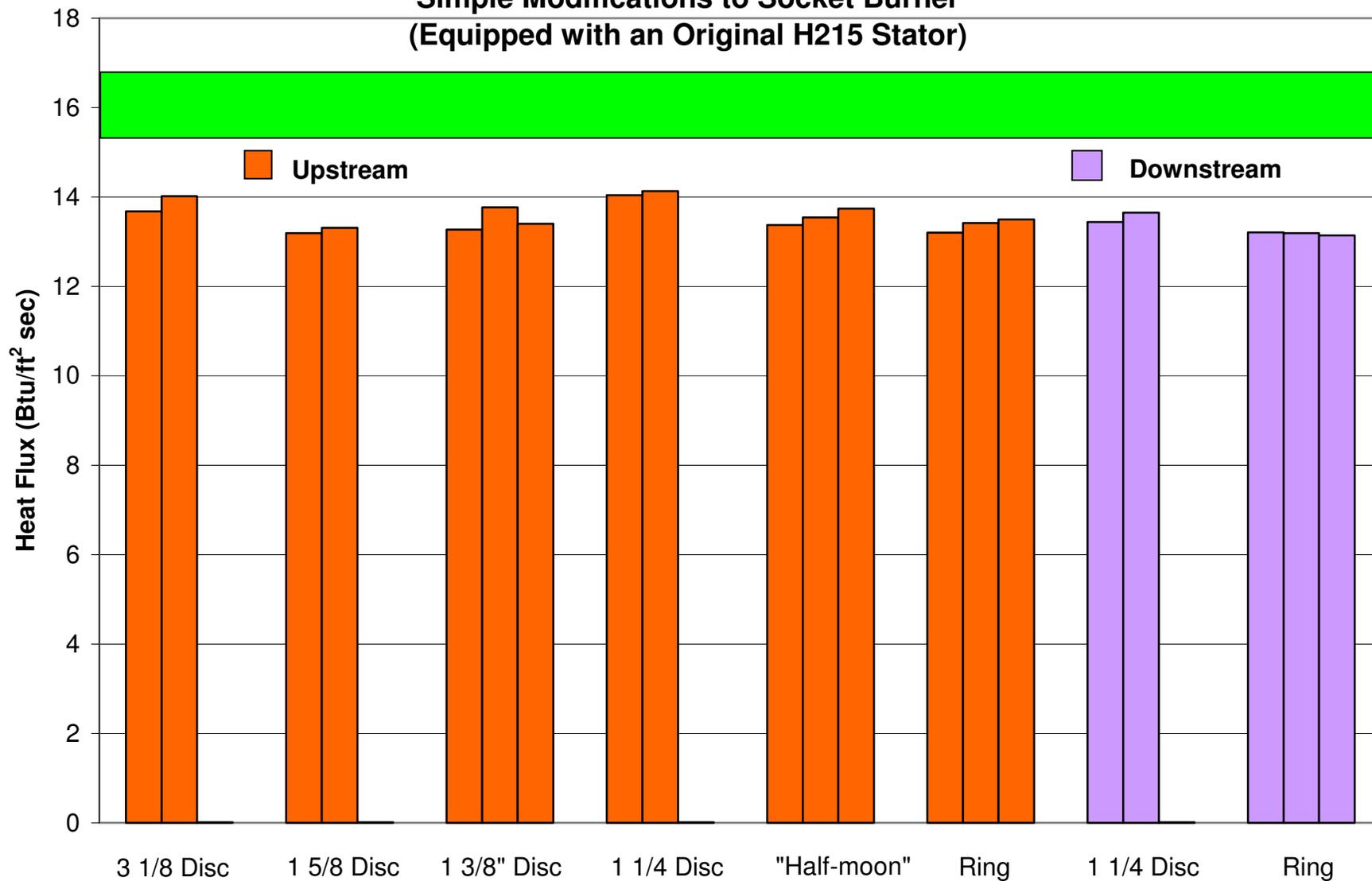




1 1/4 inch disc in front of stator

Socket Burner Testing

Simple Modifications to Socket Burner
(Equipped with an Original H215 Stator)



