



Federal Aviation
Administration

International Aircraft Materials Fire Test Working Group Meeting

Development of a New Flammability Test for Magnesium-Alloy Seat Structure

Presented to: International Aircraft Materials Fire Test
Working Group, Atlantic City, NJ

By: Tim Marker, FAA Technical Center

Date: October 19-20, 2015



Magnesium Alloy Flammability Highlights

Round Robin III: Results obtained so far

Mag Use in Other Areas: What is the appropriate method of testing?

Development of Acceptance Criteria for Allowing Use of Oil Burner

Small-scale flammability test results using Radiant Panel

Discussion Items for Task Group/Future

Magnesium Alloy Flammability Test Round Robin III

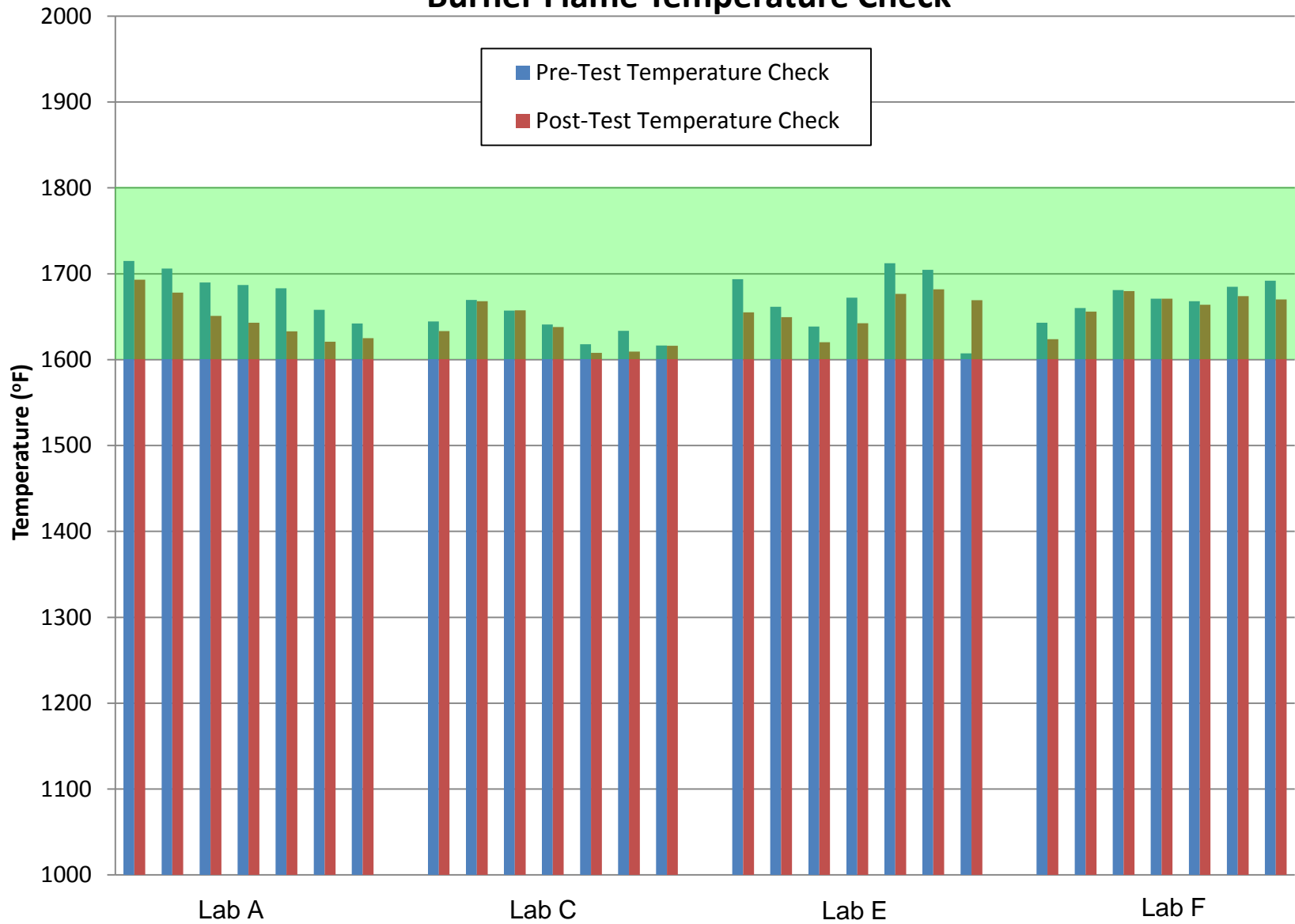
Purpose: To help identify differences in labs. Results will help in the development of a repeatable test.

