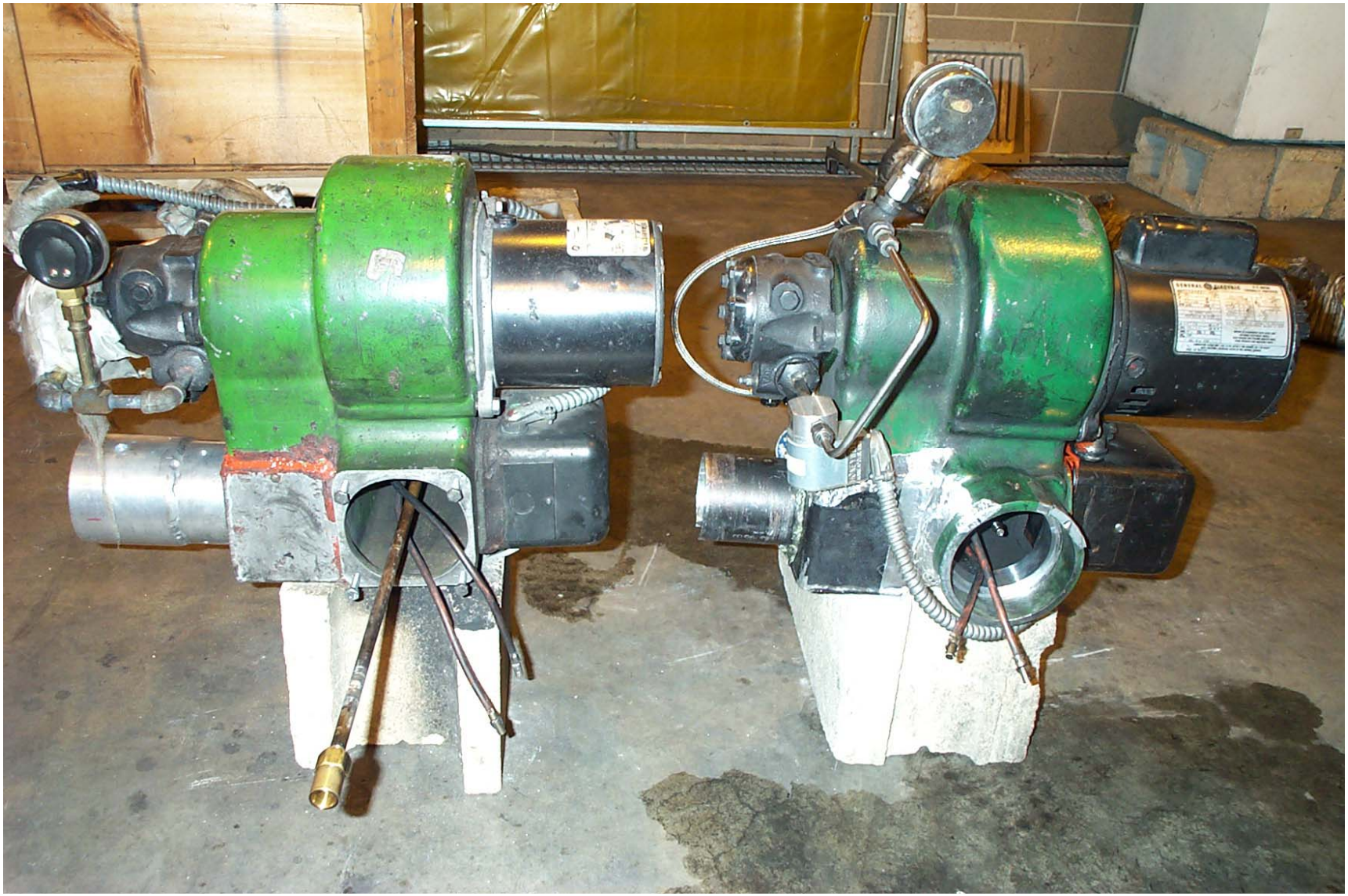
Discussion of Burnthrough Test Method for Aircraft Thermal Acoustic Insulation Blankets

Tim Marker

FAA Technical Center

Review from previous meeting in Atlantic City…



Flanged vs. Socket Type Draft Tube

Review from previous meeting in Atlantic City…

Primary differences between flanged and socket burners:

1. Length difference (socket shorter by 1.25 inches)

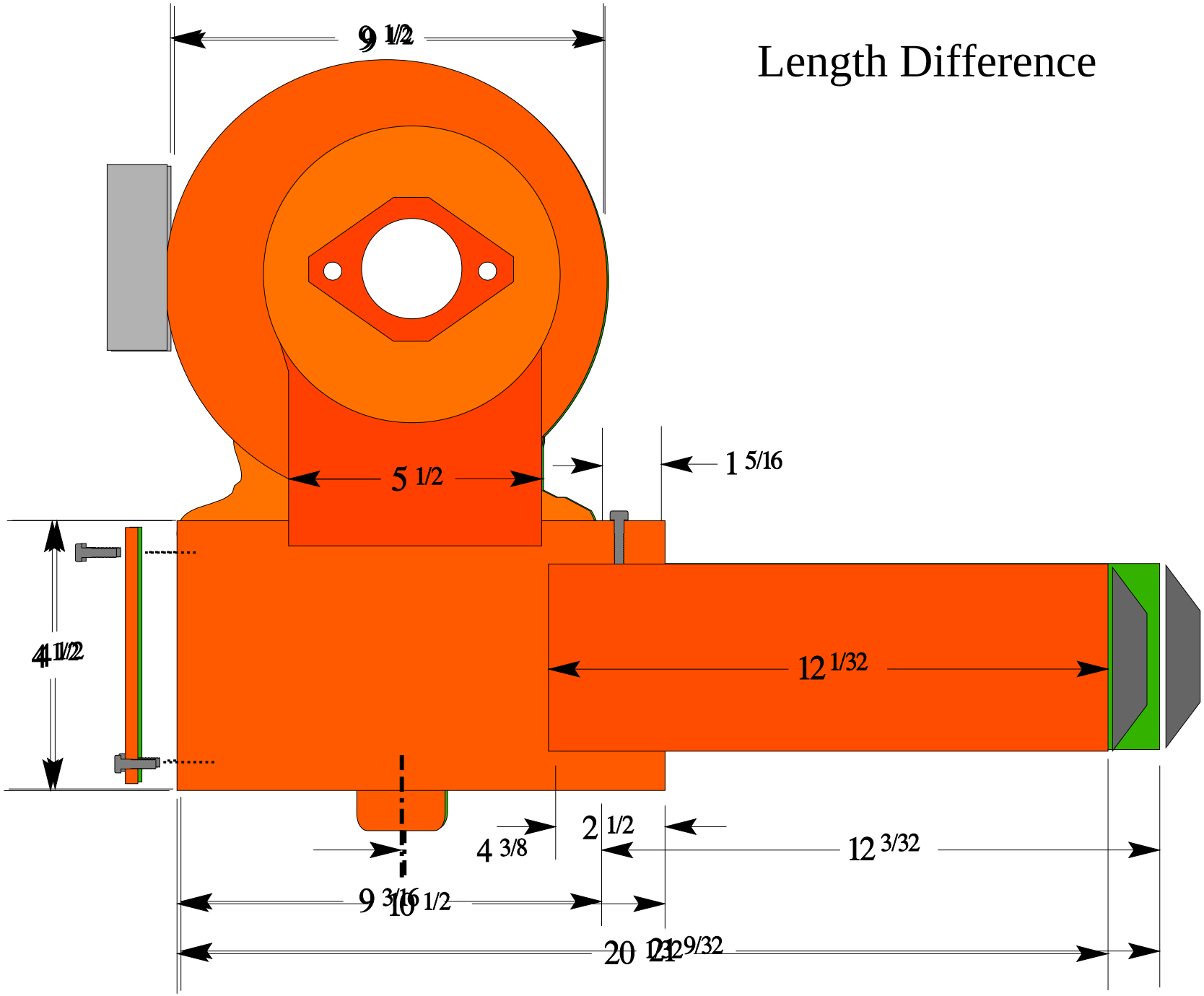
2. Exit air velocity difference (socket higher by 50 ft/min)

Differences resulted in:

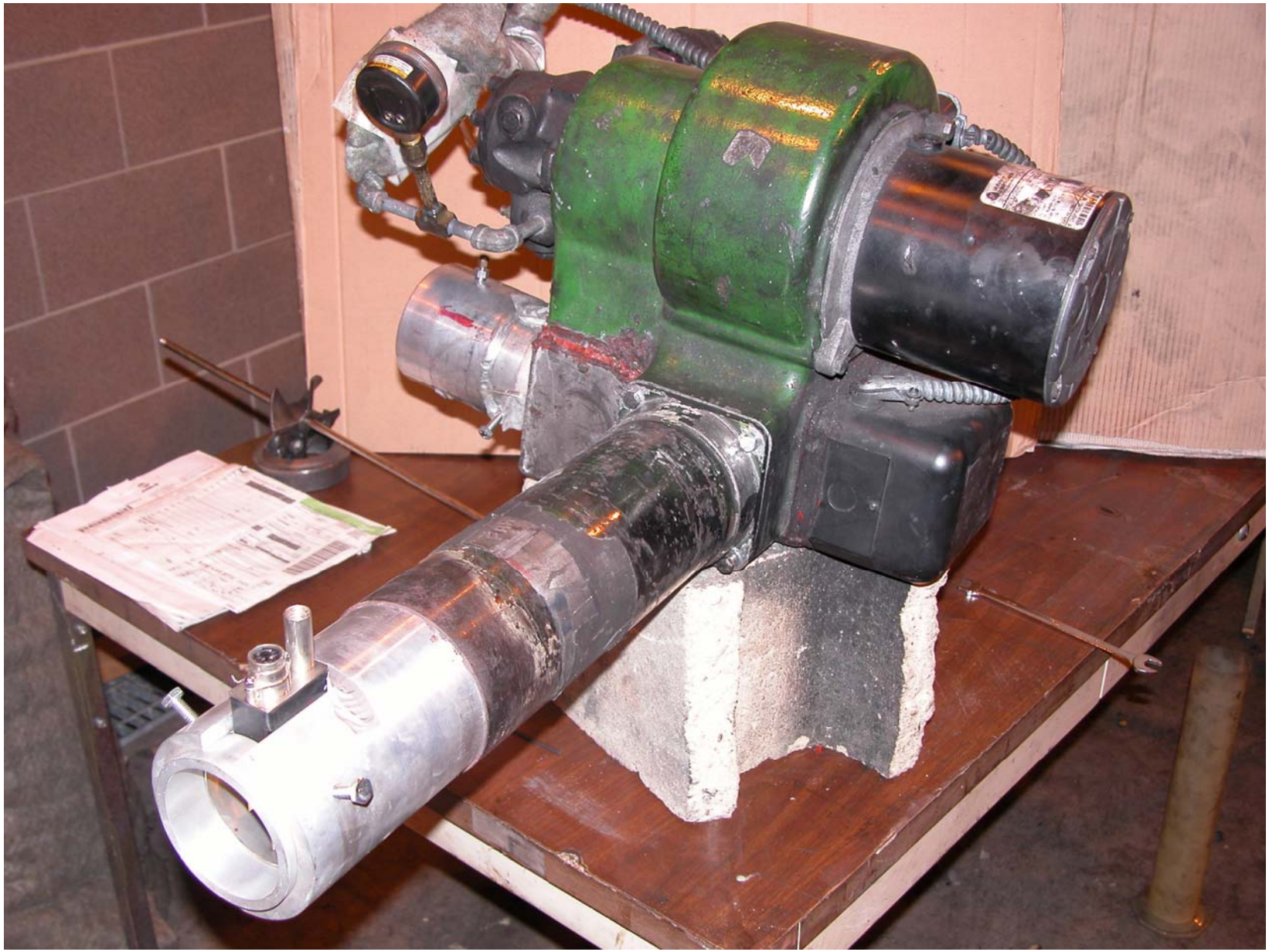
1. Different calibration results (lower H/F with socket)

2. Different test results (earlier B/T with socket)

Length Difference



Measurement of Exit Air Velocity



Comparison of Exit Air Velocity, Flanged vs. Socket

	Inlet Velocity Through Stream Straightening Device (ft/min)	Exit Velocity Through Sleeve Containing Annemometer (ft/min)
Flanged Burner	**2000**	**1300**
Socket Burner	**2000**	**1350**

Results indicate higher exit velocity with socket burner. However, air velocity device could be sensing a higher “stream”, and not necessarily the true average velocity of the exit area.

Review from previous meeting in Atlantic City…

Modify/Adjust socket to perform like flanged burner

Lower intake air velocity to 1900 ft/min ✗

Discs in front of or behind stator ✗

Thin, 4-blade “cross” in front of or behind stator ✗

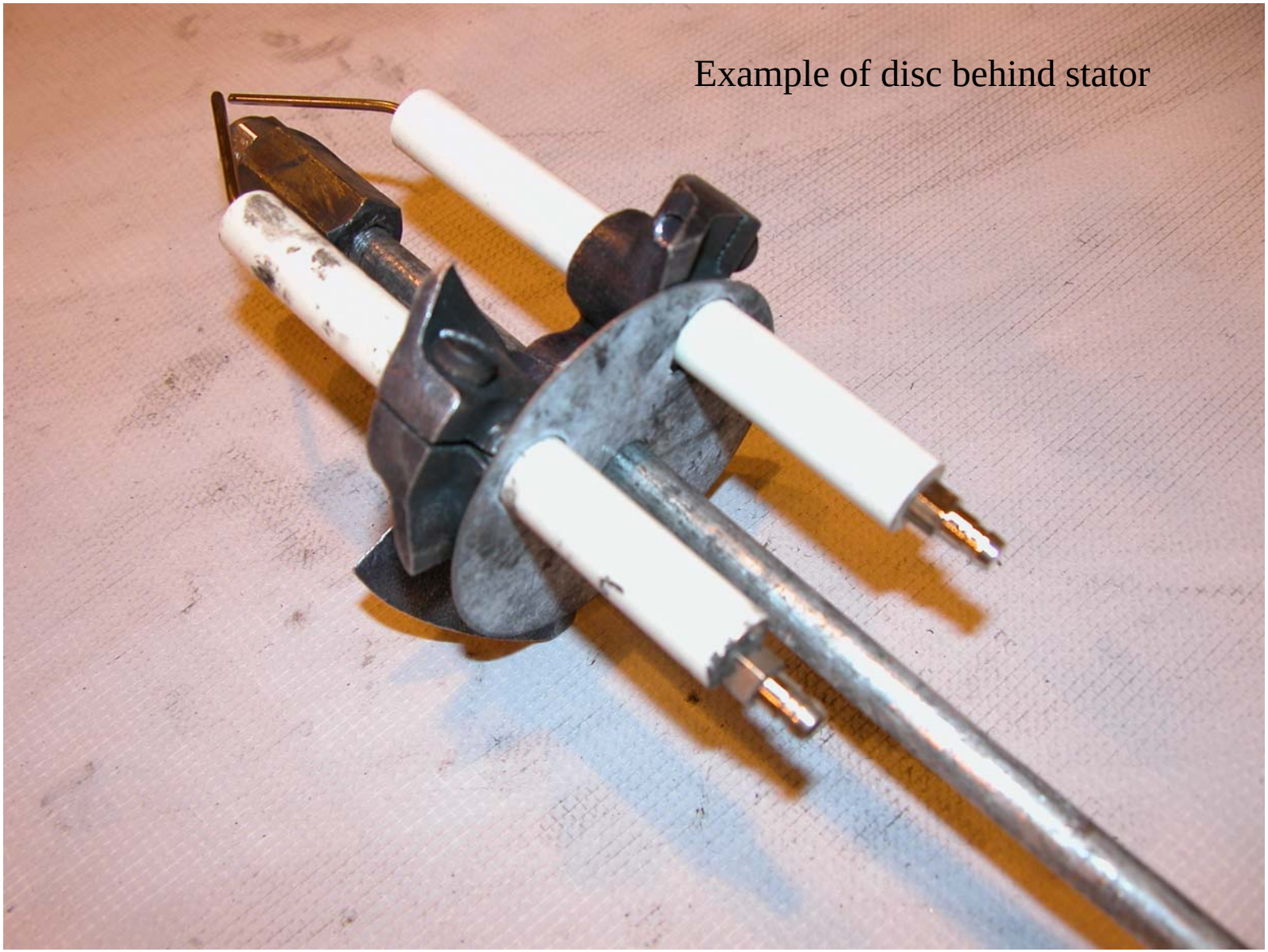
Deflection cone in front of or behind stator ✗