Possible Simple Modifications to Socket Burner



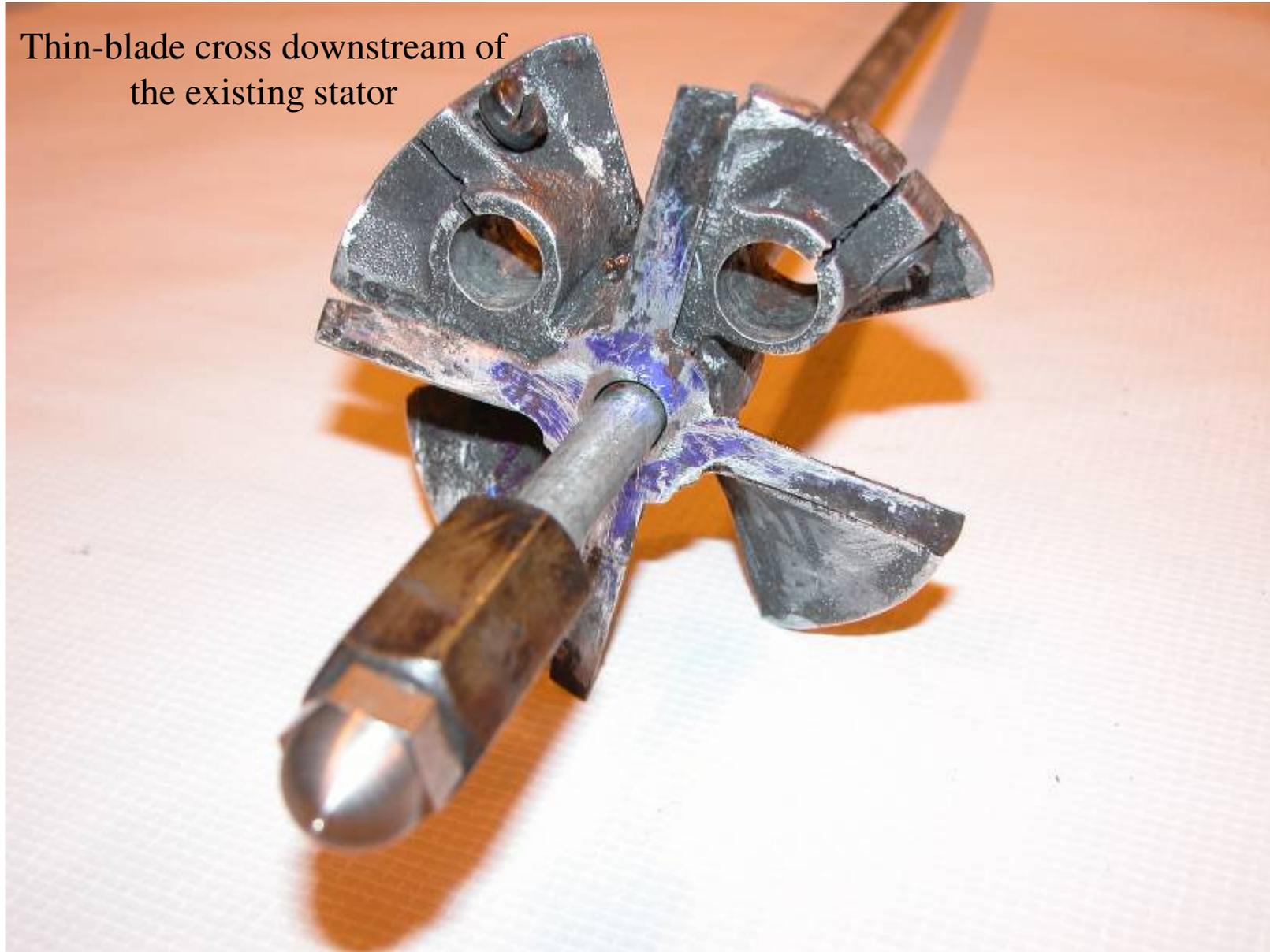
Possible Simple Modifications to Socket Burner

Thin-blade cross upstream of
the existing stator



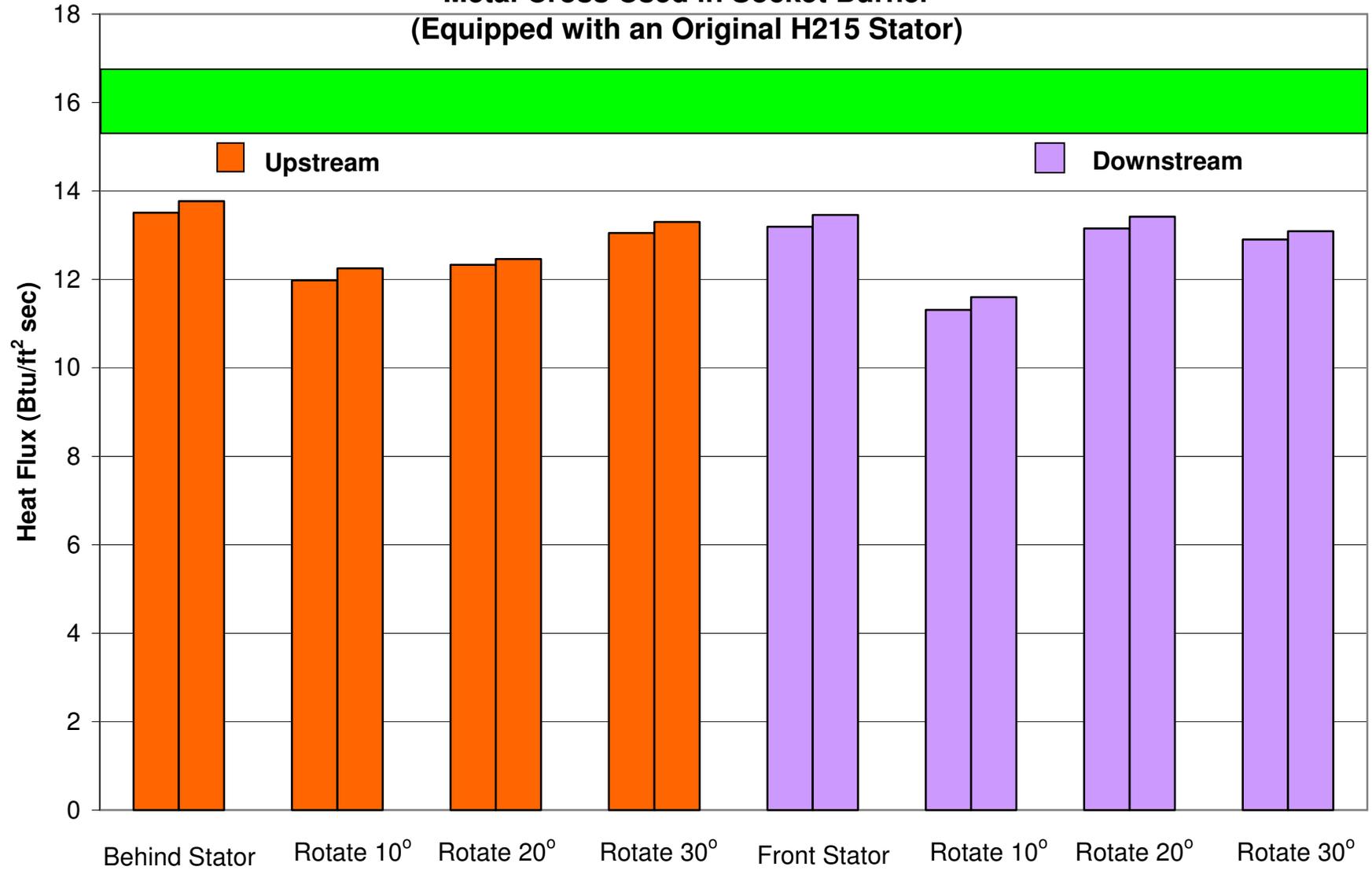
Possible Simple Modifications to Socket Burner