Technique: Test identically-prepared samples under controlled conditions

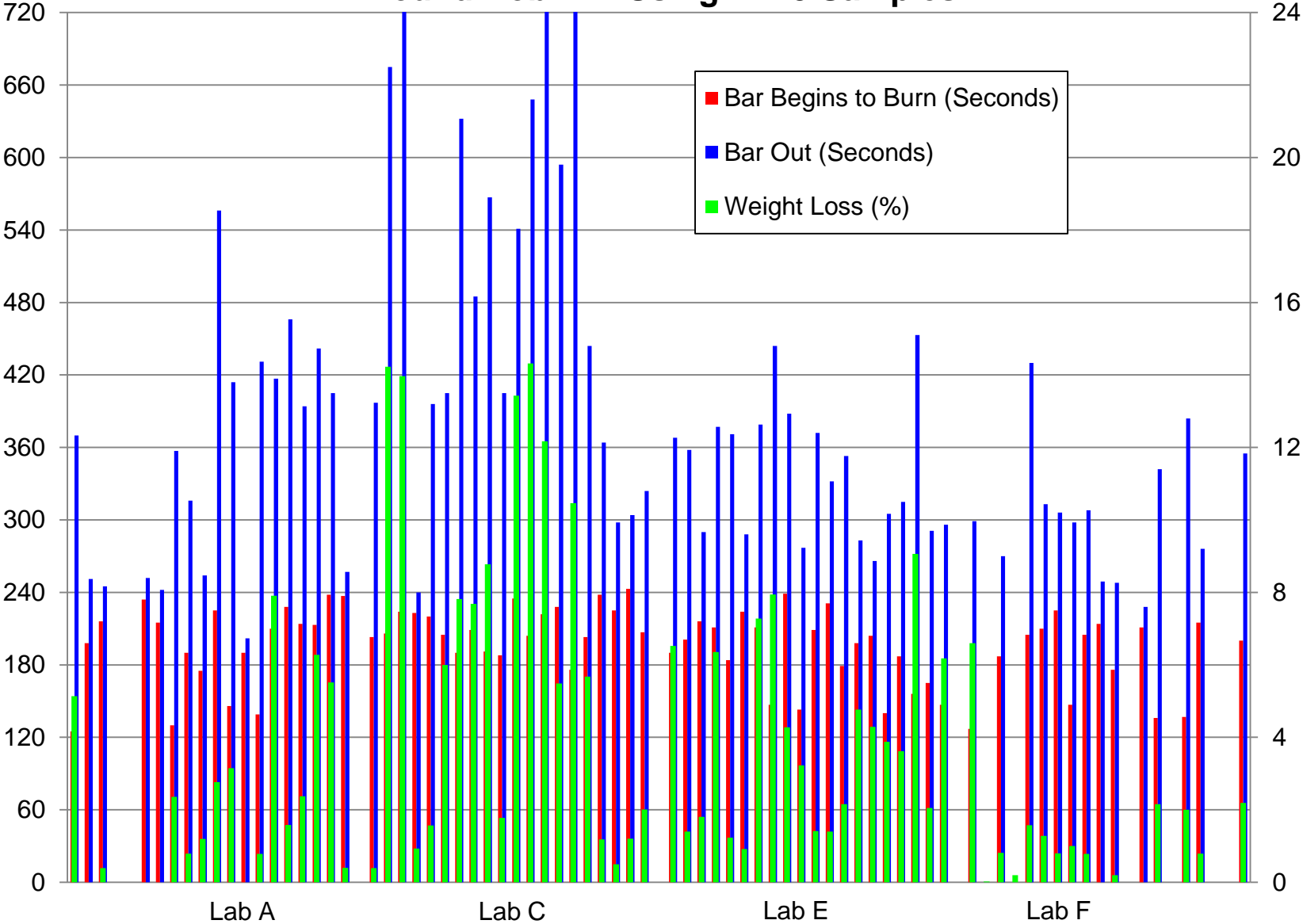
Participants: FAA, Accufleet, Airbus, Magnesium Elektron