Draft tube ring in front of or behind stator ✗

Enlargement of stator diameter ✓

Adjustment of stator depth ✓

Possible Simple Modifications to Socket Burner



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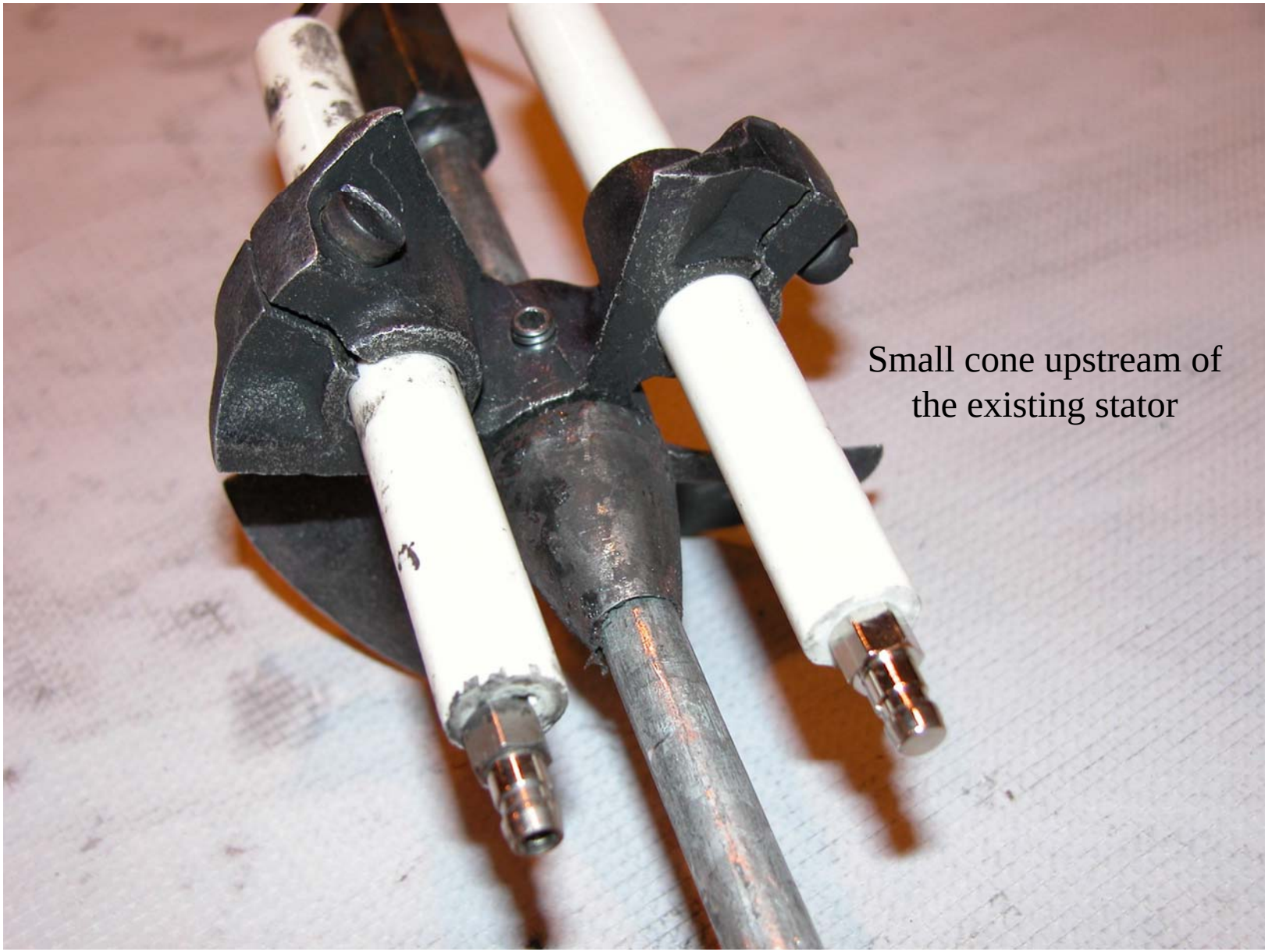

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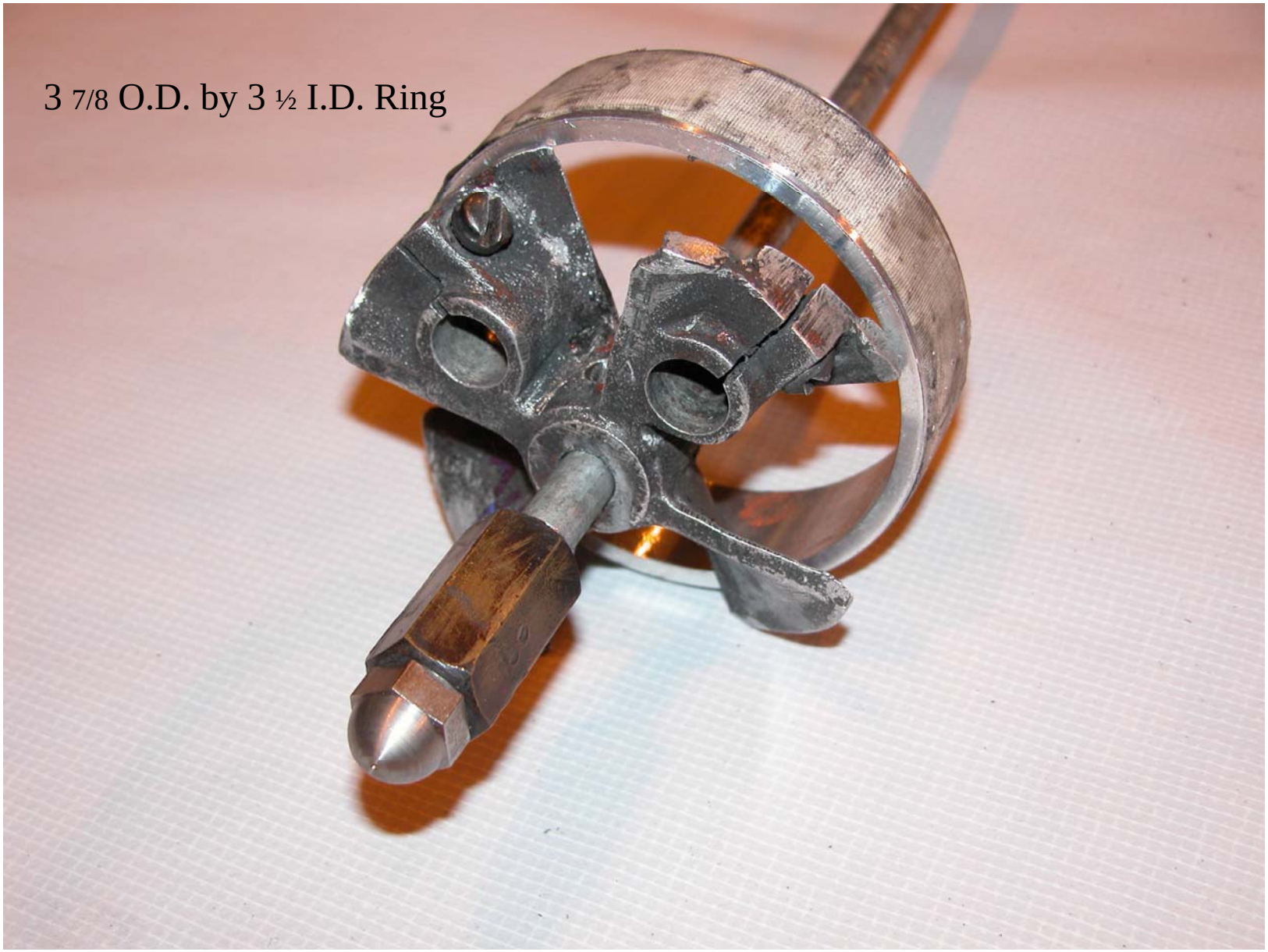

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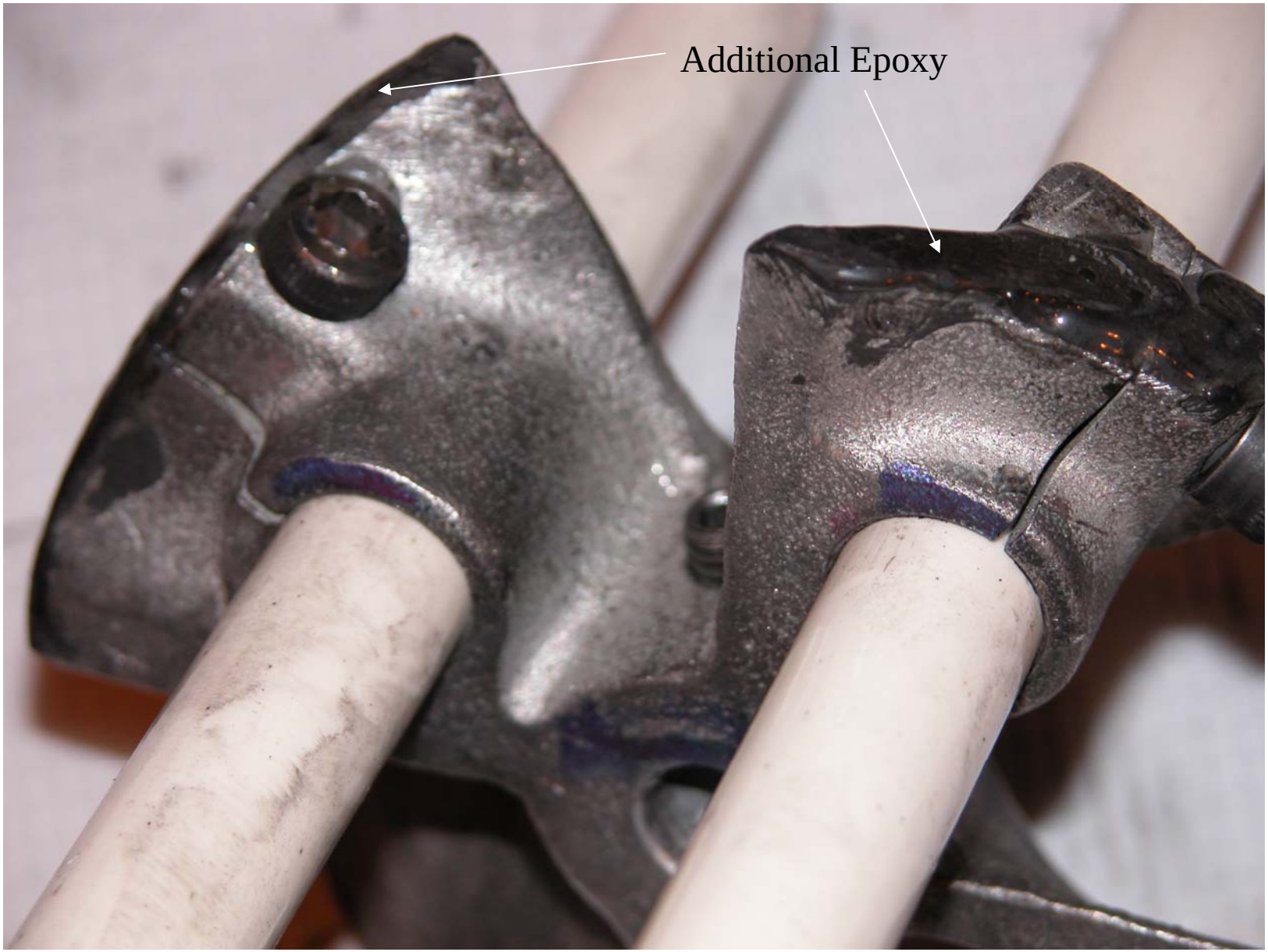
Reproduction Stator, Modified at Edges of Blades



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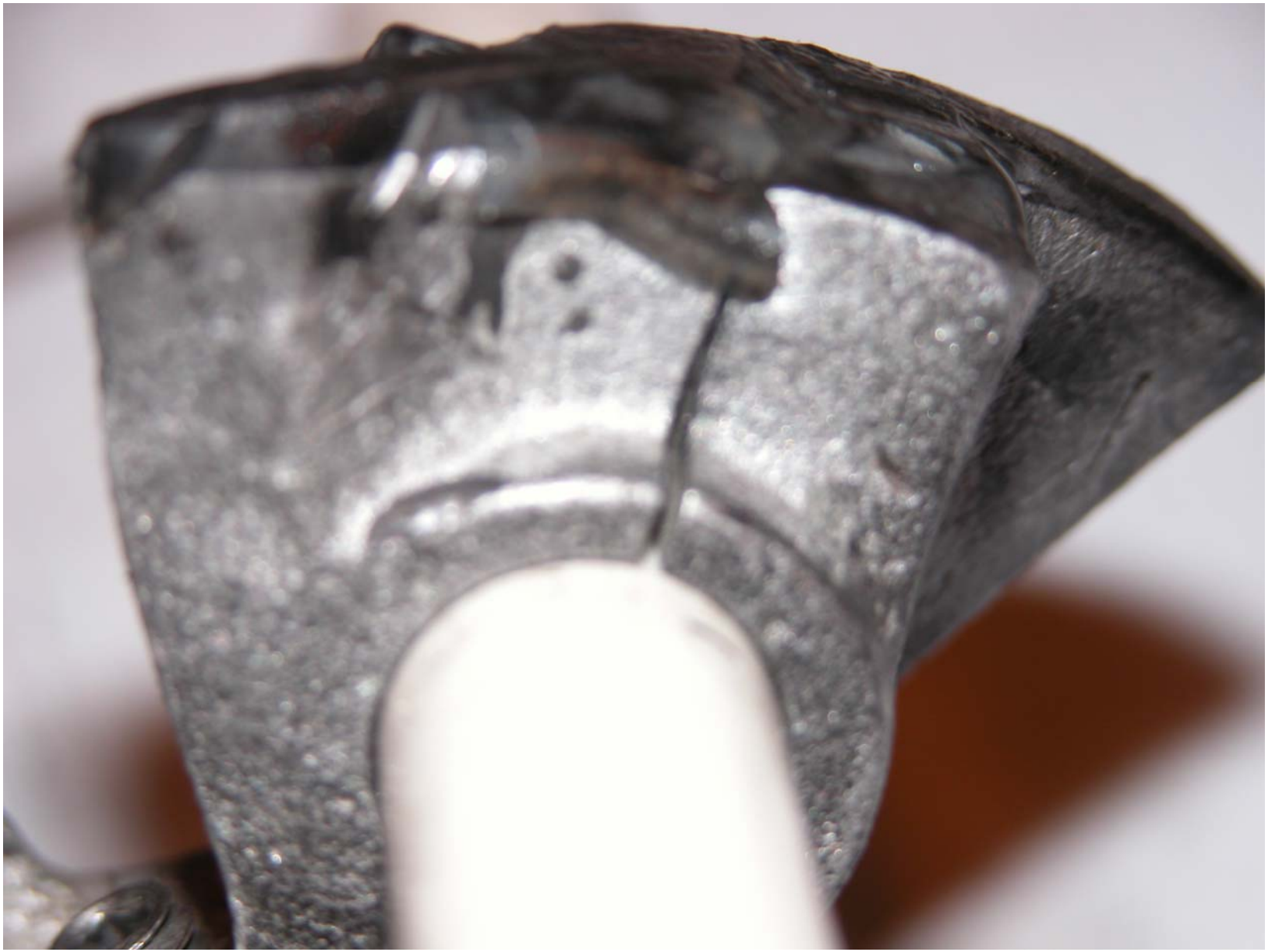
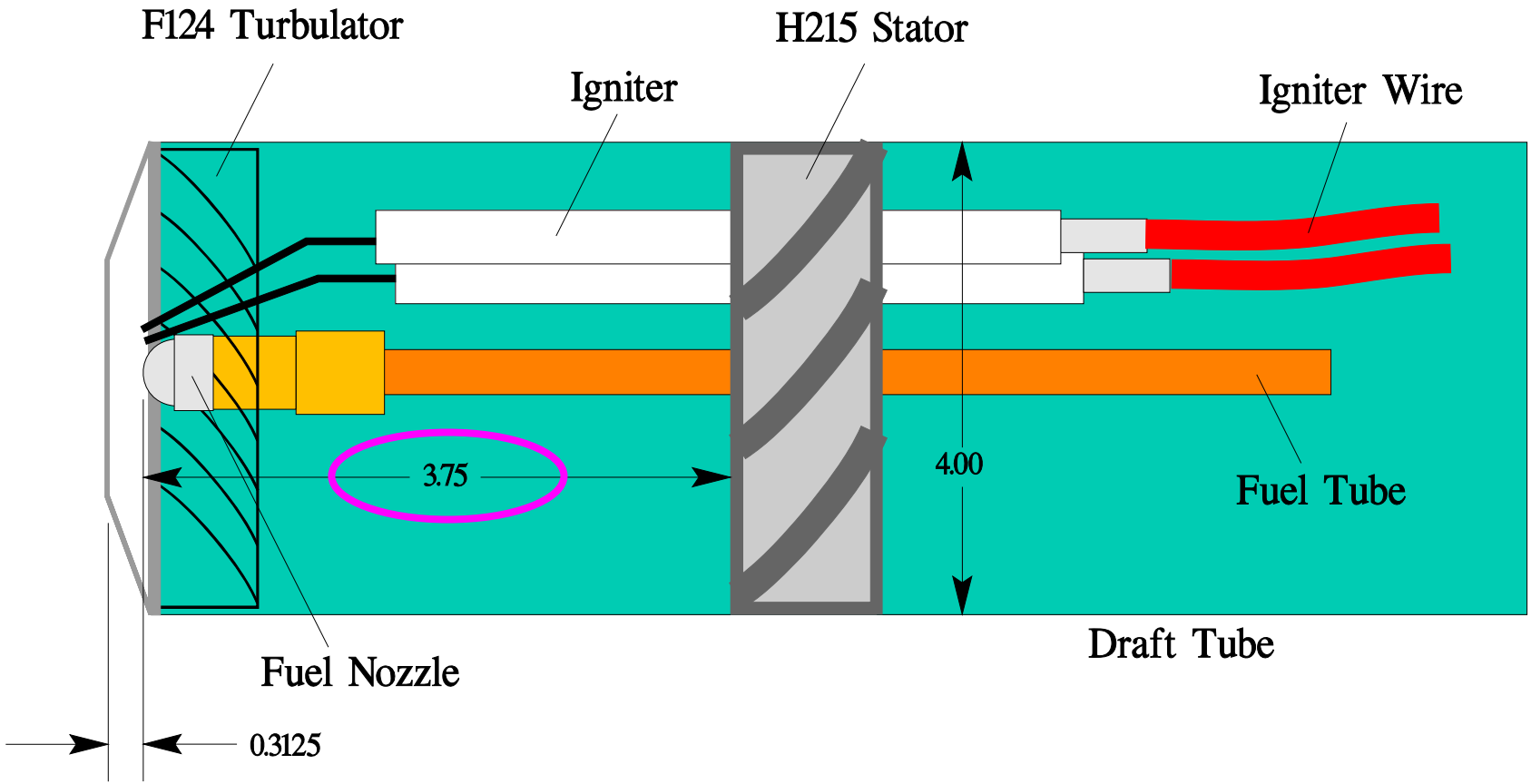
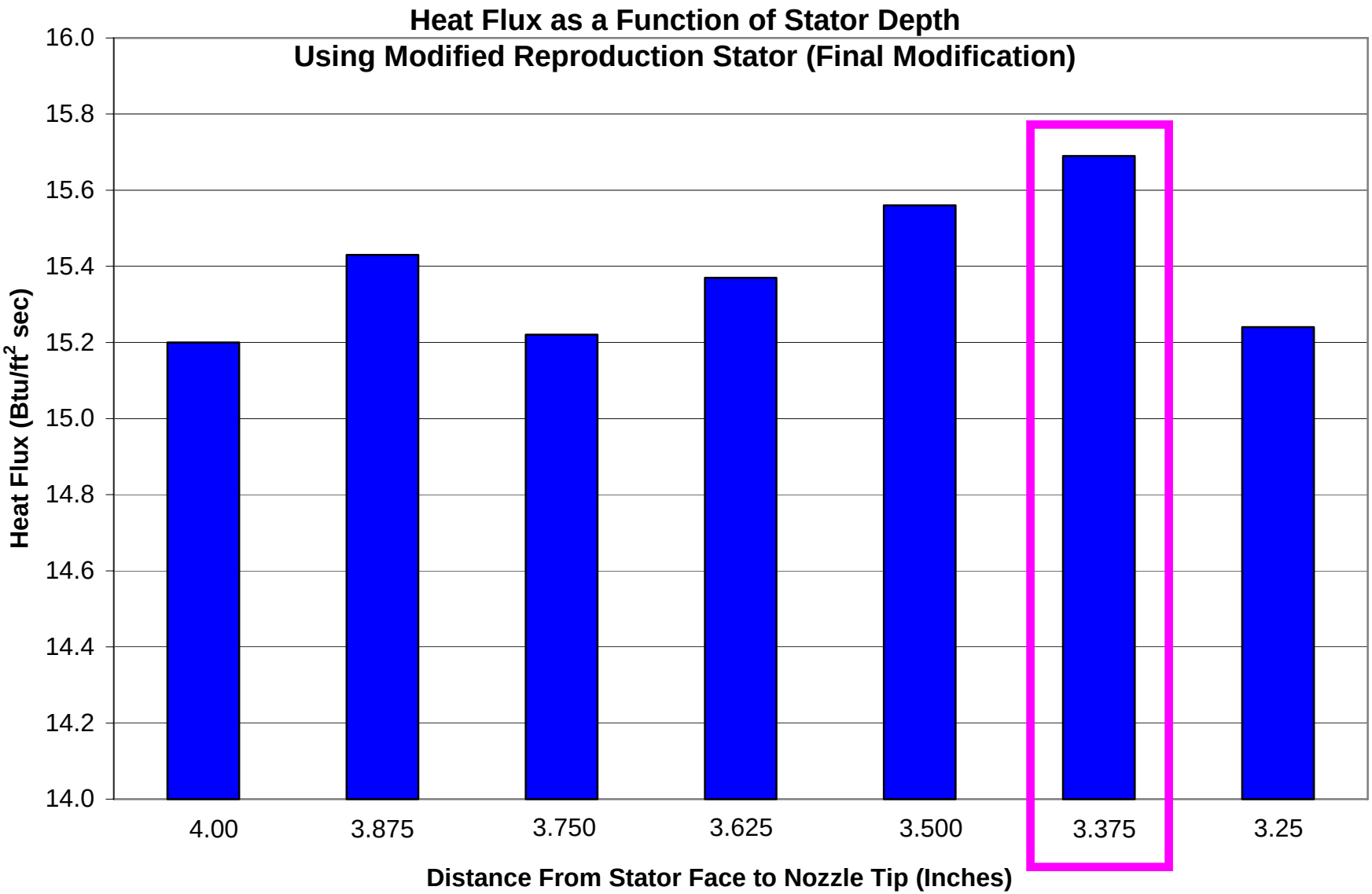