Thin-blade cross downstream of
the existing stator



Socket Burner Testing

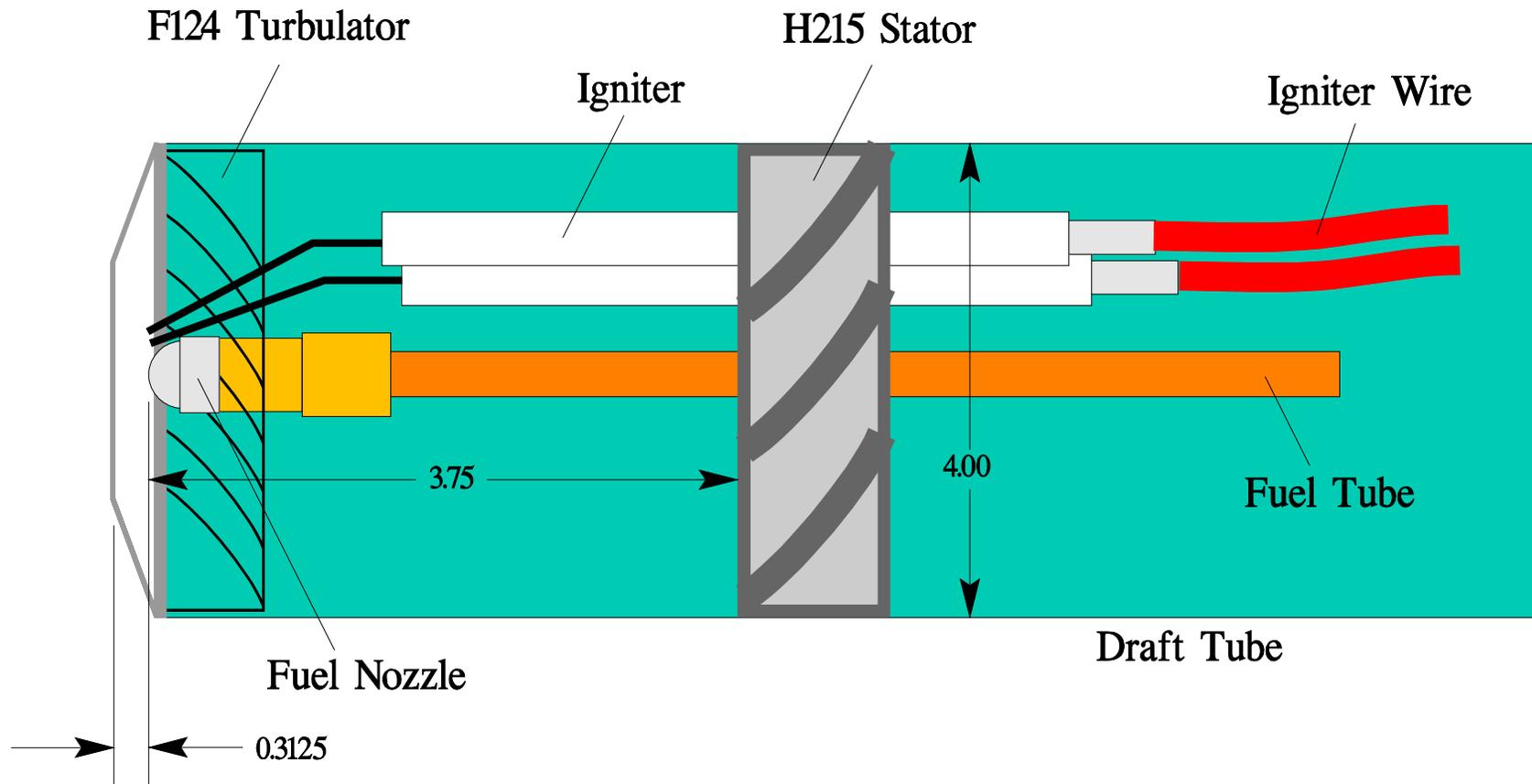
**Metal Cross Used in Socket Burner
(Equipped with an Original H215 Stator)**