Equipment: Igniterless stator, spark plug, new clamp-style sample holder, 20 samples of EL43, 1 sample AZ31

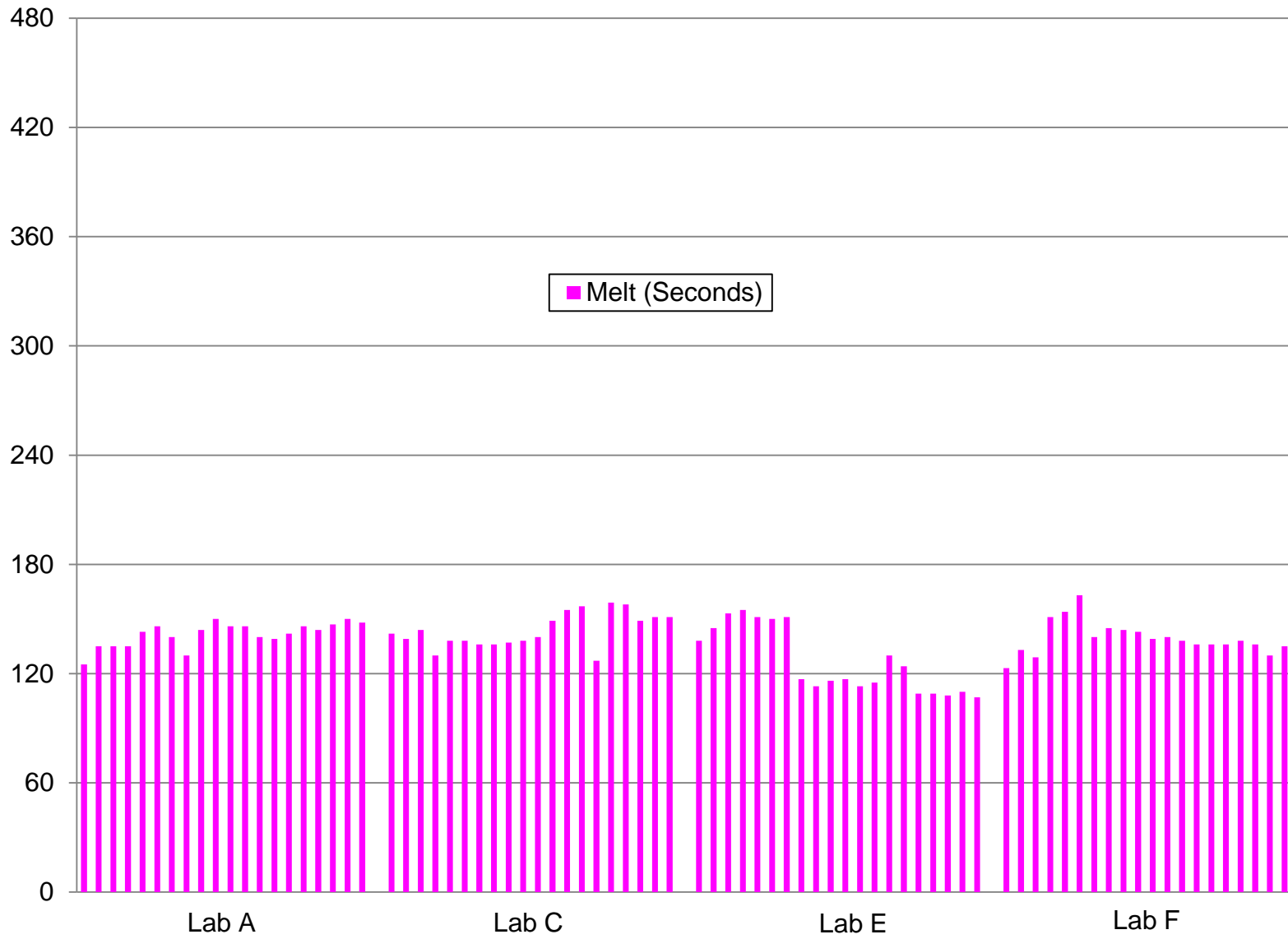