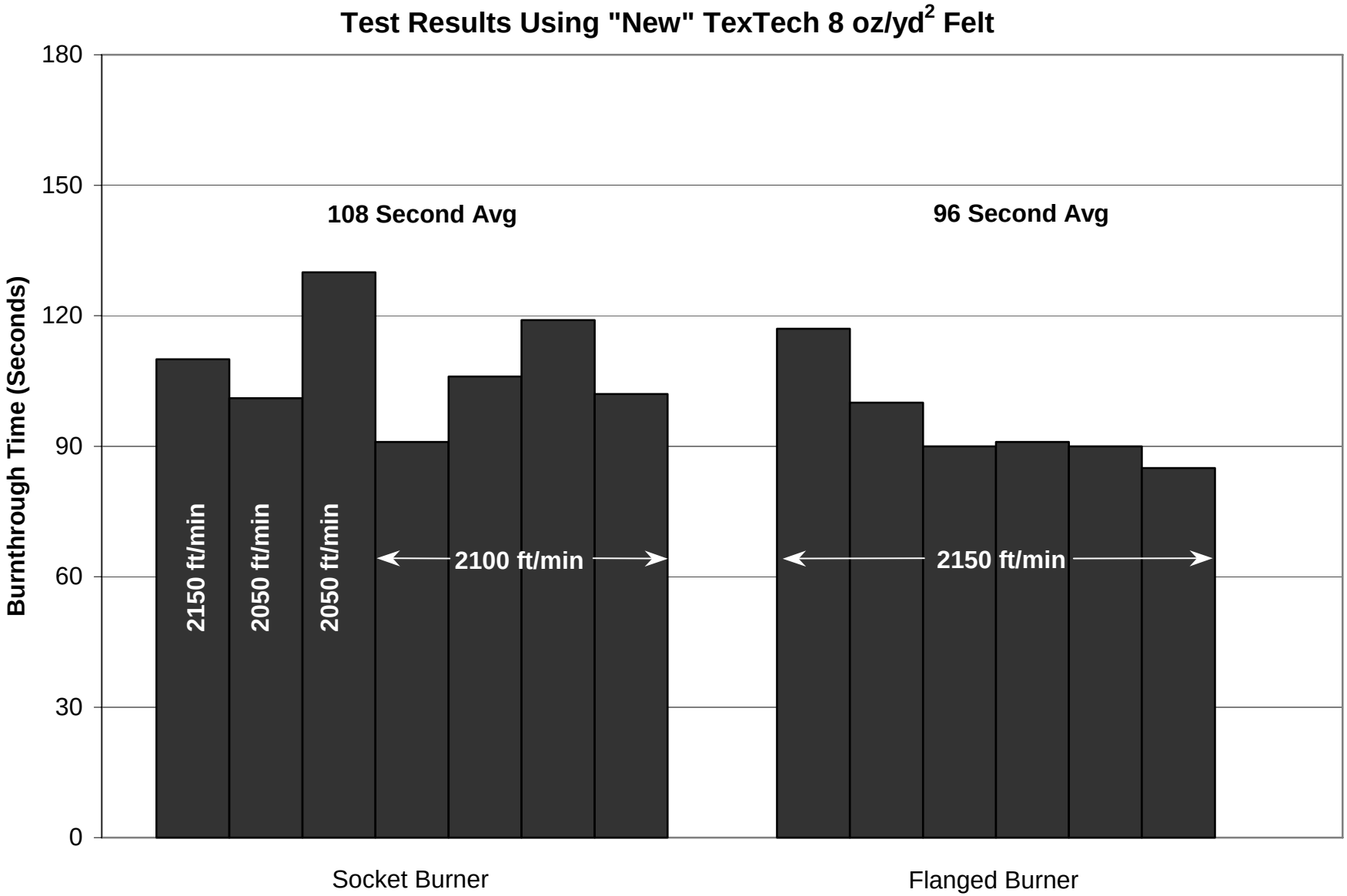
Current Specification for Stator Position



Socket Burner Testing



Comparison of Flanged and Socket Burners



Planned Activities (*from previous meeting*)

Confirm stator modifications are repeatable in socket burner. ✓

Supply modified stators to participating labs that currently use the socket style burner. ✓

Conduct socket-burner round robin, with original FAA burner as a control. ✓

Consider blueprinting optimal stator, reproduce via machining (no casting!).

Develop a new stator for future use, which can be produced via machining.

Round Robin 8

Round Robin 8 Test Parameters

In an effort to reduce any potential variables with materials, all samples will be one layer, with no film or additional insulation.

It is important that the samples be clamped in place as shown in the following slides. If you do not have the proper clamps, please obtain them before proceeding.

Please run all TexTech samples (black) until failure, and run all Nextel samples for 240 seconds. No need to supply backface heat flux information for the TexTech samples, but please submit a plot of heat flux versus time for the Nextel samples if possible.

Record all of the data on the test form, and please do not alter it, this makes things extremely difficult on my end during the analysis.

RR8 Material Information

Blanket I.D.	# of Tests	Blanket Construction	Supplier	Aerial Weight (oz/yd^2)	Film	Estimated Failure Mode and Time (Seconds)
A	8	1 Layer Pre-ox PAN	TexTech Industries	8.0	none	Burnthrough (90-120)
B	6	1 Layer Pre-ox PAN	TexTech Industries	14.0	none	Burnthrough (240-300)
C	6	1 Layer ceramic dot-printed paper	3M	2.2	none	Exceed Heat Flux (60-90)

RR8 Test Sequence

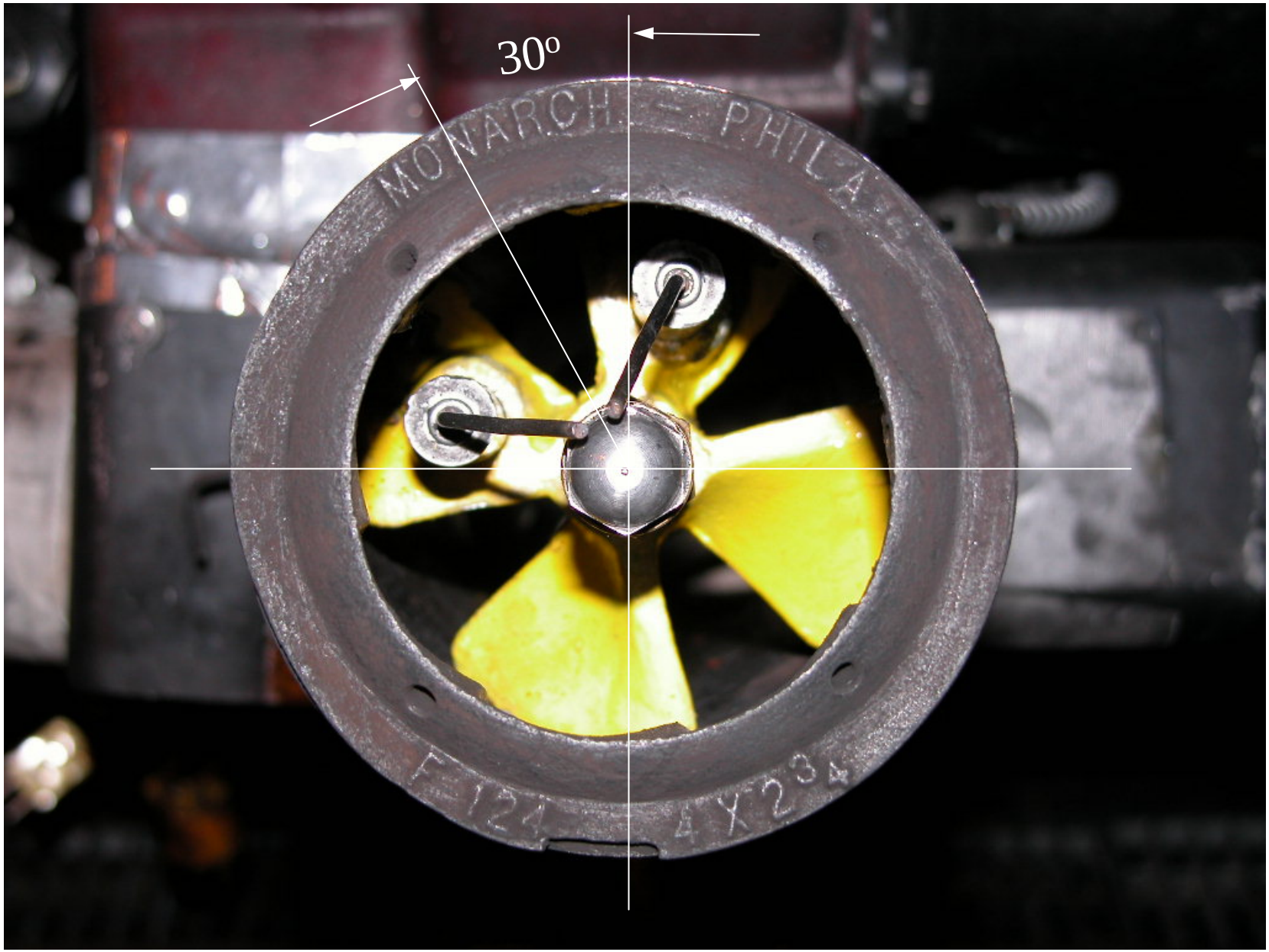
Initial Calibration	A1	B1	C1	B2	C2
Second Calibration	A2	C3	A3	B3	A4
Third Calibration	B4	C4	B5	C5	A5
Fourth Calibration	C6	A6	B6	A7	A8

RR8 Burner Configuration Checklist

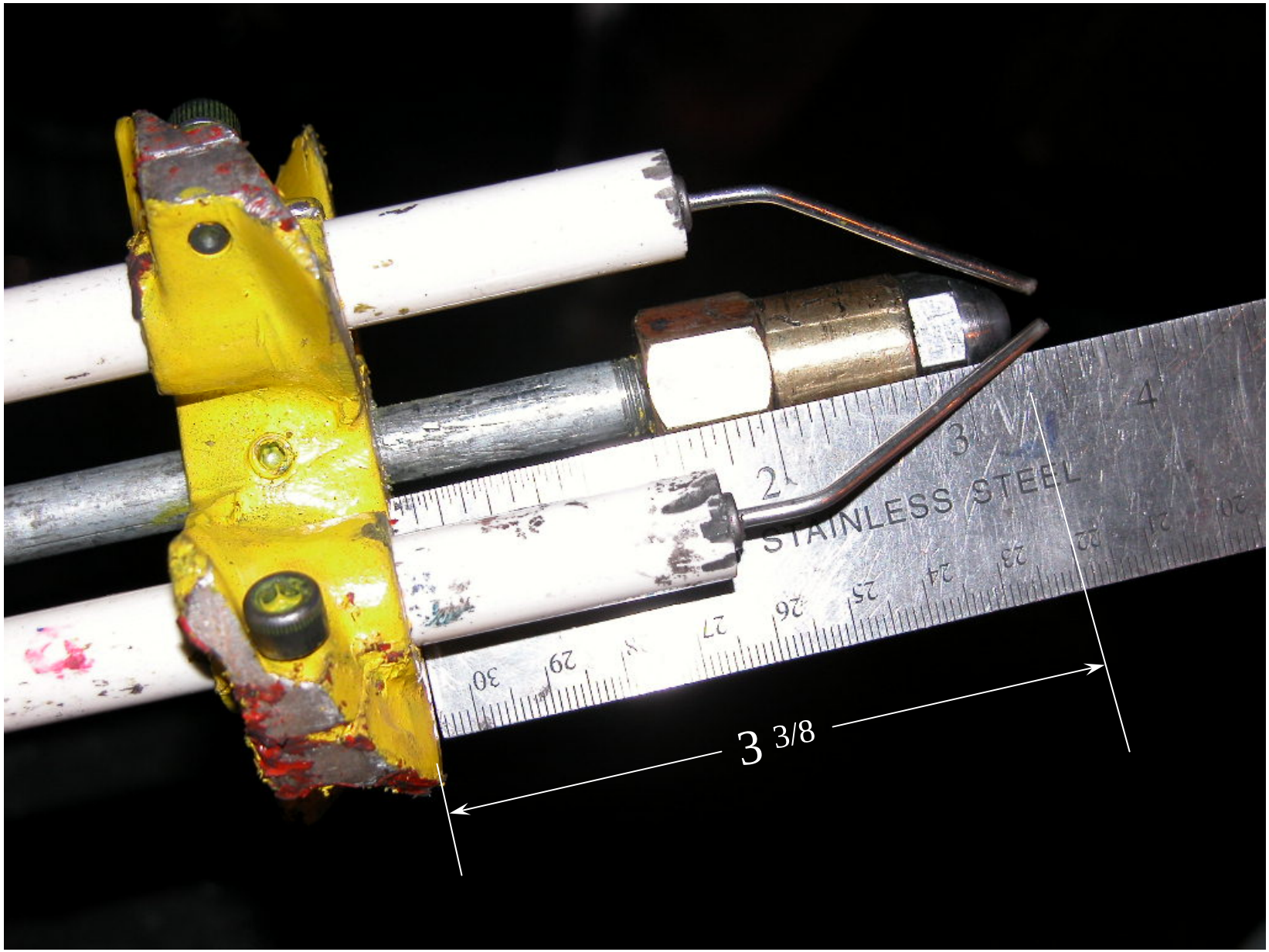
Nozzle type	Approximate pump pressure (psi)	Depth of nozzle recessed from end plane of turbulator (inches)	Distance of igniters protruding end plane of nozzle (inches)	Stator depth from nozzle (inches)	Fan size (inches)
Monarch 6.5 80^{o} PL	85	0.3125	0.15625	3.375	5.25 dia X 3.5 depth