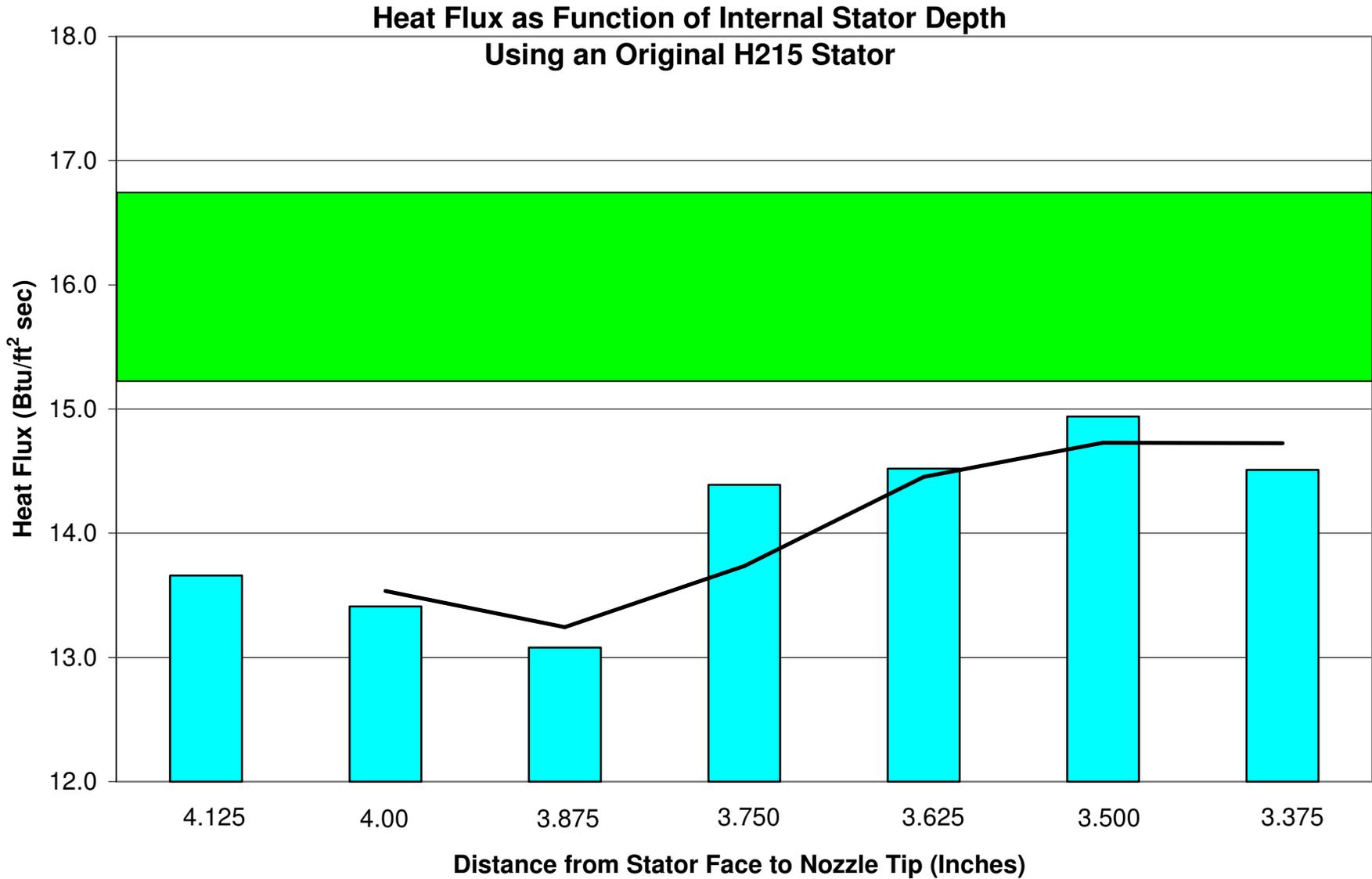
Assorted Components Used in Socket Burner



Current Specification for Stator Position (Flanged Burner)