Burner Flame Temperature Check



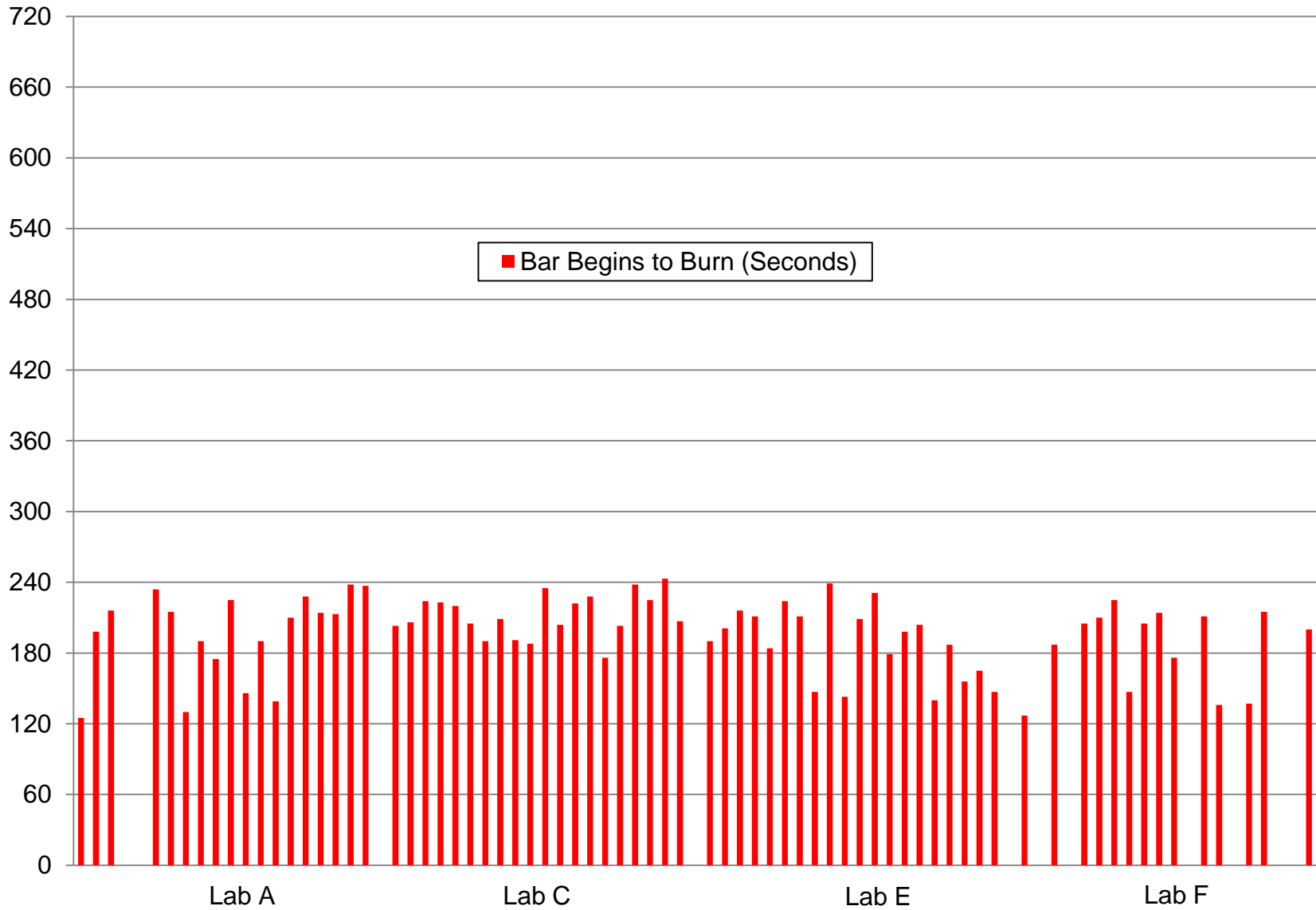
Round Robin III Using EL43 Samples