Stator type	Stator orientation	Turbulator type	Turbulator orientation	Intake air velocity (ft/min)	Intake hose length (ft)
modified H215	11 o'clock (330^{o} C.W.)	Monarch F124	notch at bottom	2100-2150	20

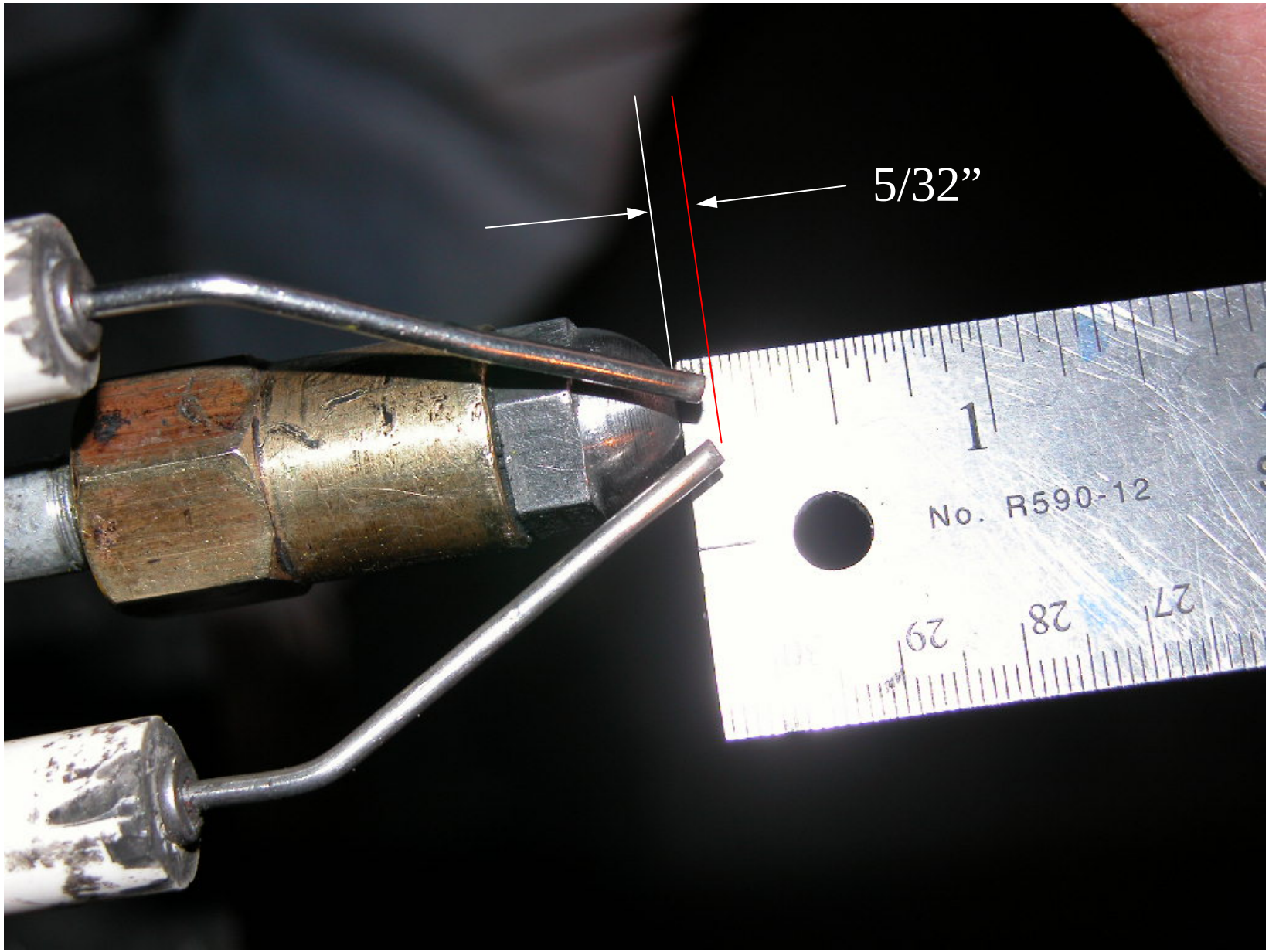
Proper Orientation of Stator and Turbulator



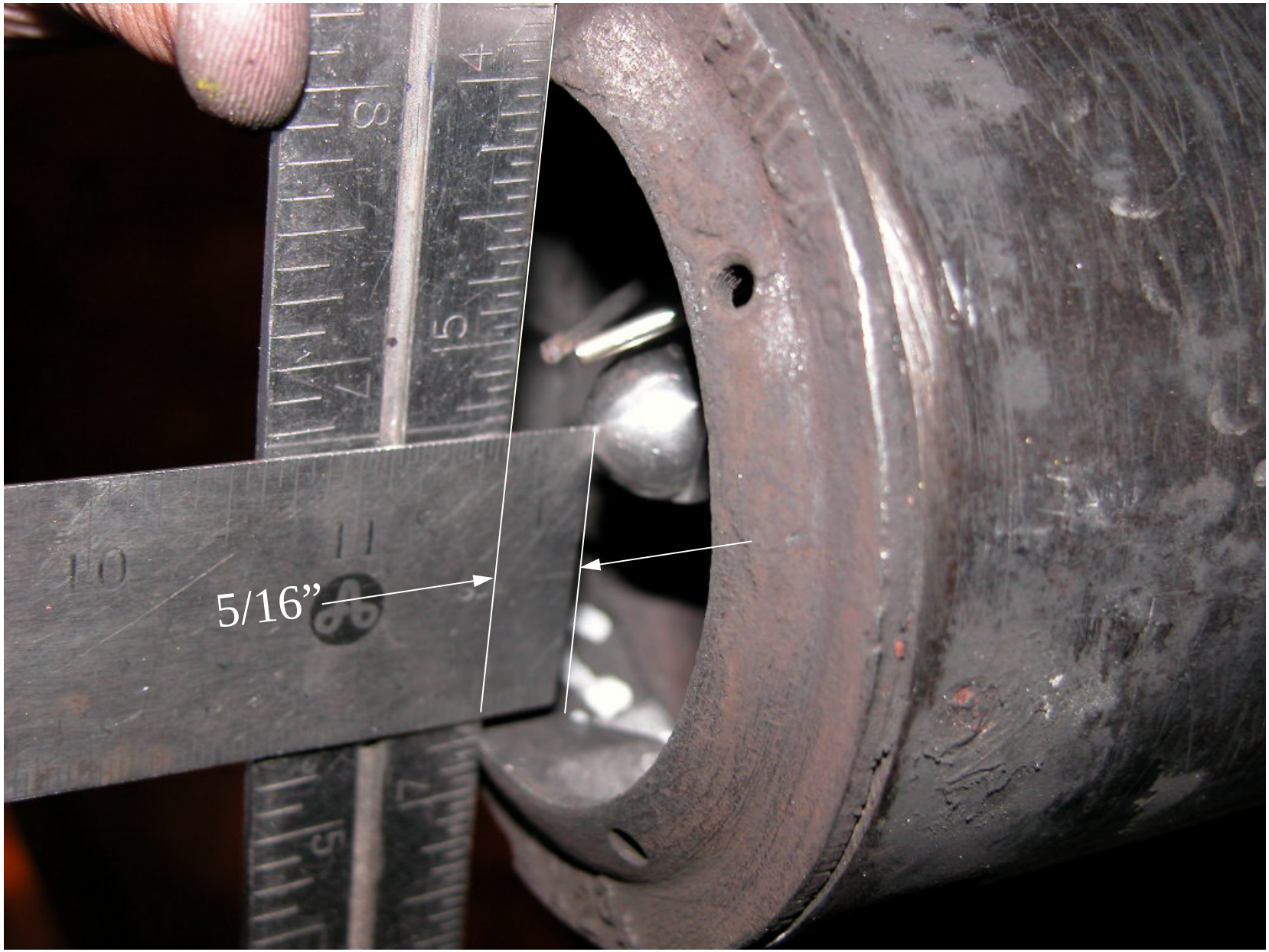
Proper Depth of Stator from Nozzle Tip (3 3/8 inches)



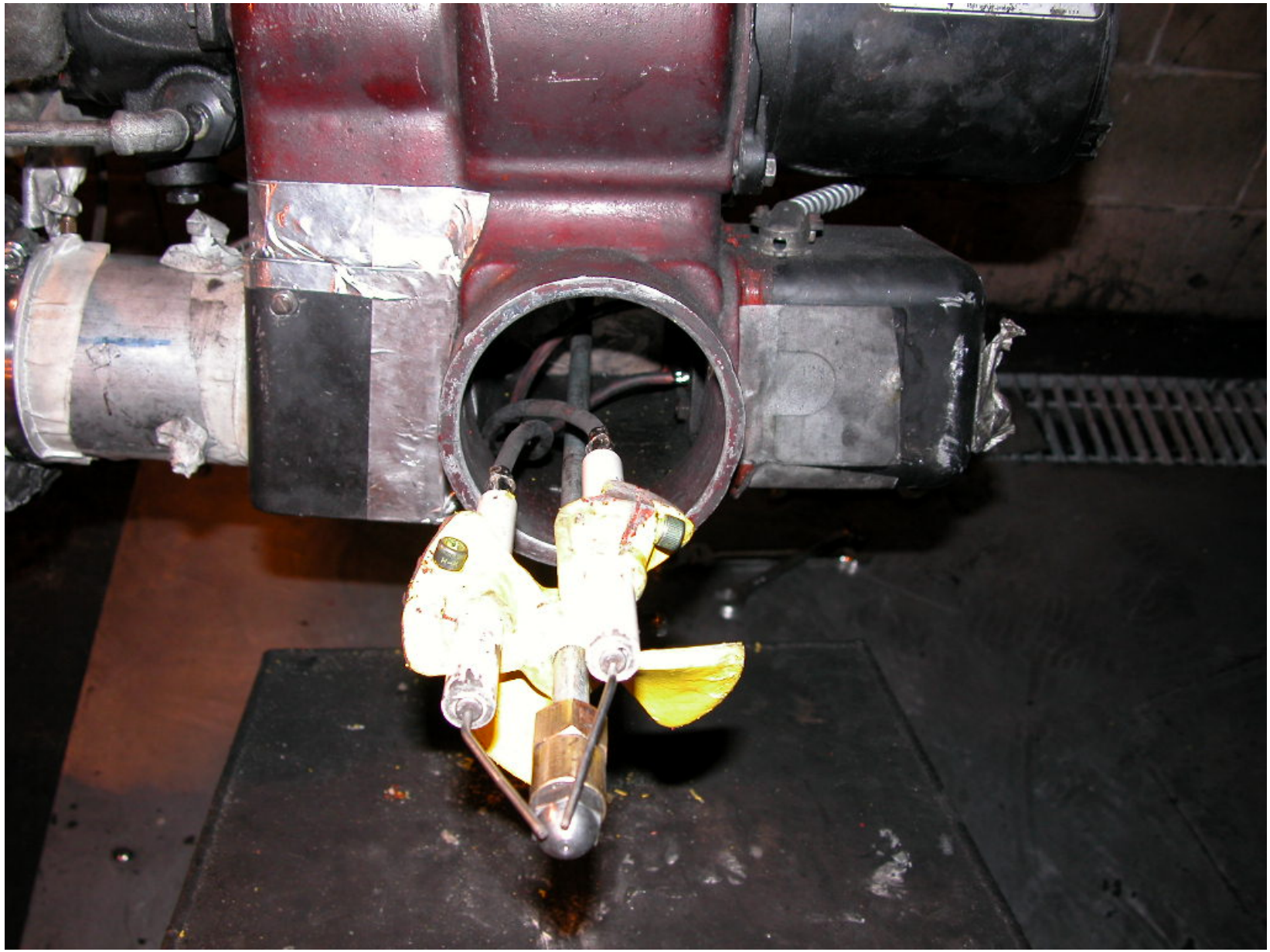
Proper Position of Igniters Past Nozzle Tip (5/32 inches)



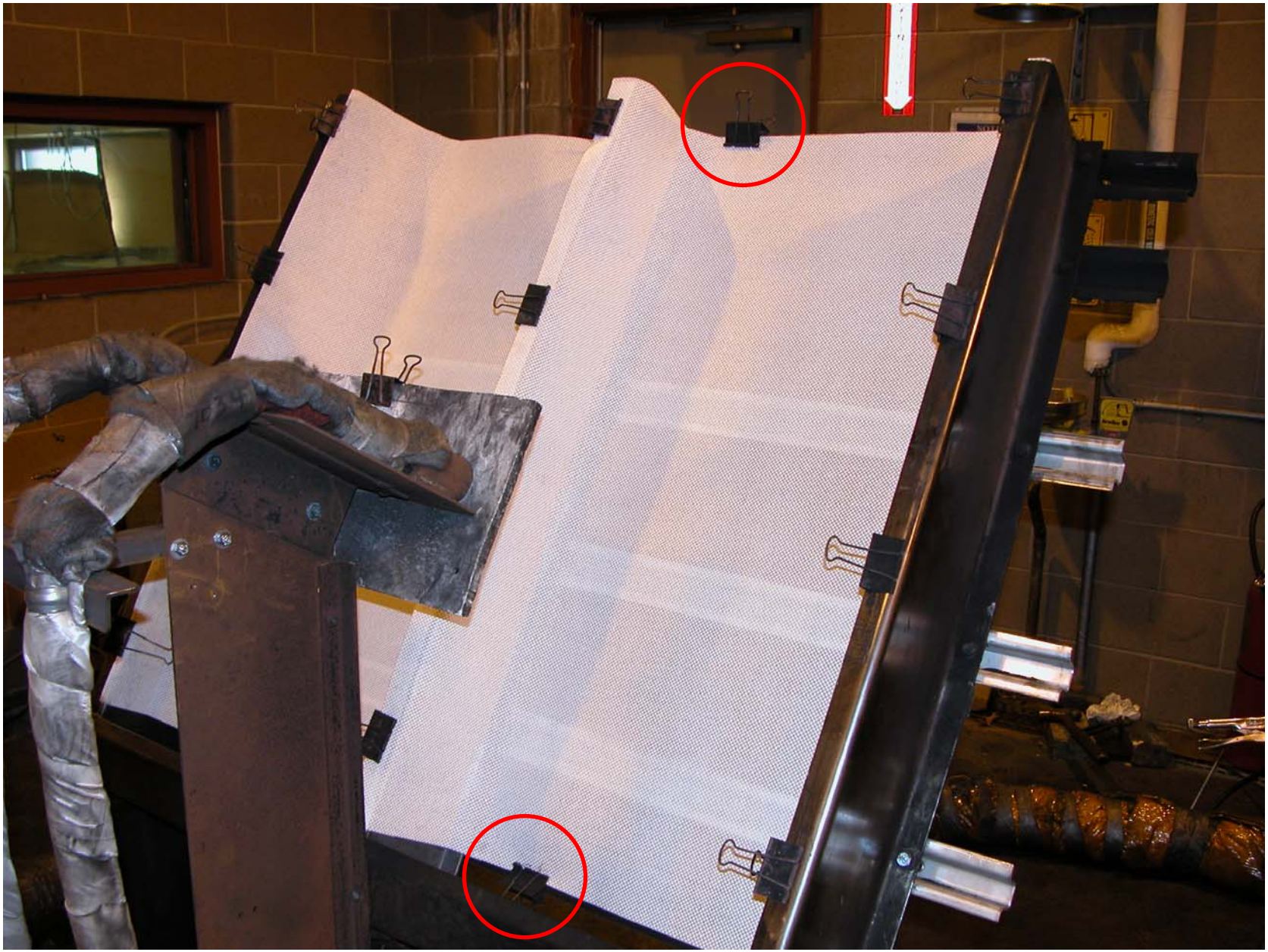
Proper Depth of Nozzle Tip from Turbulator (5/16 inches)