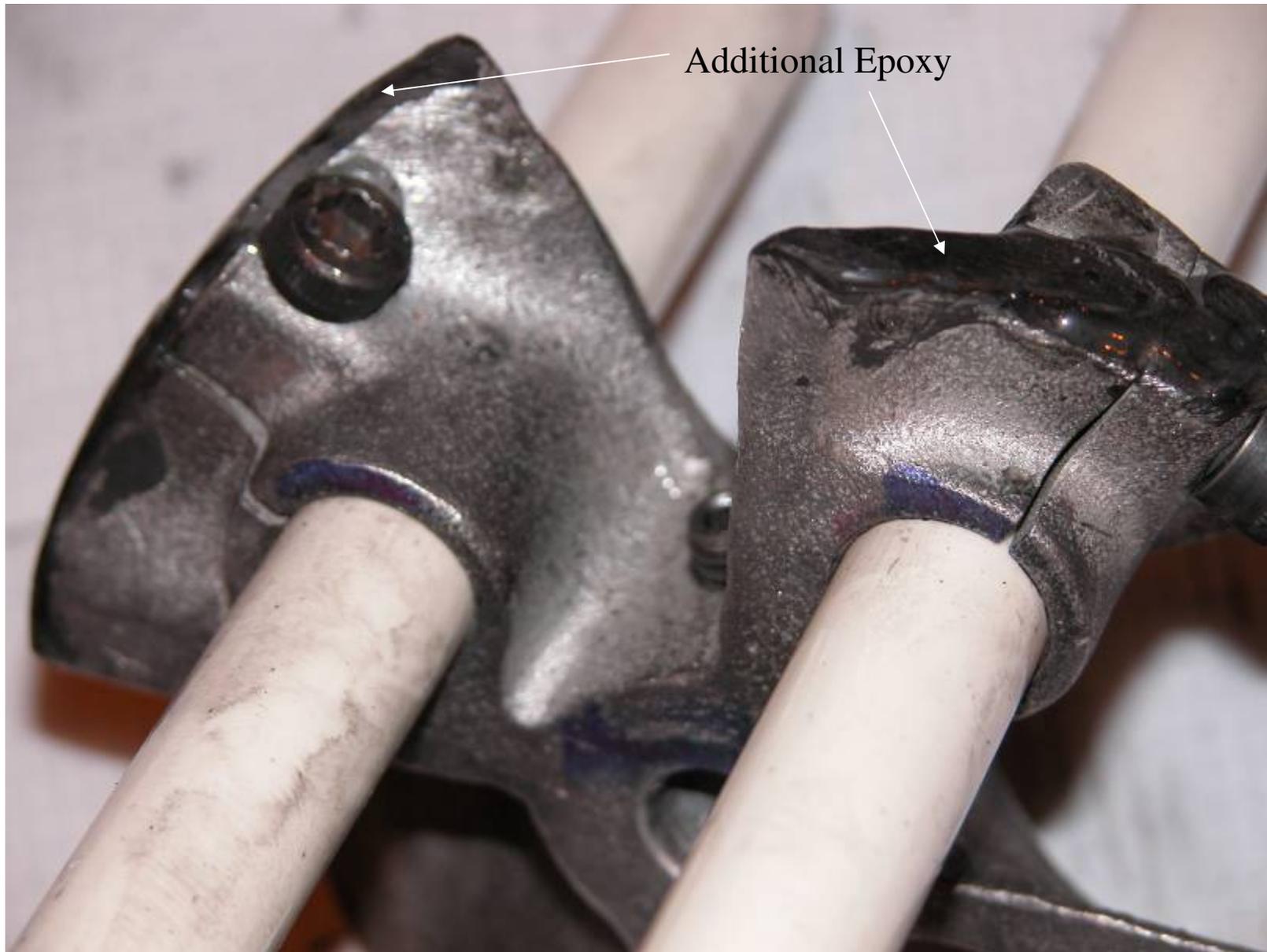
Socket Burner Testing



Reproduction Stator, Modified at Edges of Blades

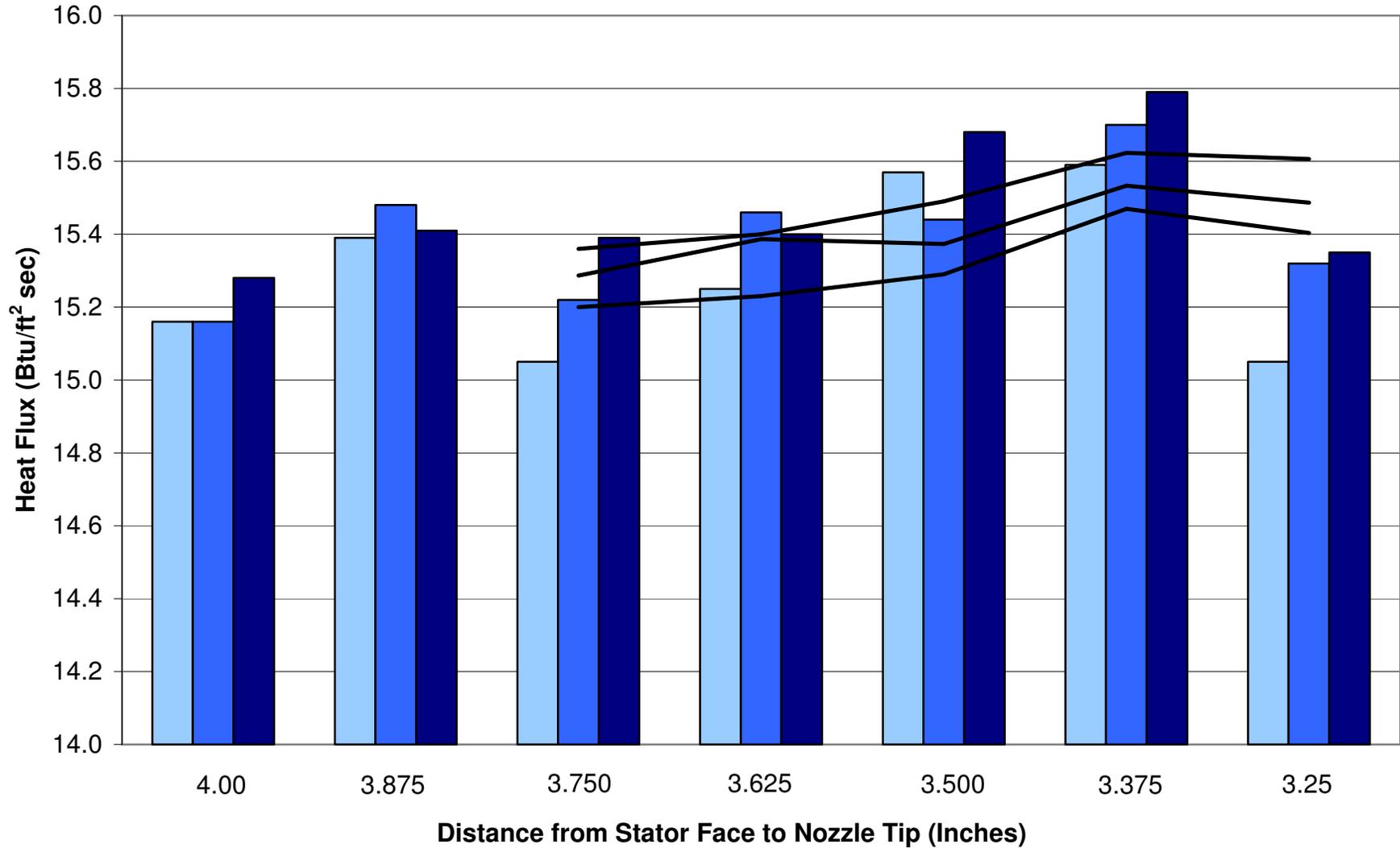


Reproduction Stator, Modified at Edges of Blades