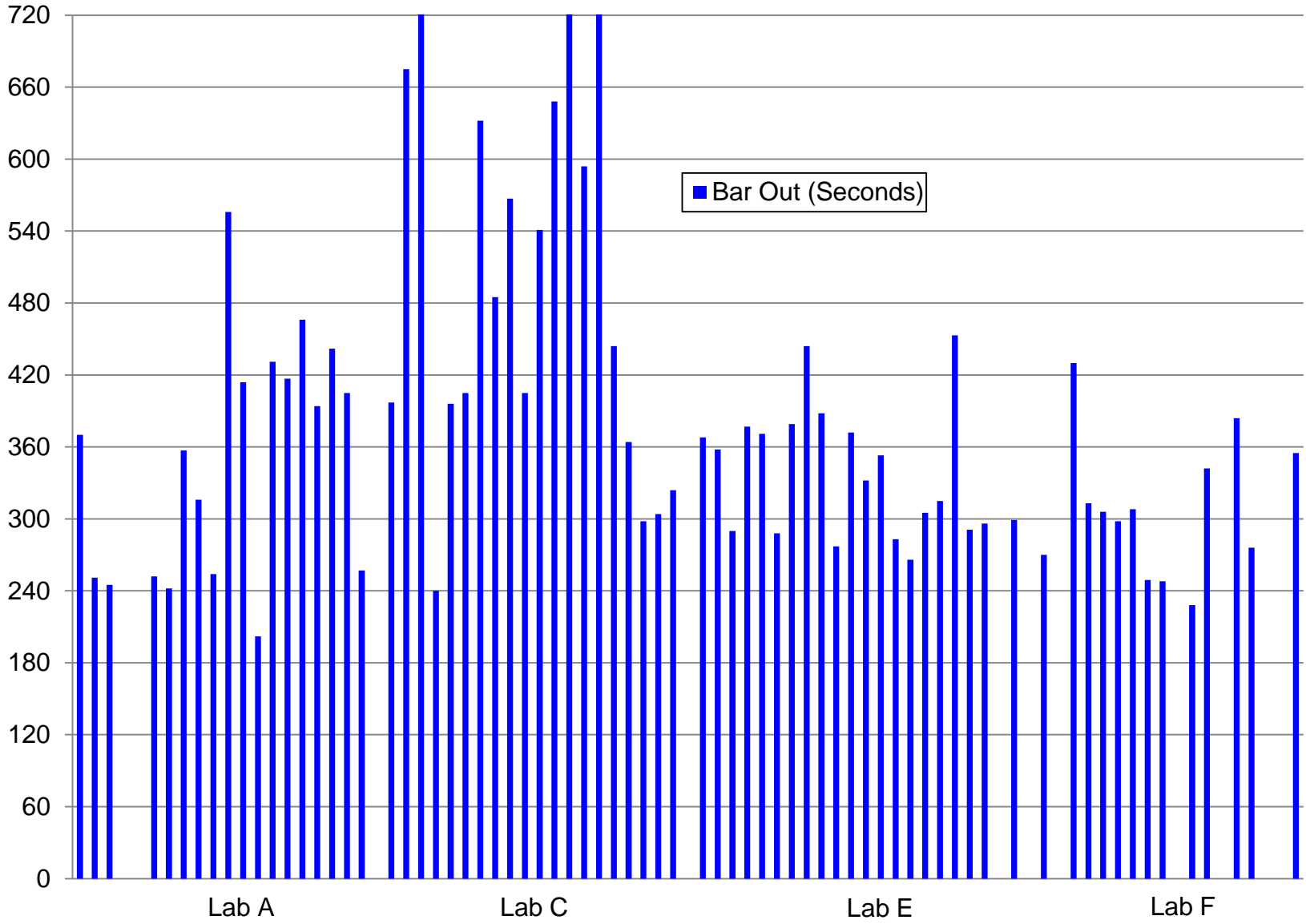
Round Robin III Using EL43 Samples



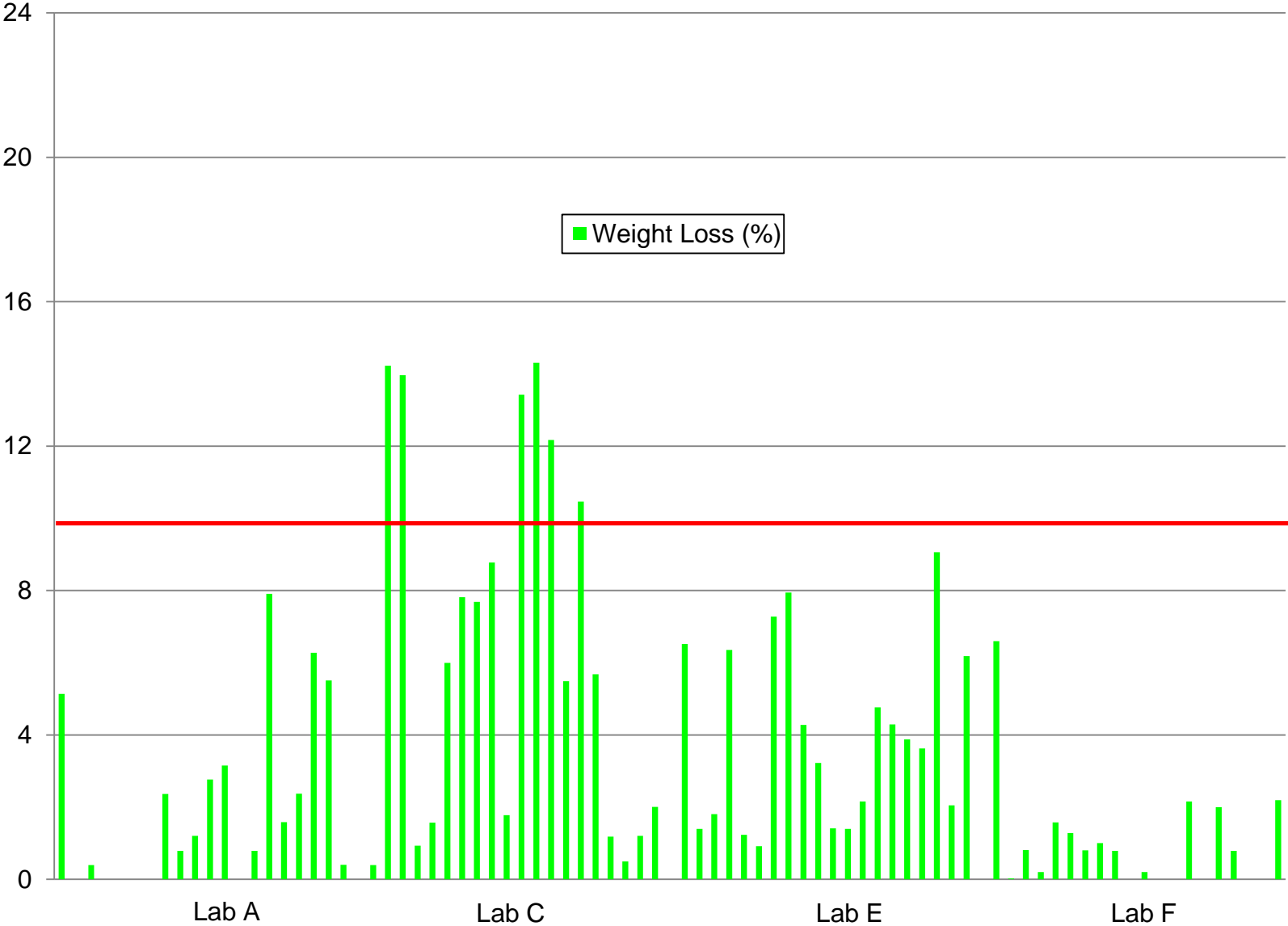