Proper Routing of Igniter Wires (13 inch length per wire)



Installation of Nextel Paper (2 additional clips per blanket)



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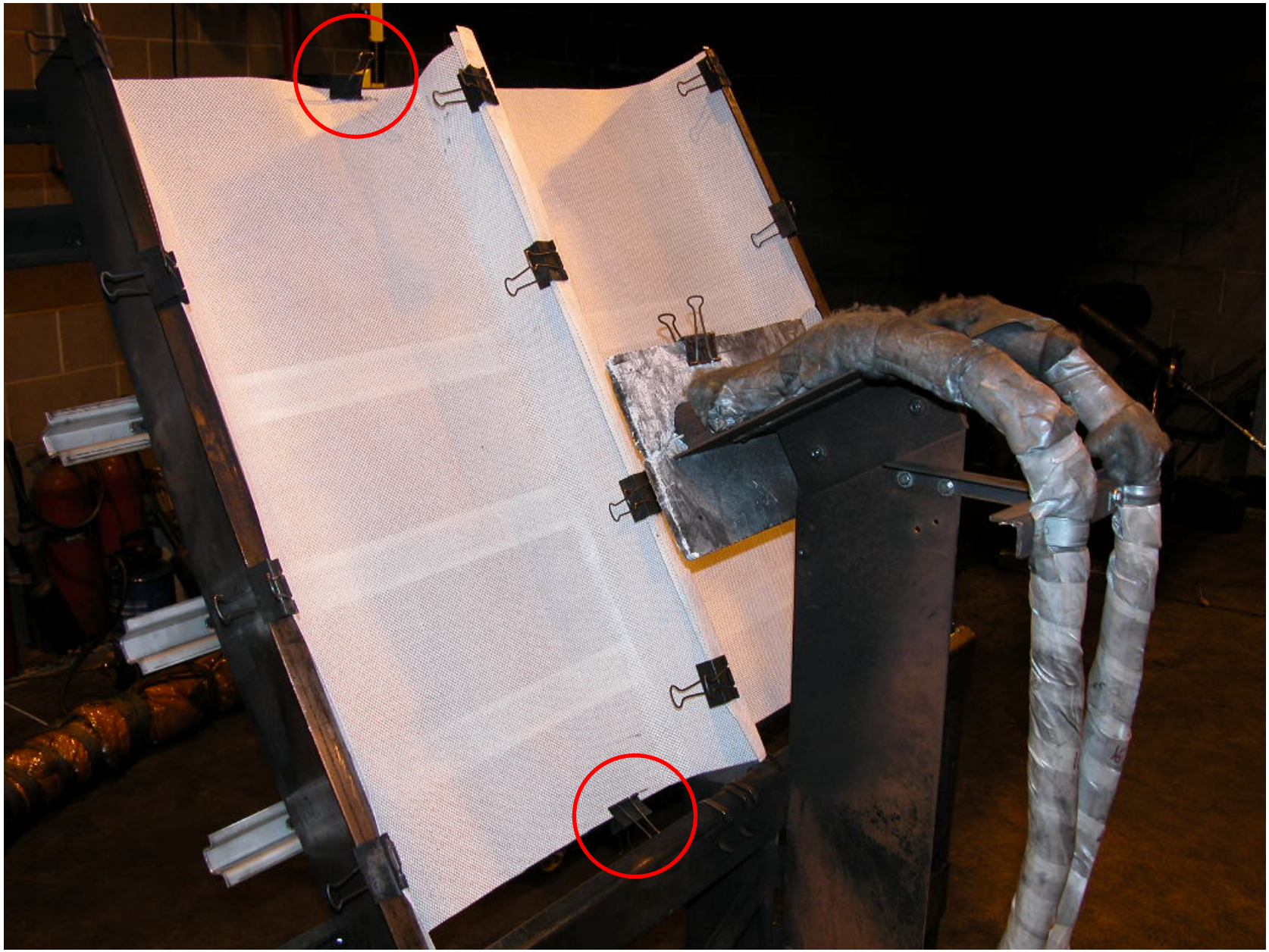
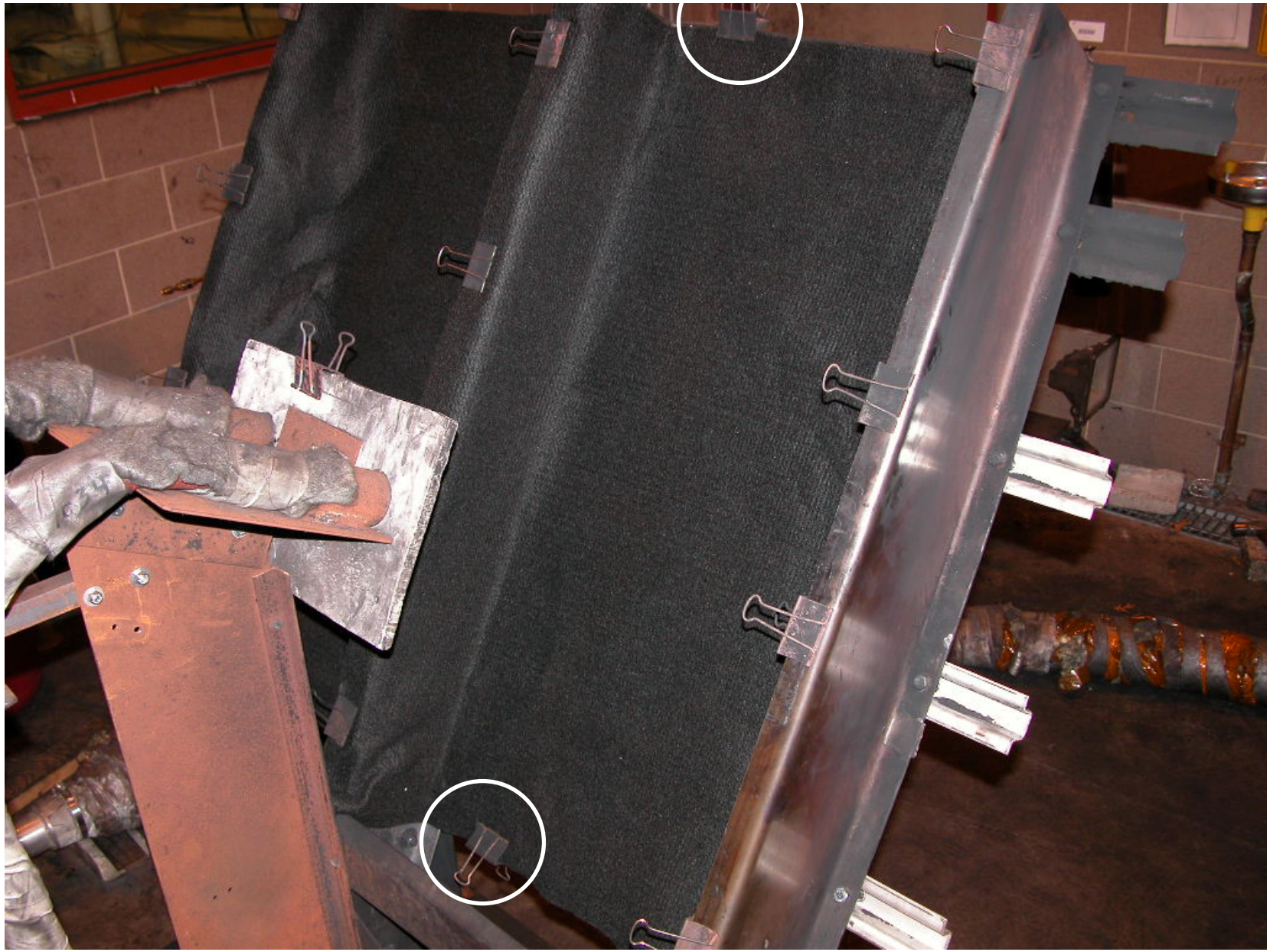


Installation of TexTech Felt (2 additional clips per blanket)



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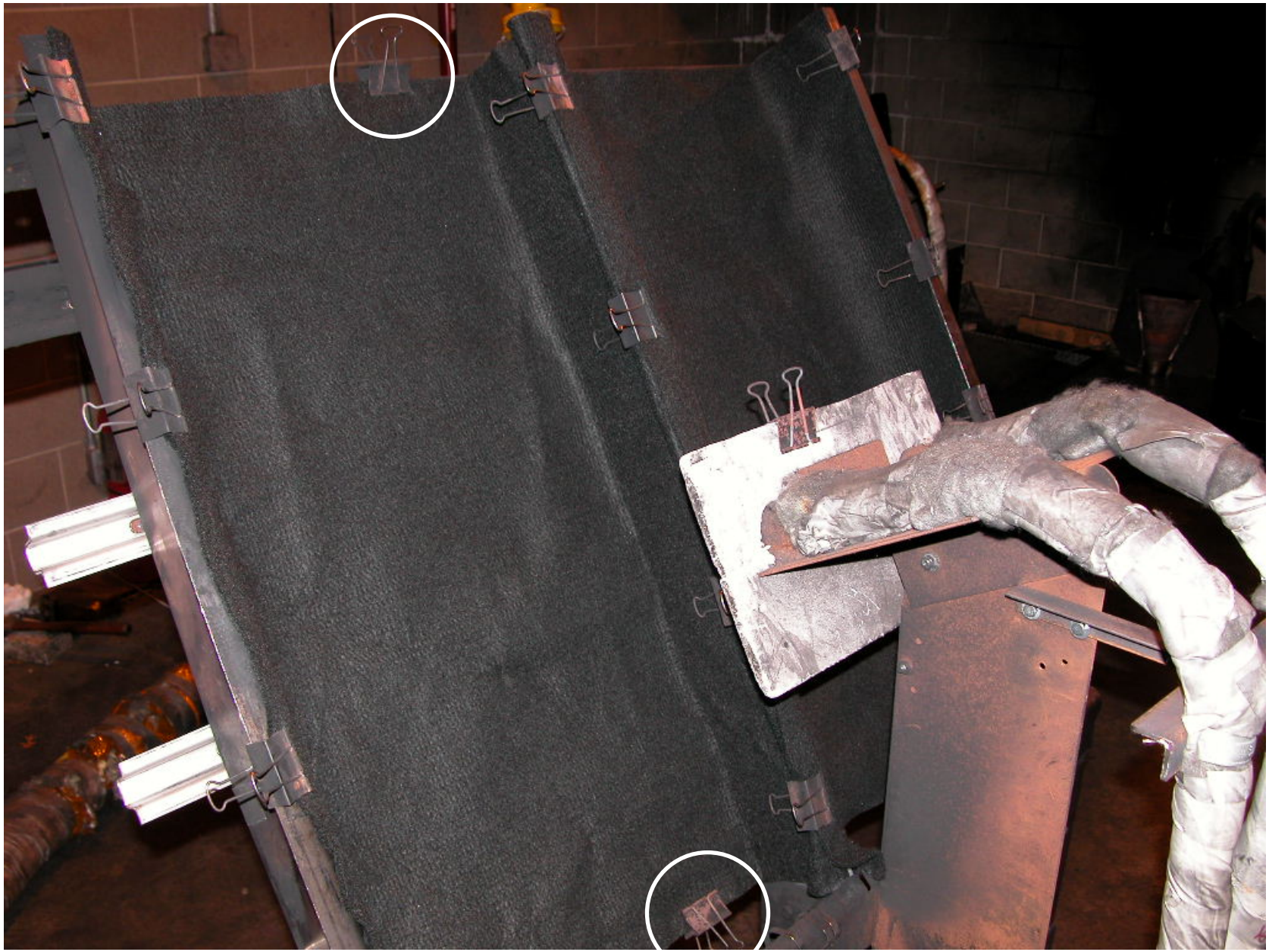

Round Robin 8 Test Results

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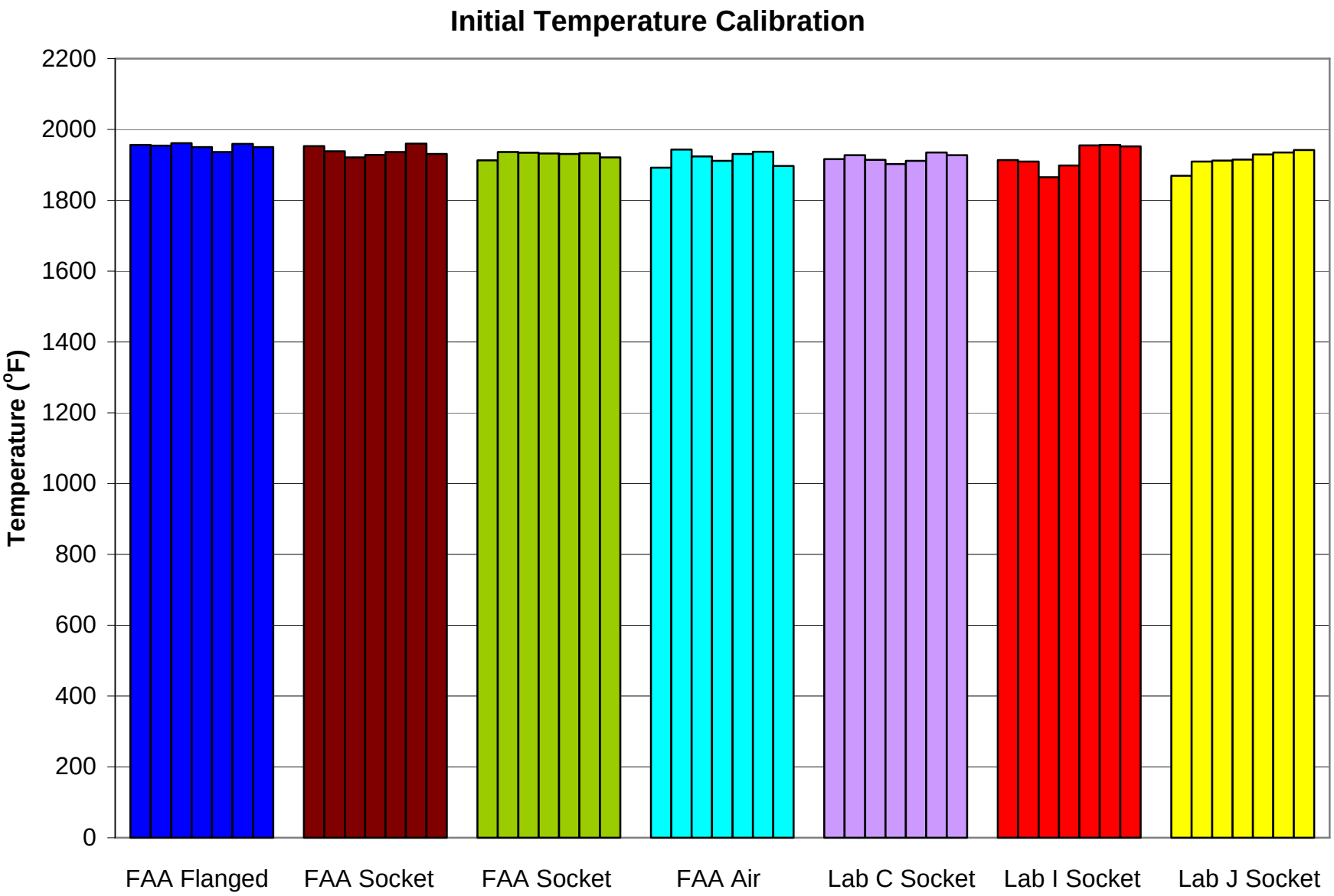