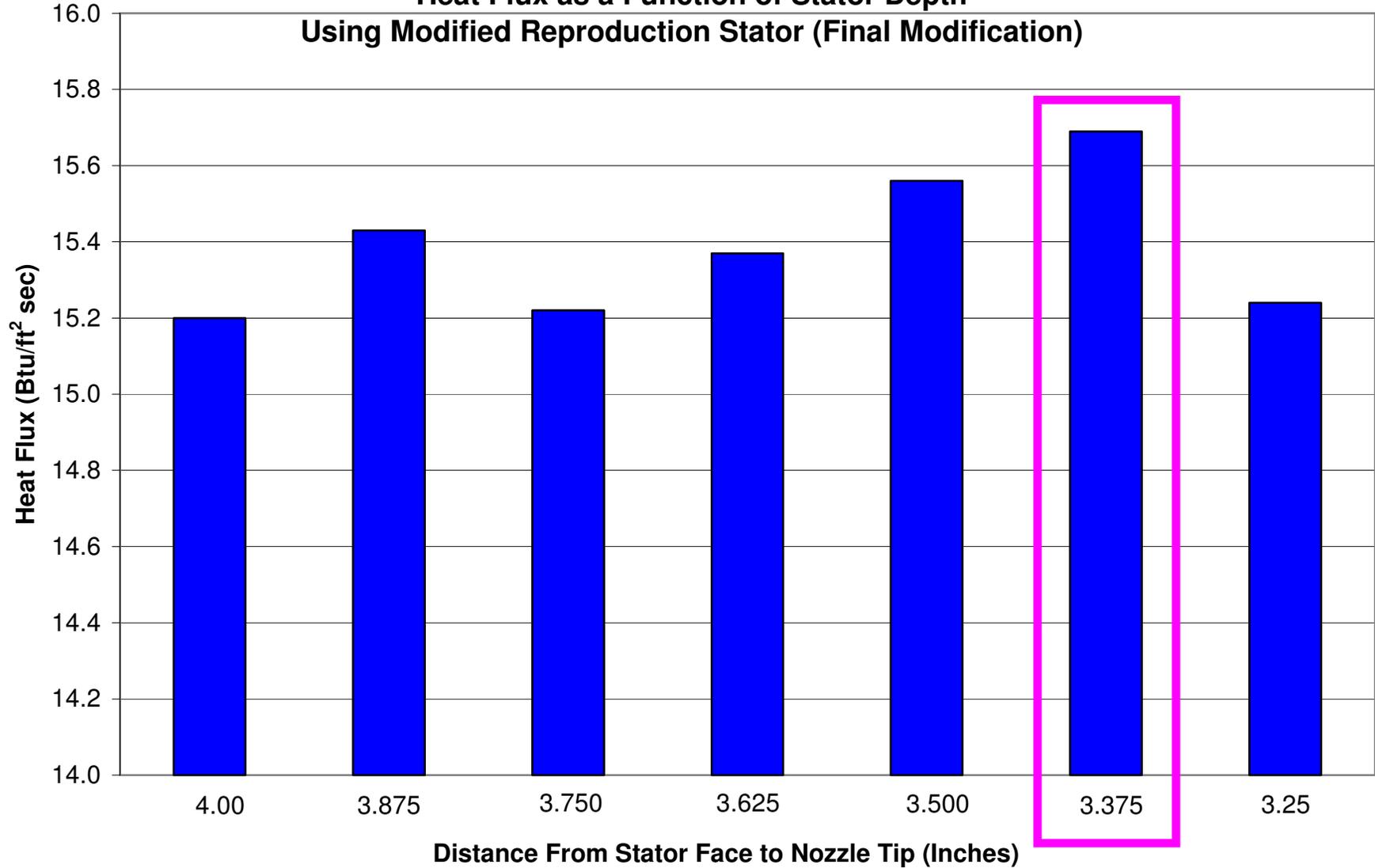
Socket Burner Testing

Heat Flux as a Function of Stator Depth
Using Modified Reproduction Stator (Final Modification)



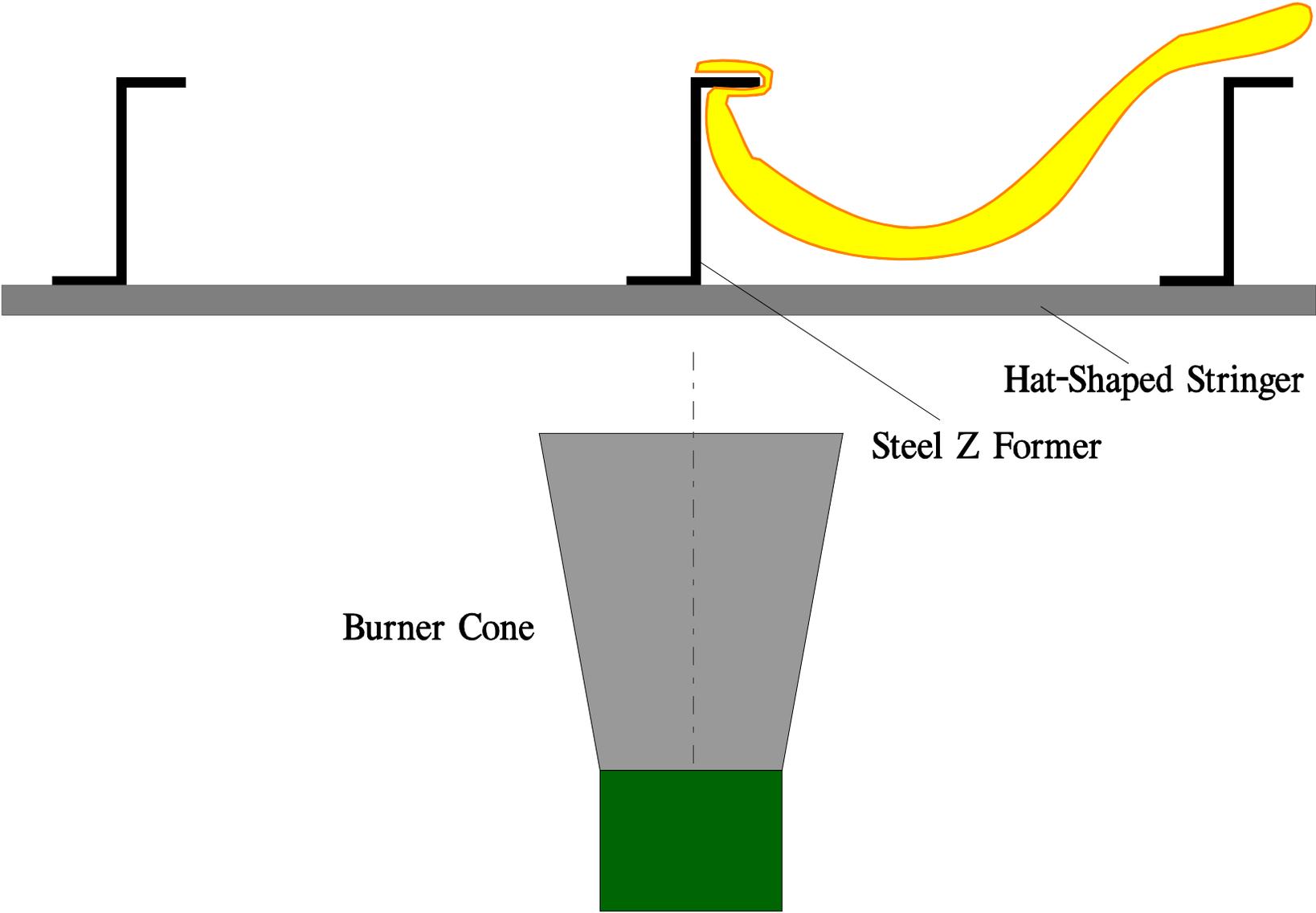
Socket Burner Testing

**Heat Flux as a Function of Stator Depth
Using Modified Reproduction Stator (Final Modification)**

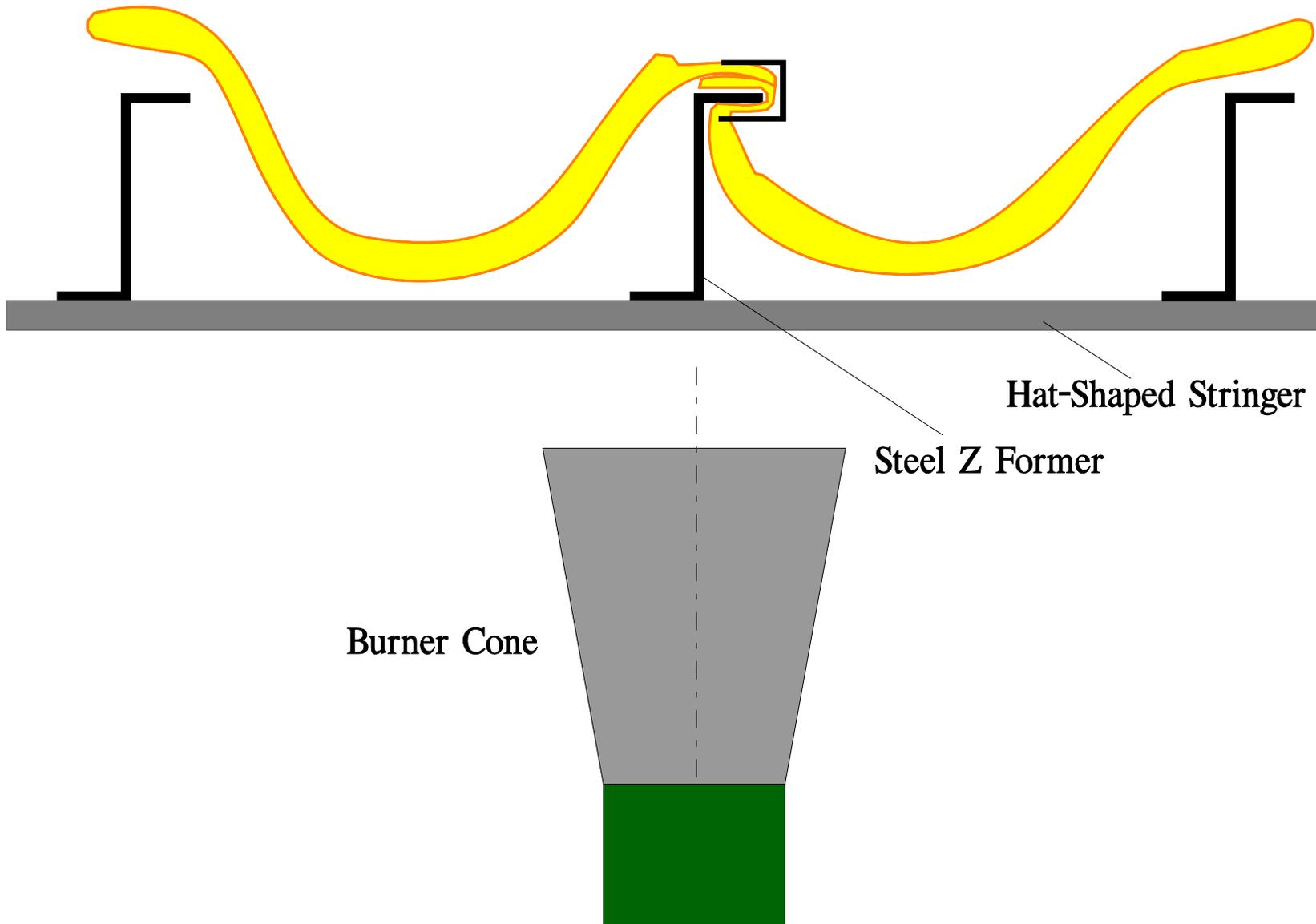


Proper Technique for Mounting Insulation Blankets on Test Frame

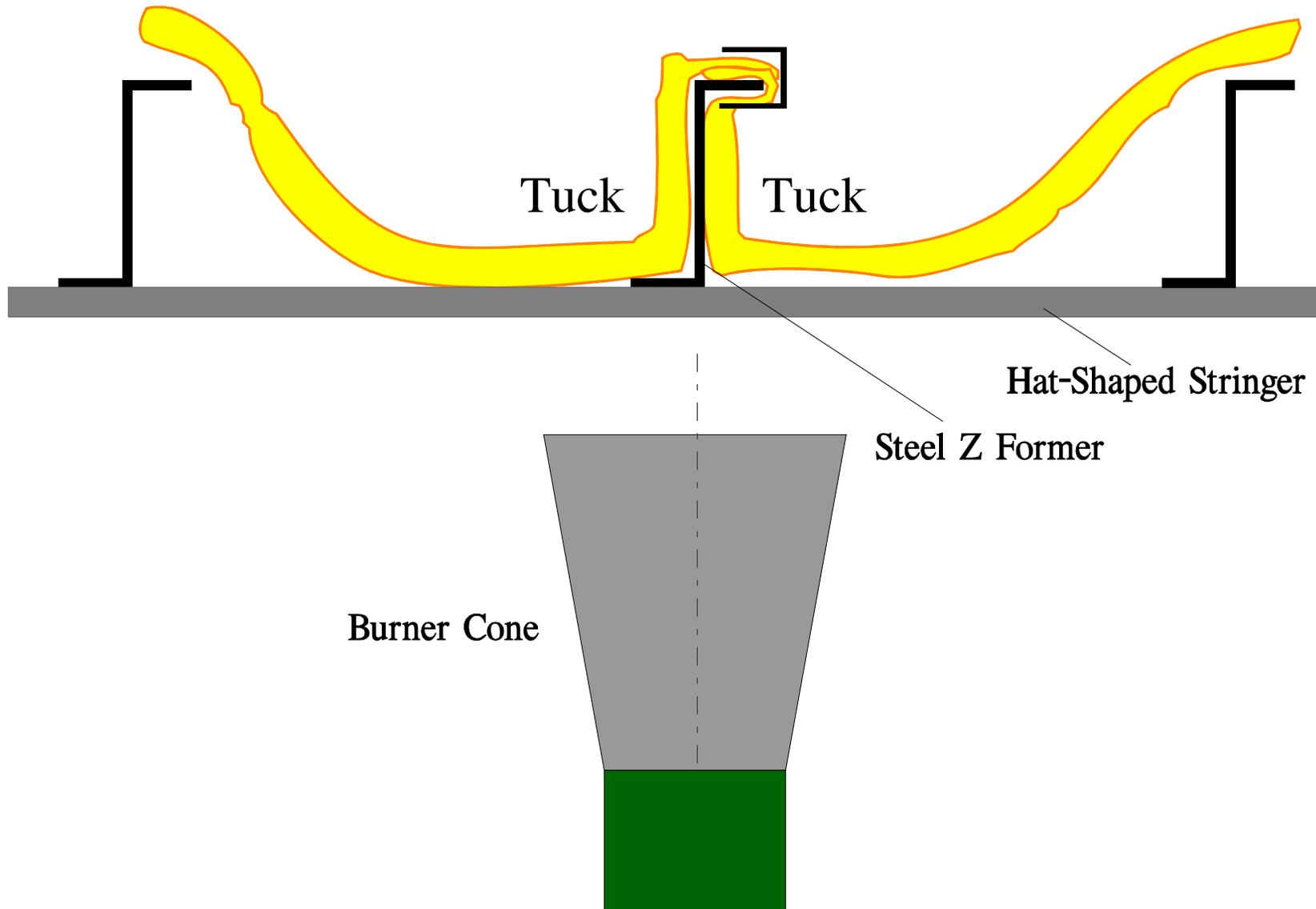
Step 1: Install Left Blanket, Squeeze Onto Former