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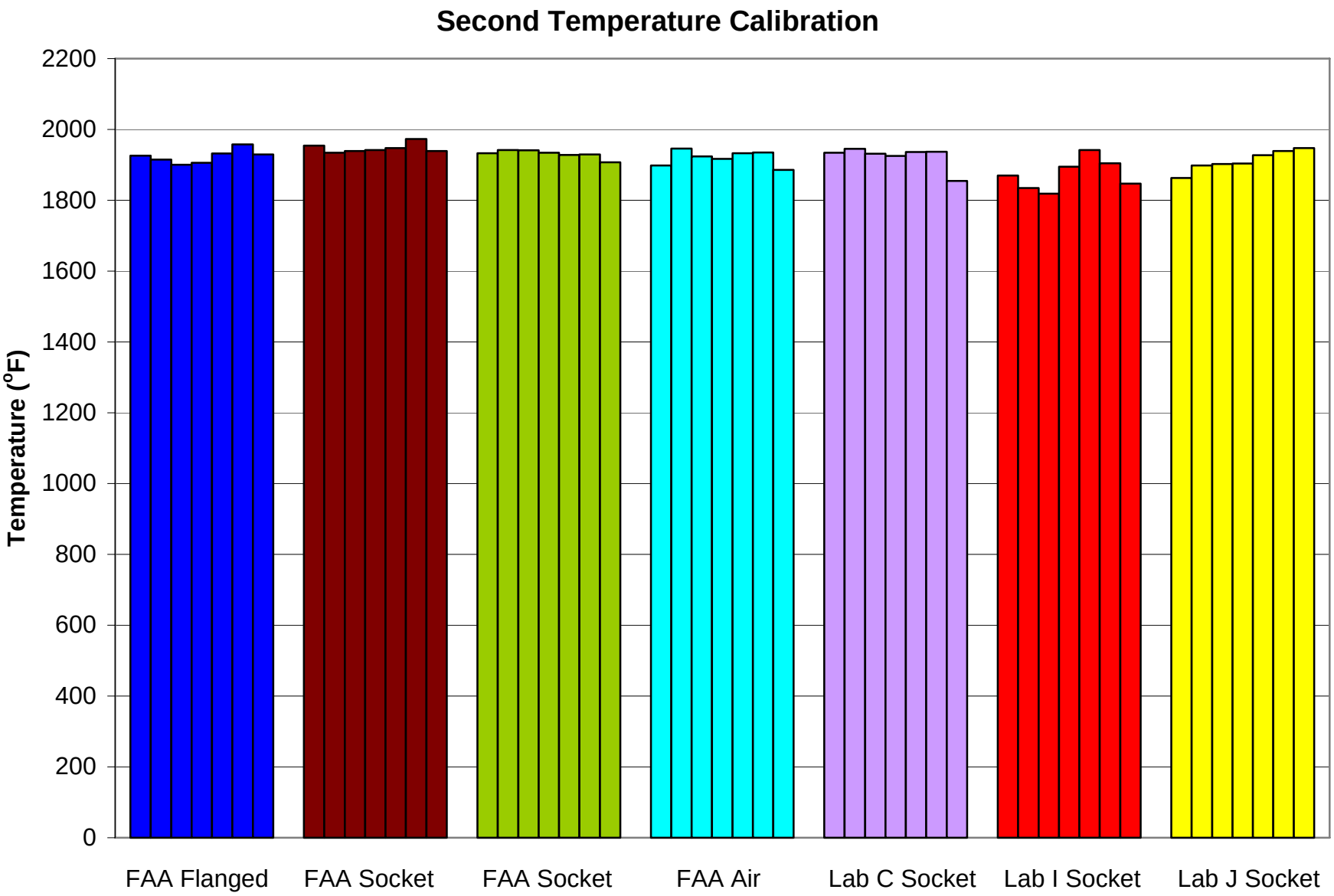

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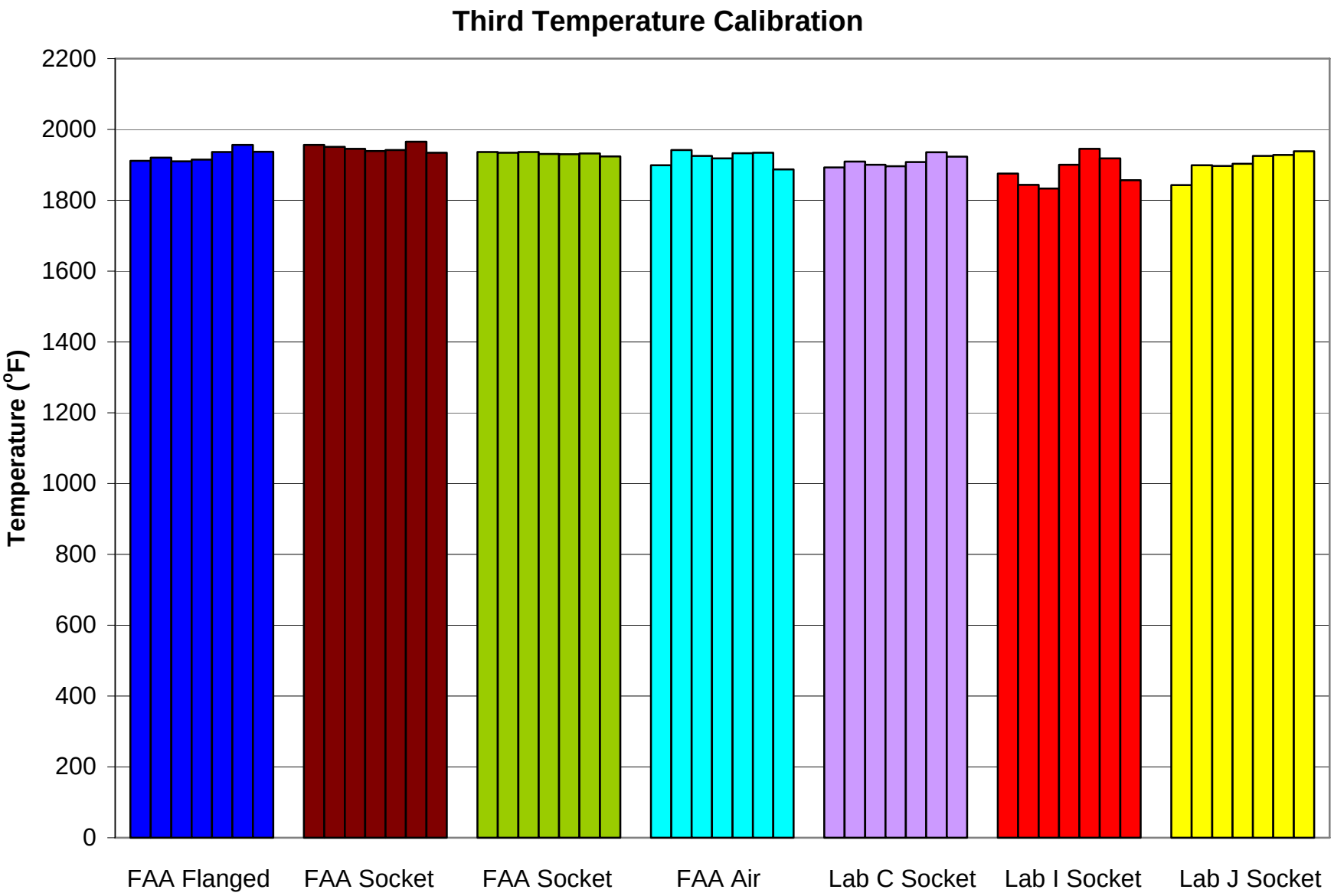

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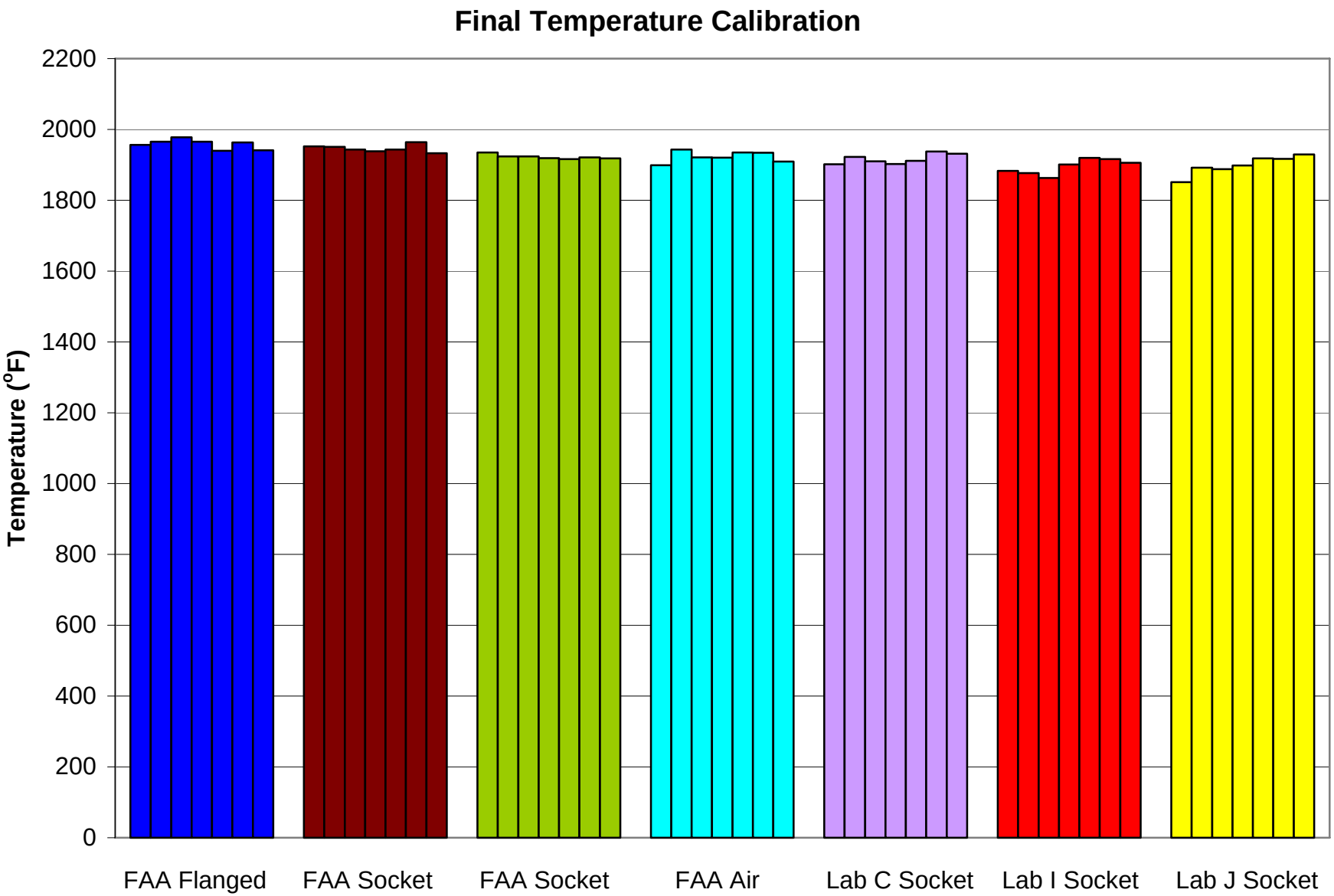

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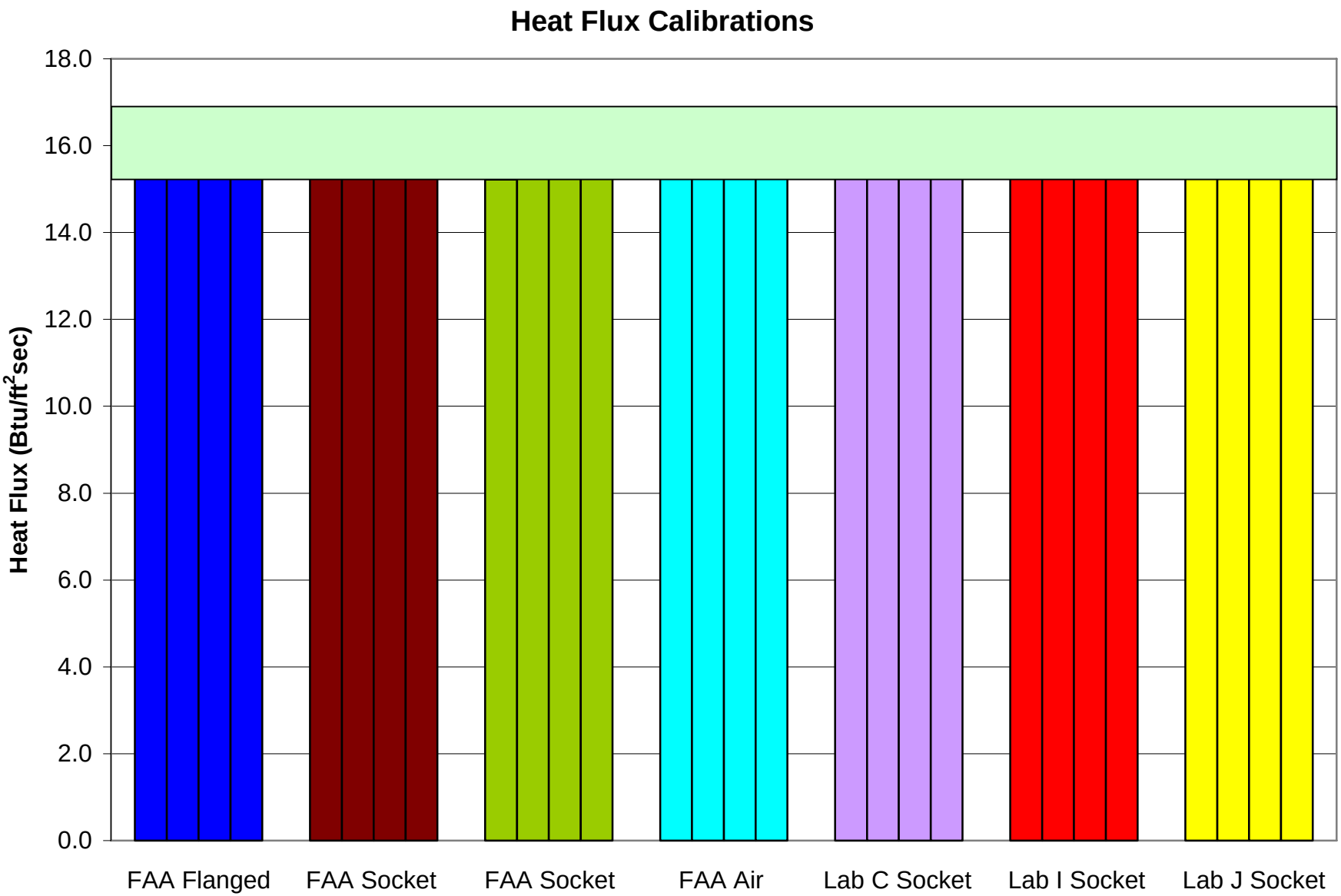

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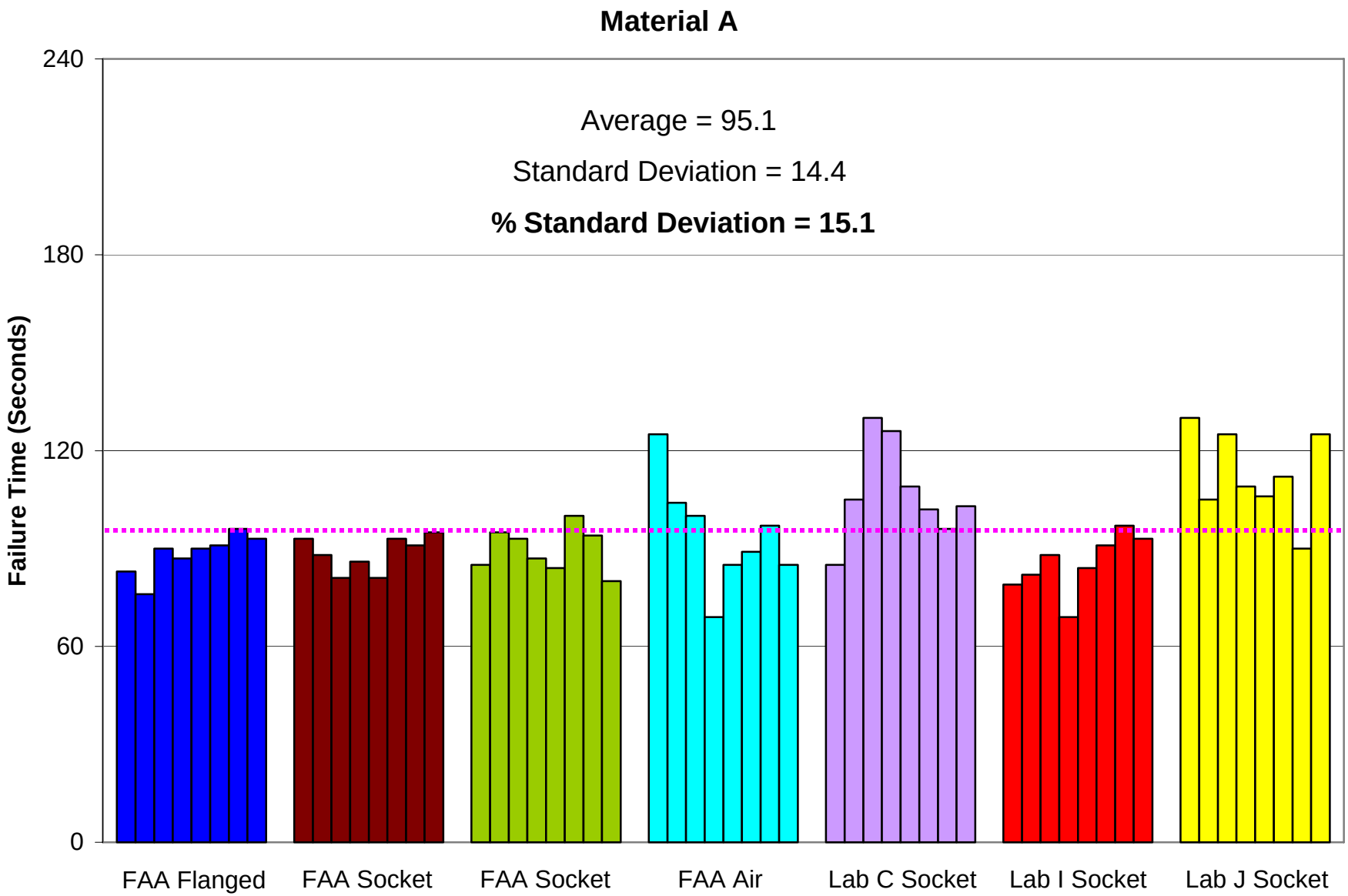