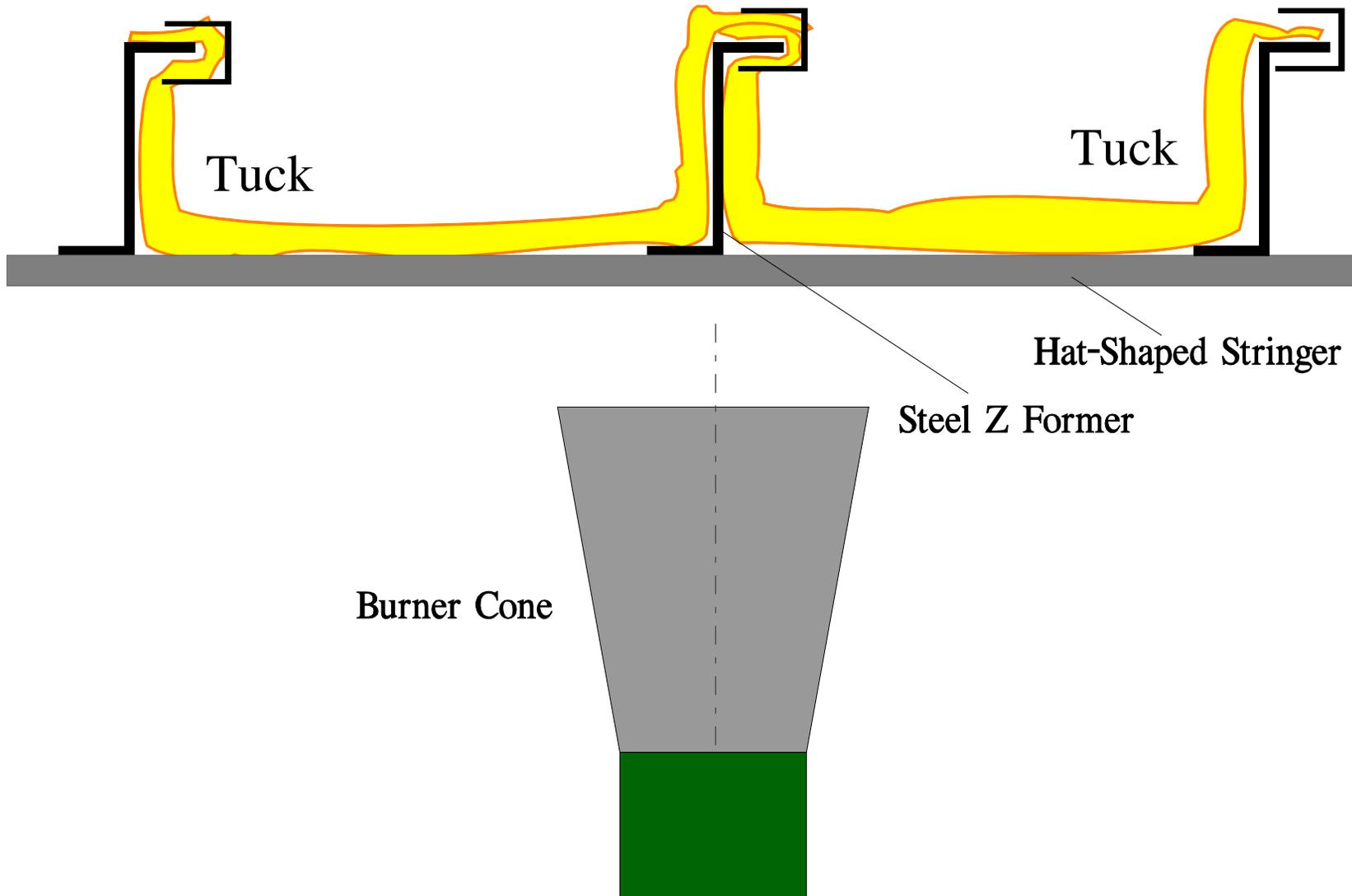
Step 2: Install Right Blanket, Clip To Frame



Step 3: Tuck Blanket Into Corners @ Center



Step 4: Tuck Blanket Into Corners @ Sides, Clip



Desired Blanket Installation on Test Frame



Desired Blanket Installation on Test Frame



Questions?