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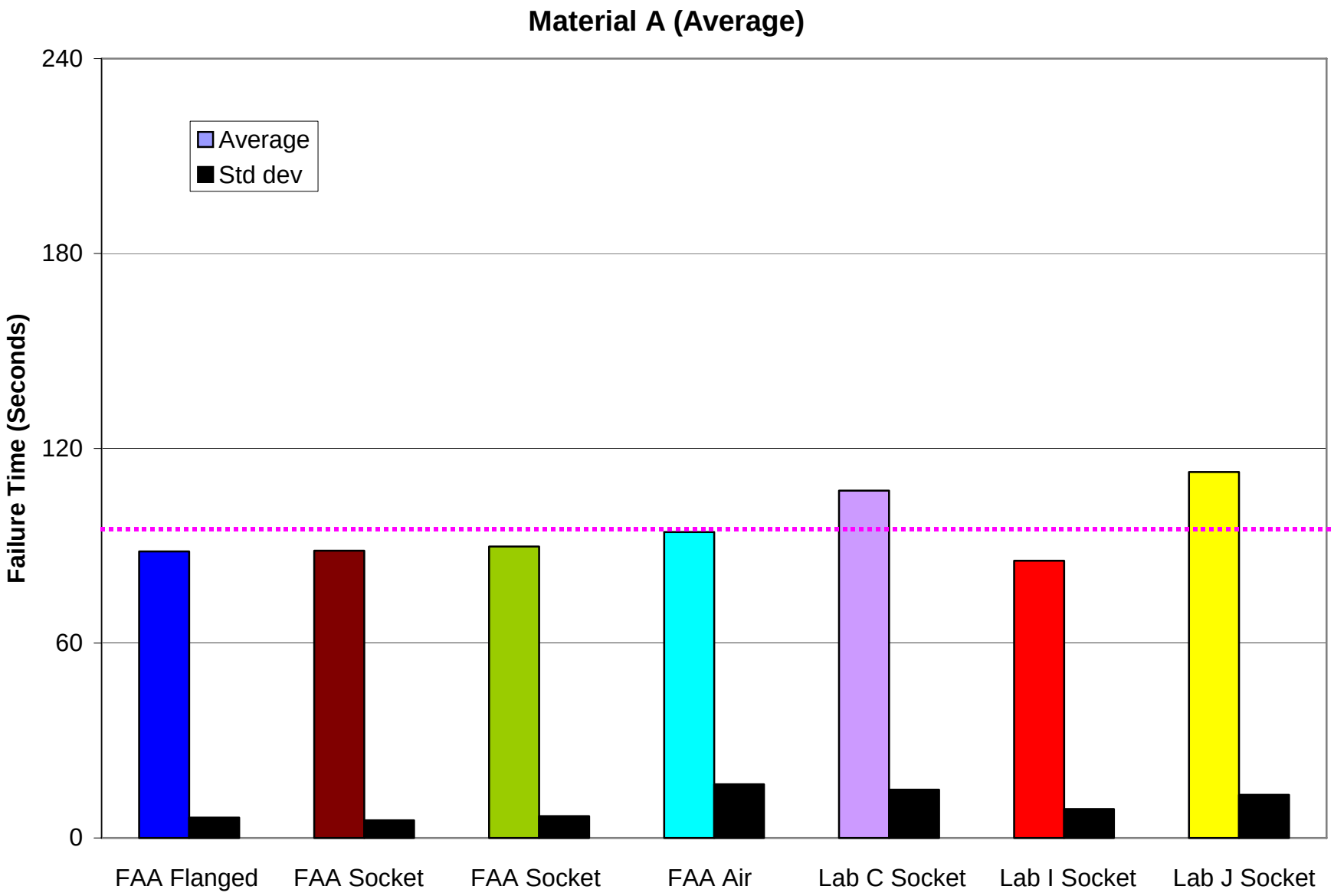

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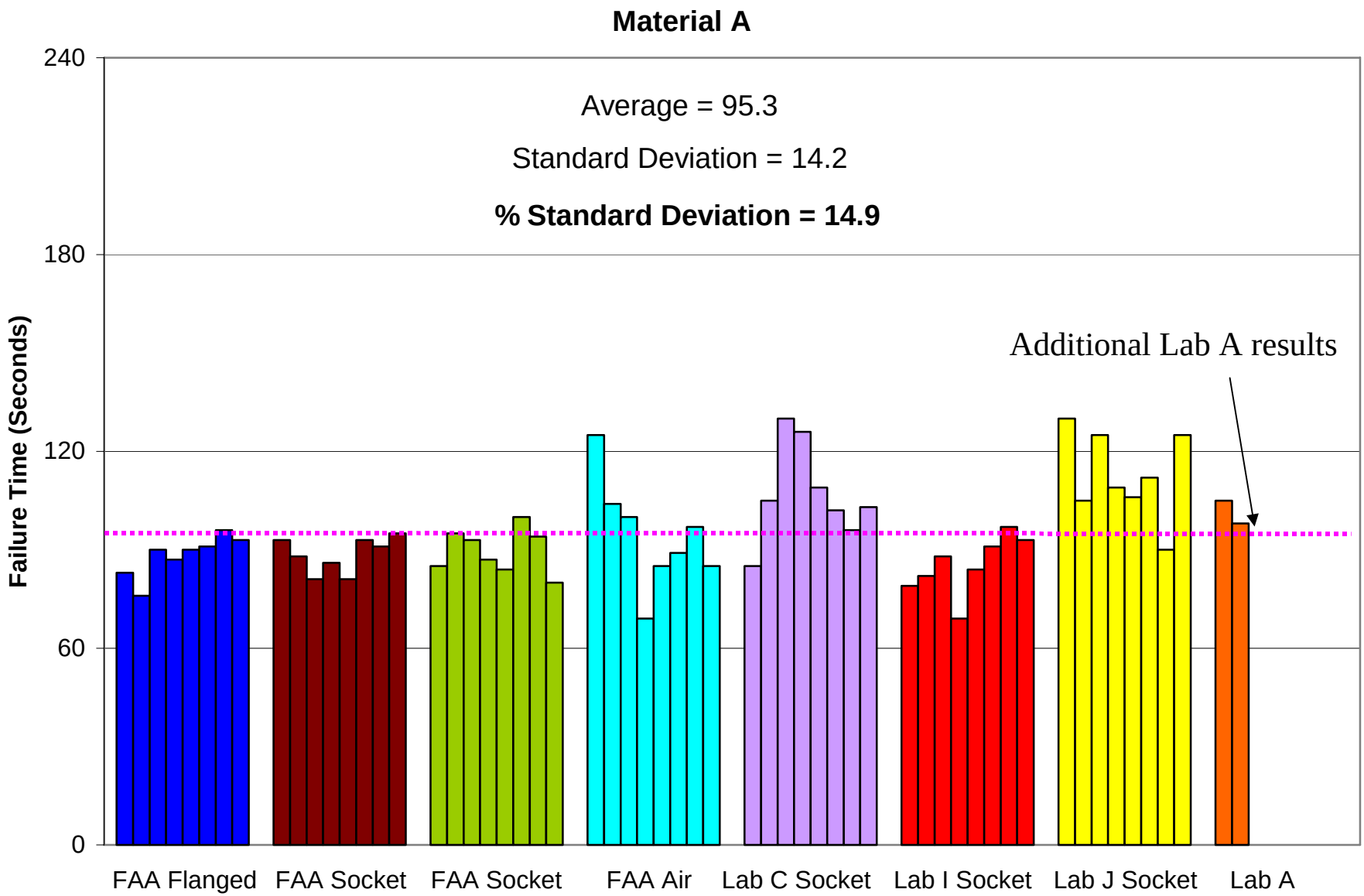

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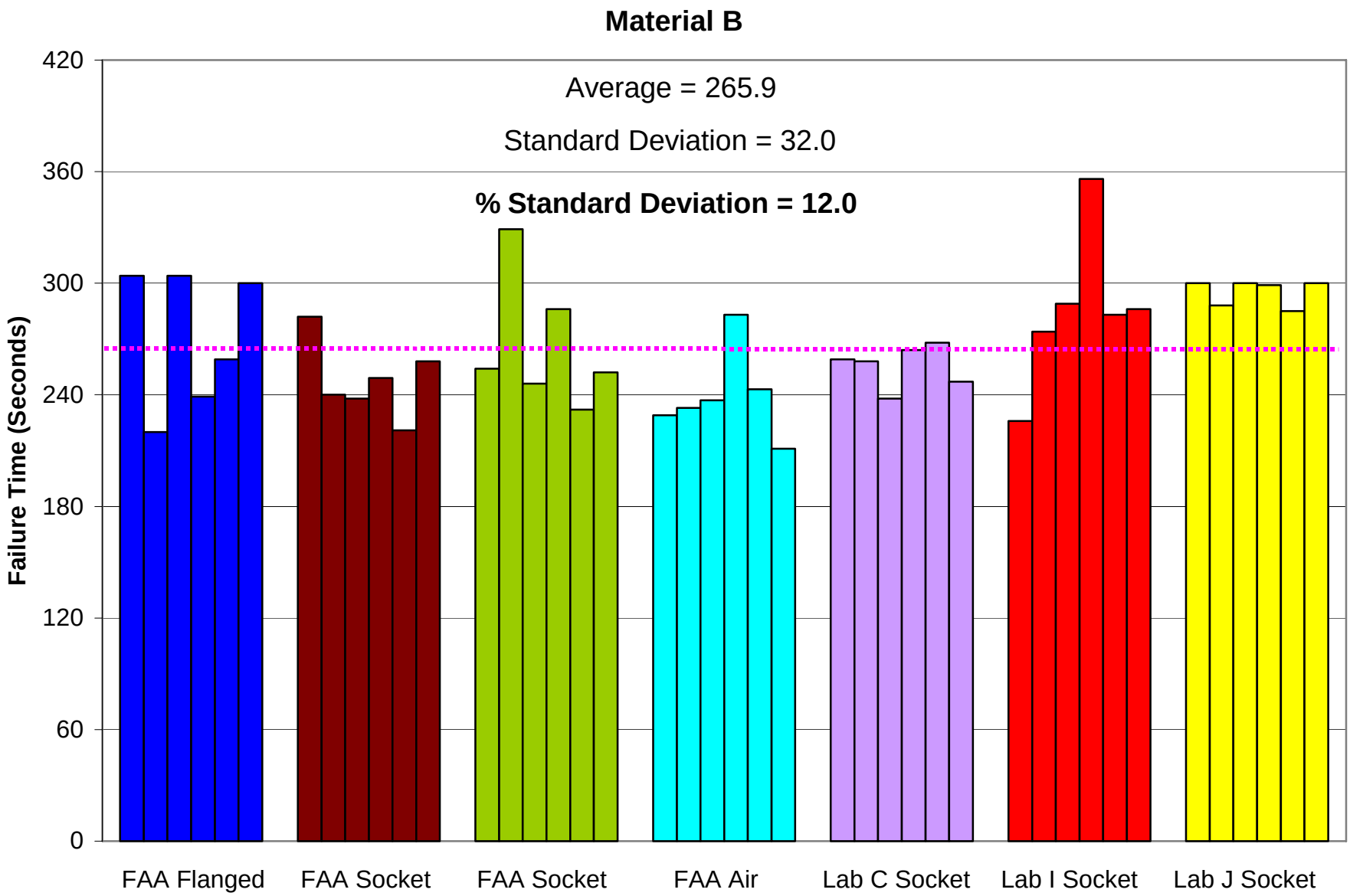

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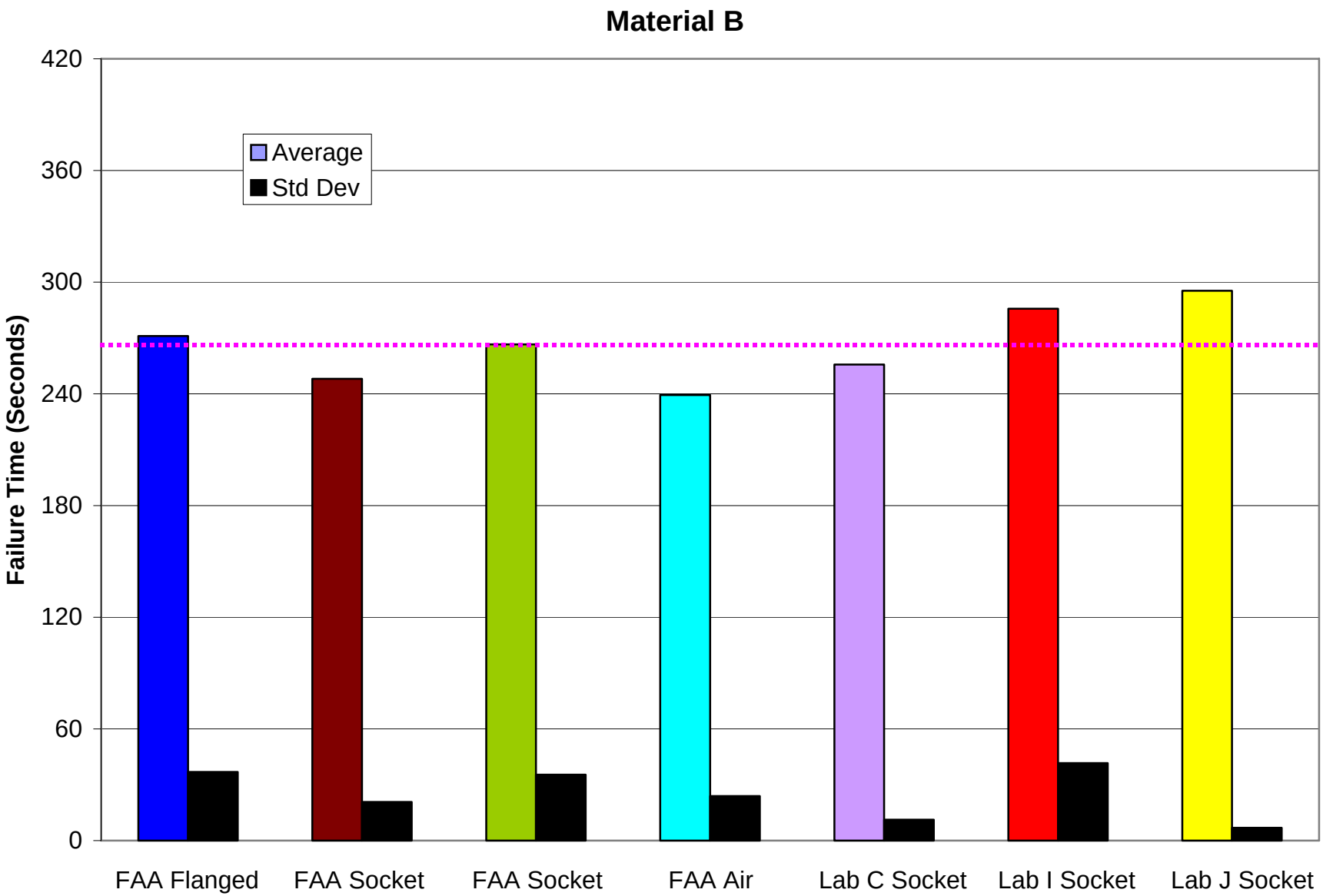

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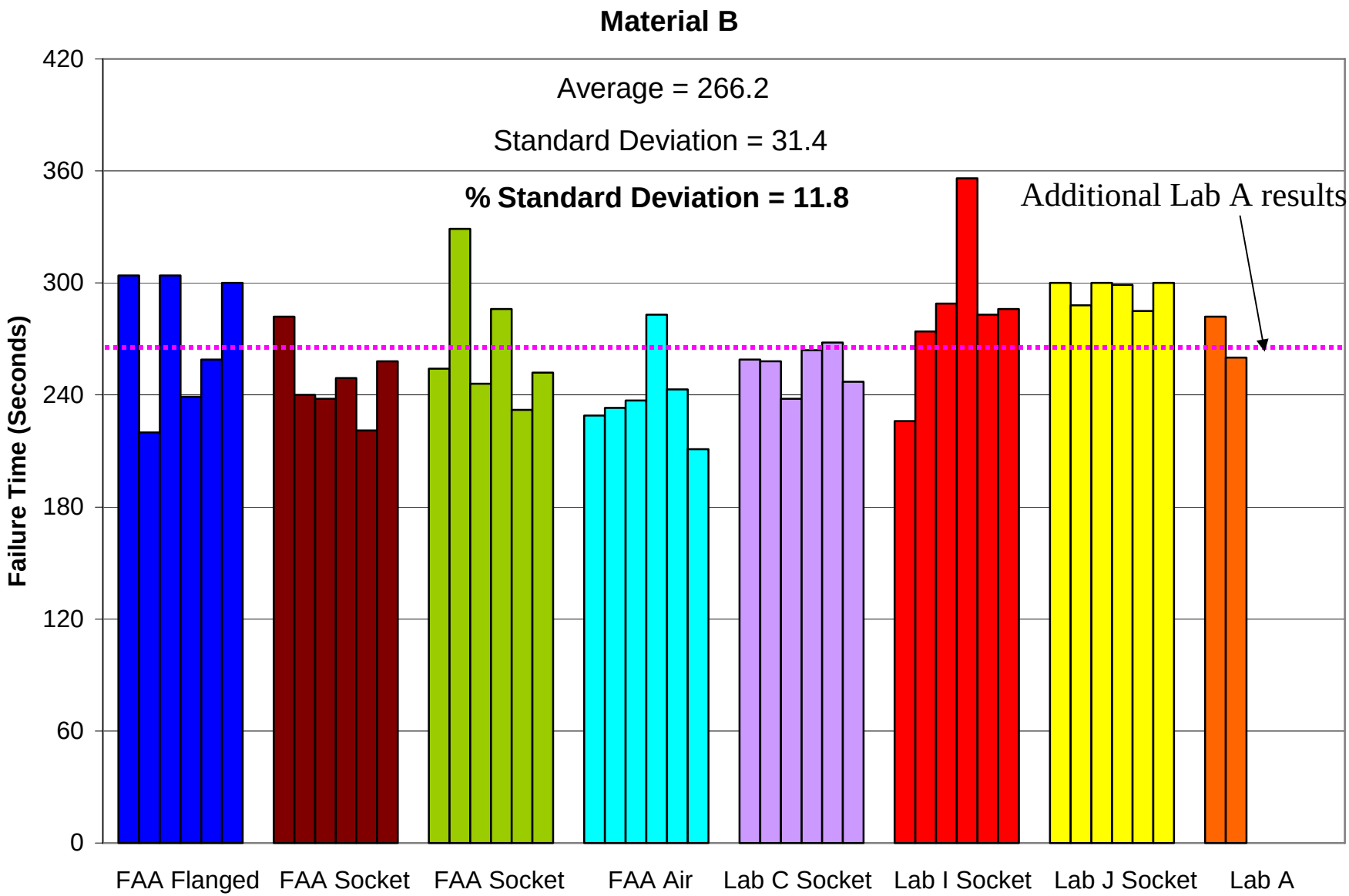

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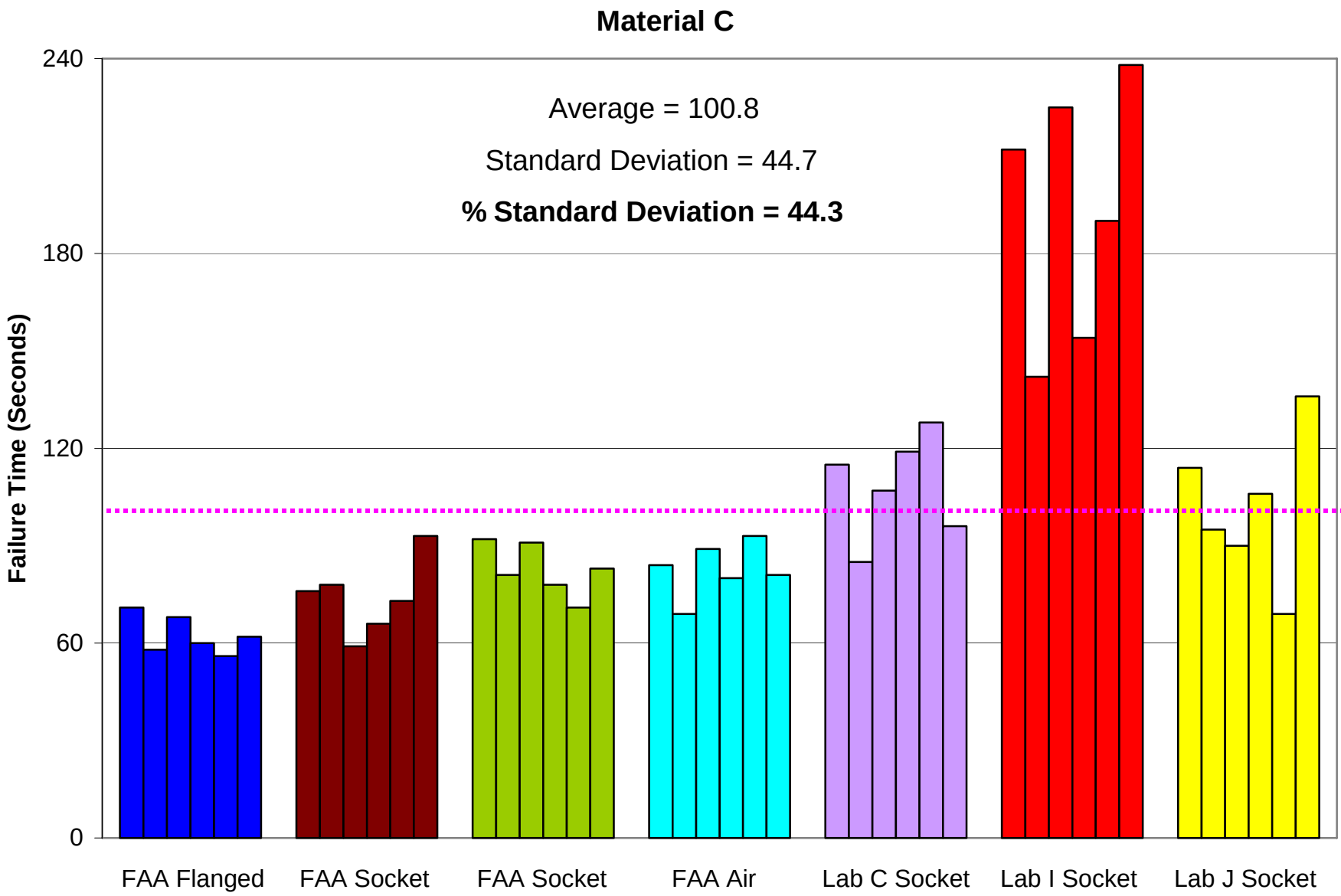

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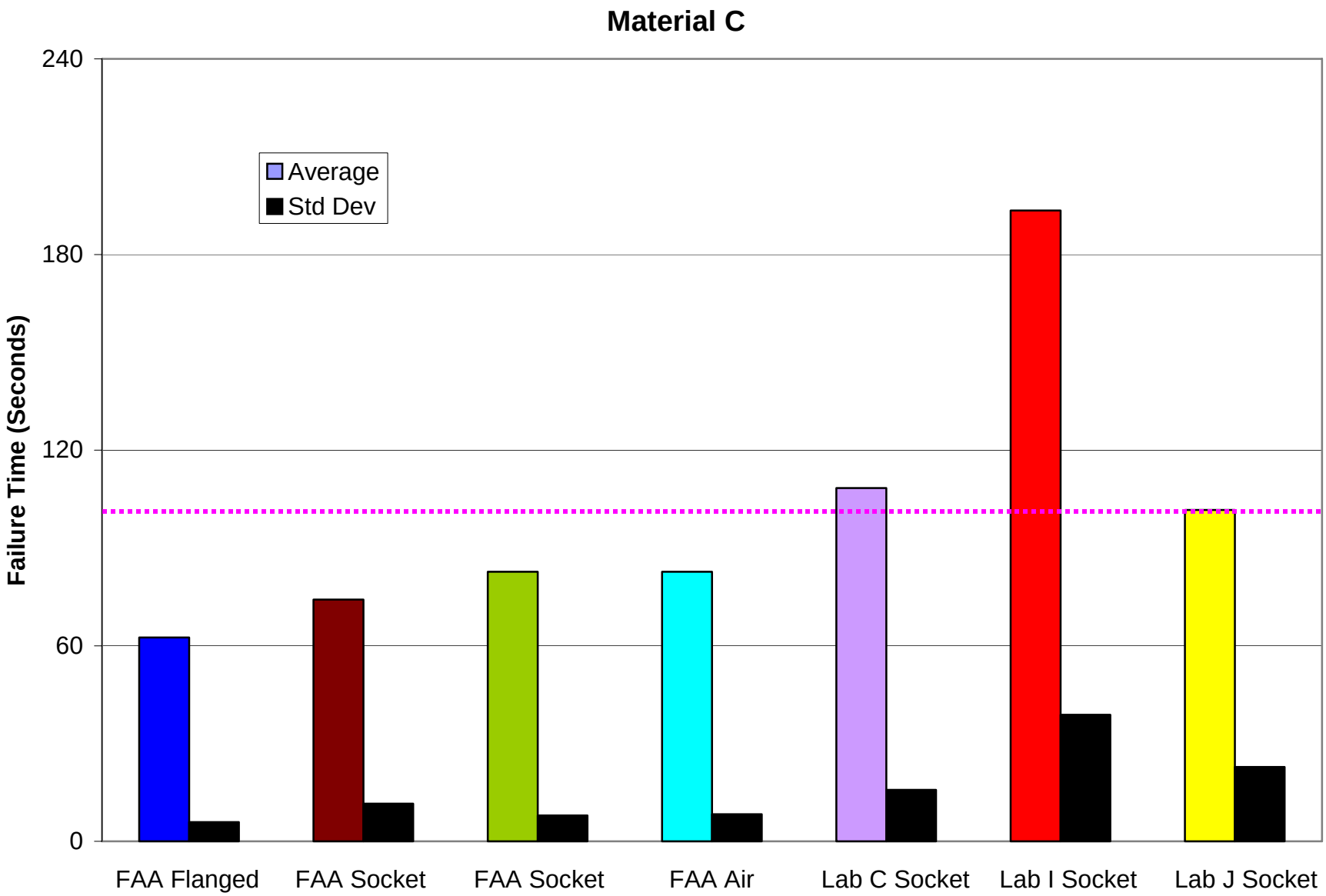

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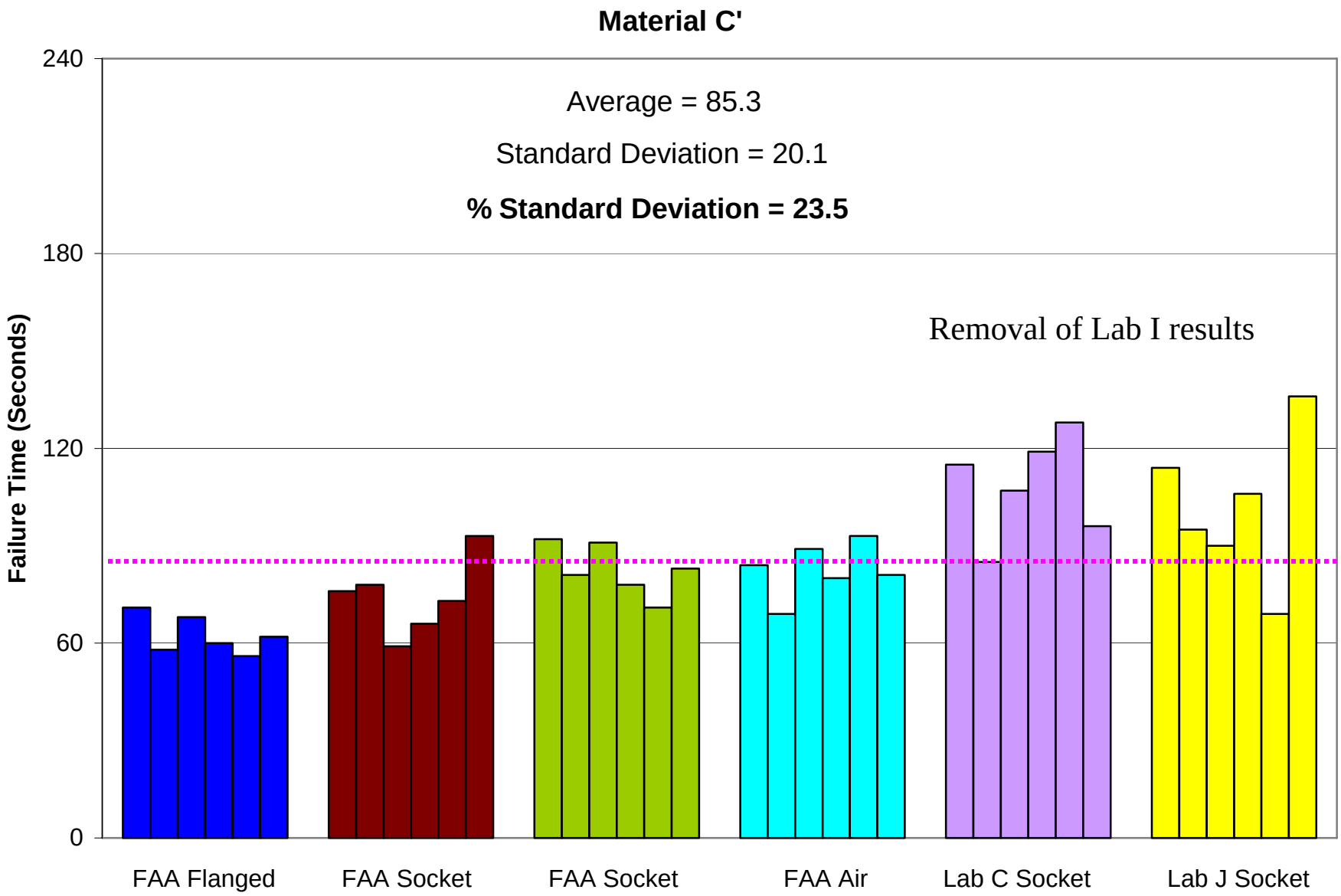

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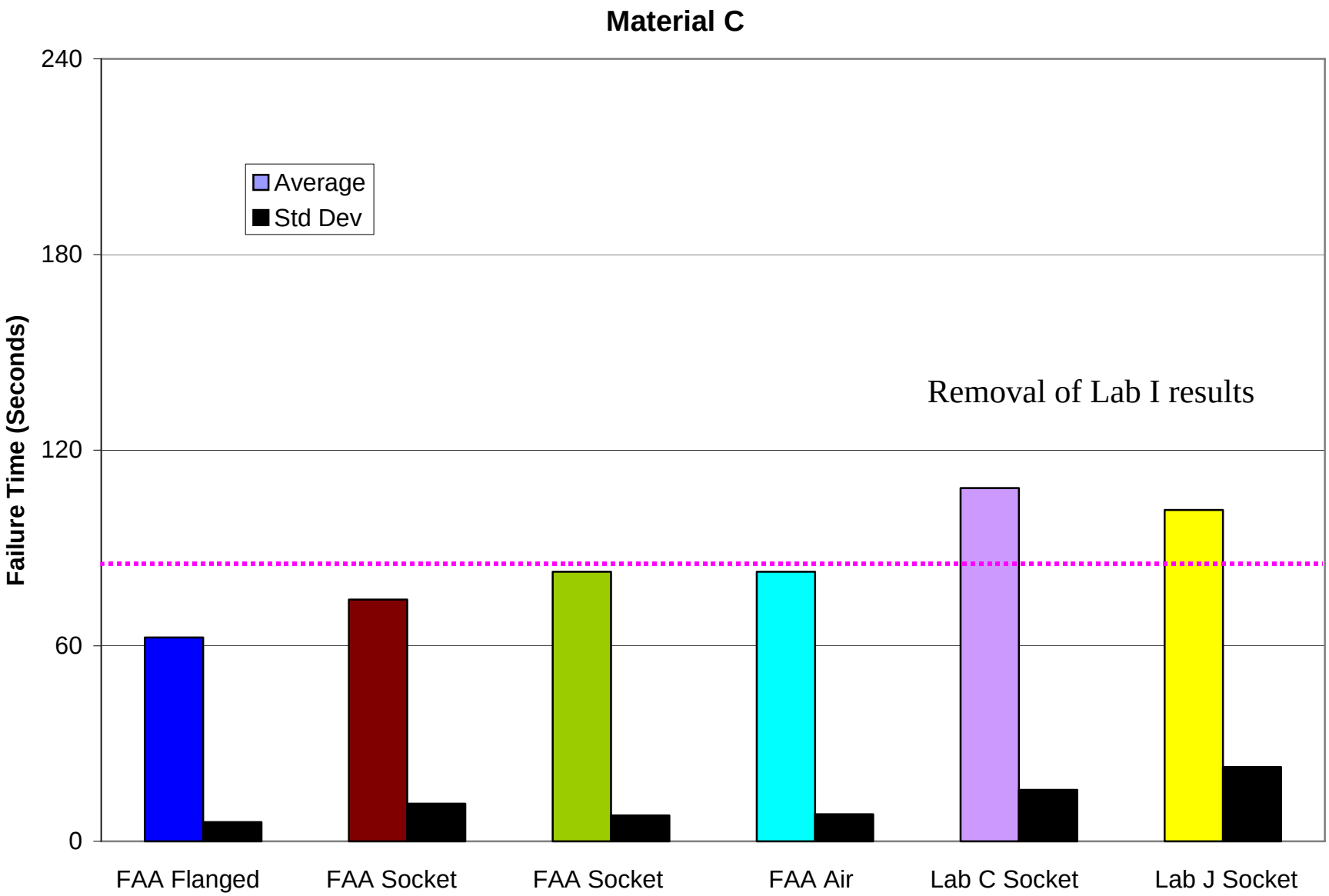

Round Robin 8 Summary of Results

Burner adjustments (stator diameter enlargement, stator distance to nozzle) resulted in good interlab correlation of temperature and heat flux.

Burner adjustments also resulted in good interlab correlation of burnthrough times and time to reach 2.0 Btu/ft^2 sec on backface.

Measurement of backface heat flux needs to be investigated.

Small amount of scatter (standard deviation) still exists within most labs.

Development of a Calibration Device for Backface Calorimeters