Round Robin III Using EL43 Samples



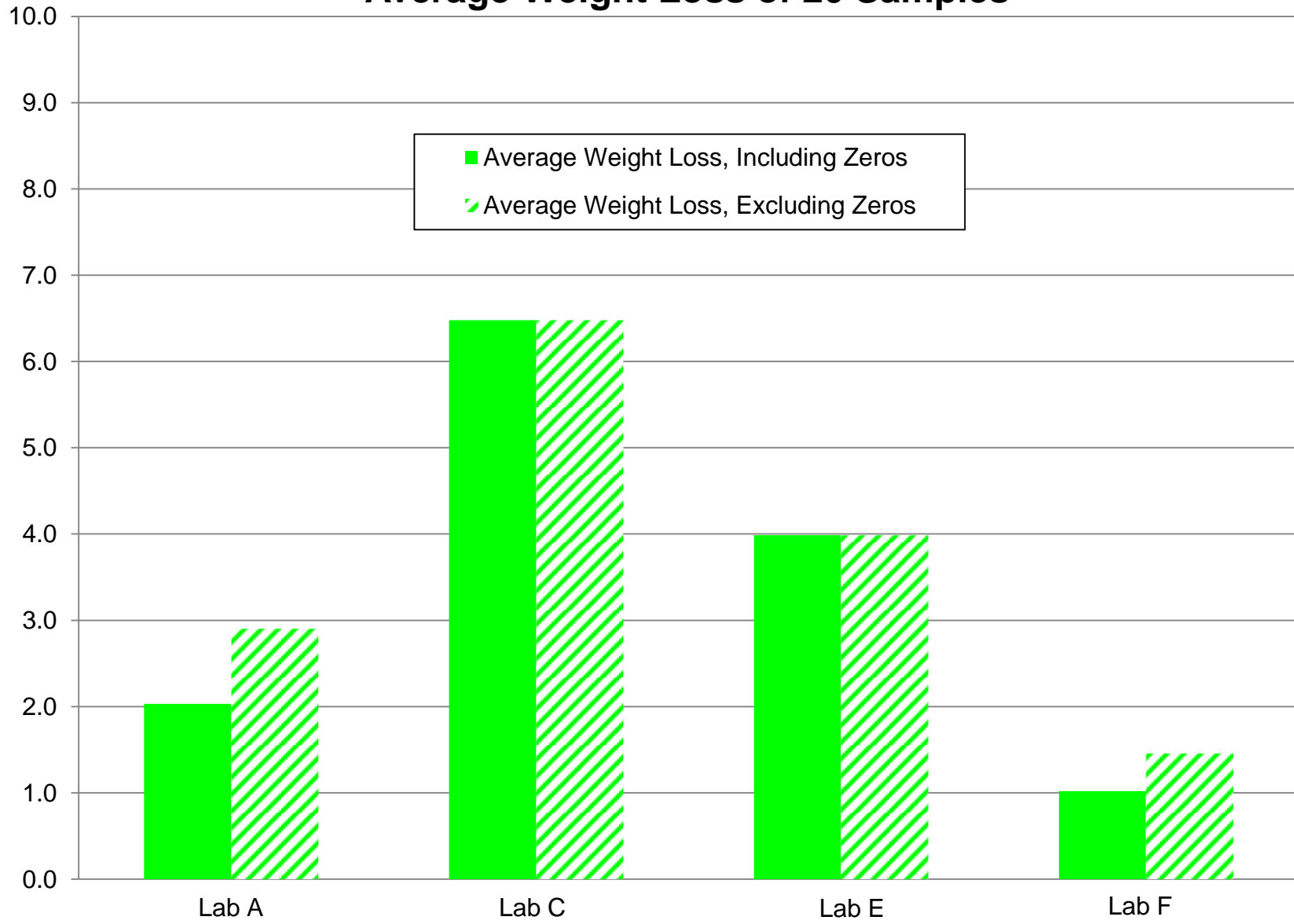
Round Robin III Using EL43 Samples



Round Robin III Using EL43 Samples



Average Weight Loss of 20 Samples



Magnesium Alloy Flammability Test Round Robin III

Preliminary Findings:

Temperature Check shows burner flame agreement using igniterless stator

Melt times consistent between labs, indicating samples being exposed similarly

Time when sample begins to burn also consistent between labs

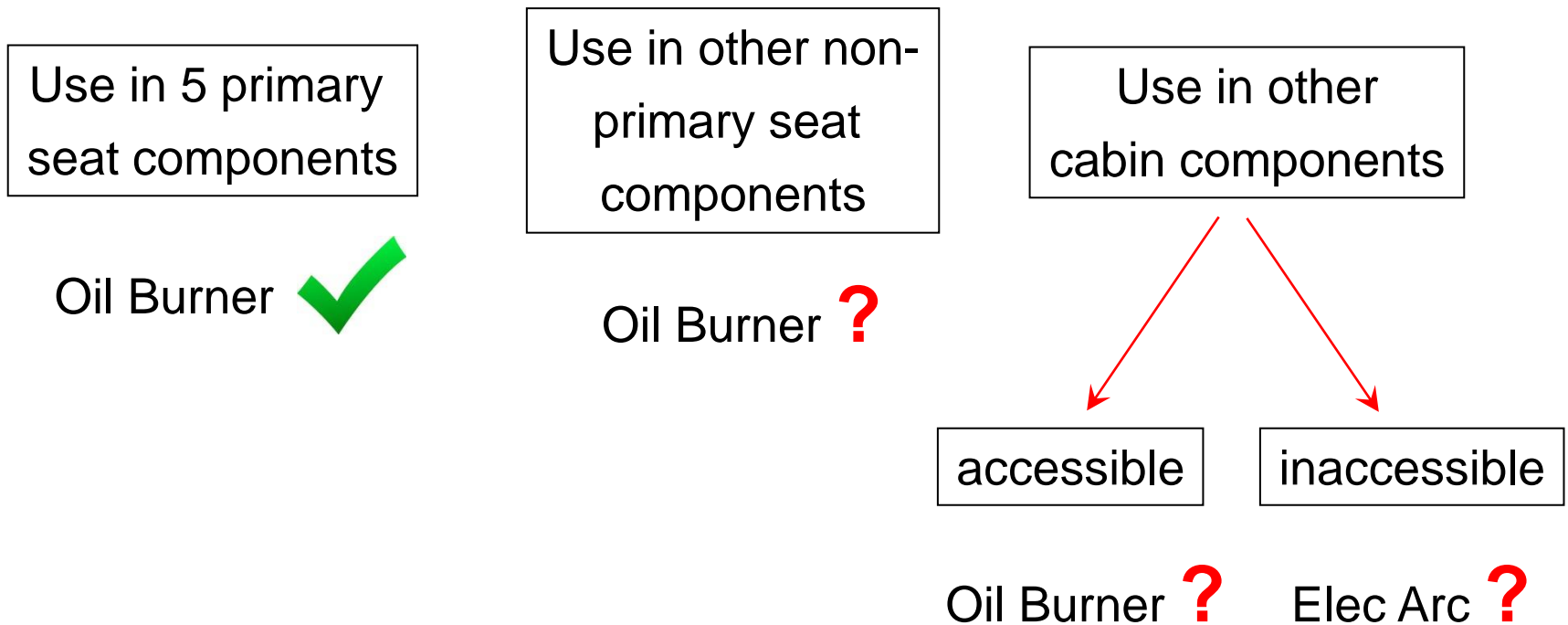
Time for sample to self extinguish remains inconsistent

Weight Loss results still an issue, with excessive scatter

Further analysis to follow now that all data received

The Use of Magnesium Alloy in Other Cabin Areas

What is the appropriate method of test?



Surface Area-to-Volume (SAV) Ratios of Seat Components

Part Description	Surface Area (in ²)	Volume (in ³)	SAV ratio
Test sample	70.750	7.500	9.43
Leg assembly	193.474	24.661	7.85
Front leg	77.315	7.583	10.20
Center spreader	237.049	18.225	13.01
Wall spreader	175.869	13.446	13.08
Aisle spreader	291.297	19.266	15.12
Backrest Frame	581.000	36.250	16.03
Crosstube	579.616	34.704	16.70
Baggage Bar	373.357	10.073	37.07

Low SAV ratio = low probability of ignition

High SAV ratio = high probability of ignition

The Use of Surface Area-to-Volume (SAV) to Predict Flammability

...from previous IAMFTWG meeting...

- SAV ratio of flat panels $\sim 2/t$
- SAV ratio of hollow tubes $\sim 2/t$
- For a $SAV \leq$ test sample, a flat panel or hollow tube would have to be:
...at least 0.2 inches thick

However...

Parts tested during full-scale tests (cross tubes, seat back, baggage bar) were substantially less thick (0.06 inches, 0.125 inches, 0.054 inches)

So...

Propose 2 different SAV ratios: max 20 for solid parts, max 40 for hollow parts

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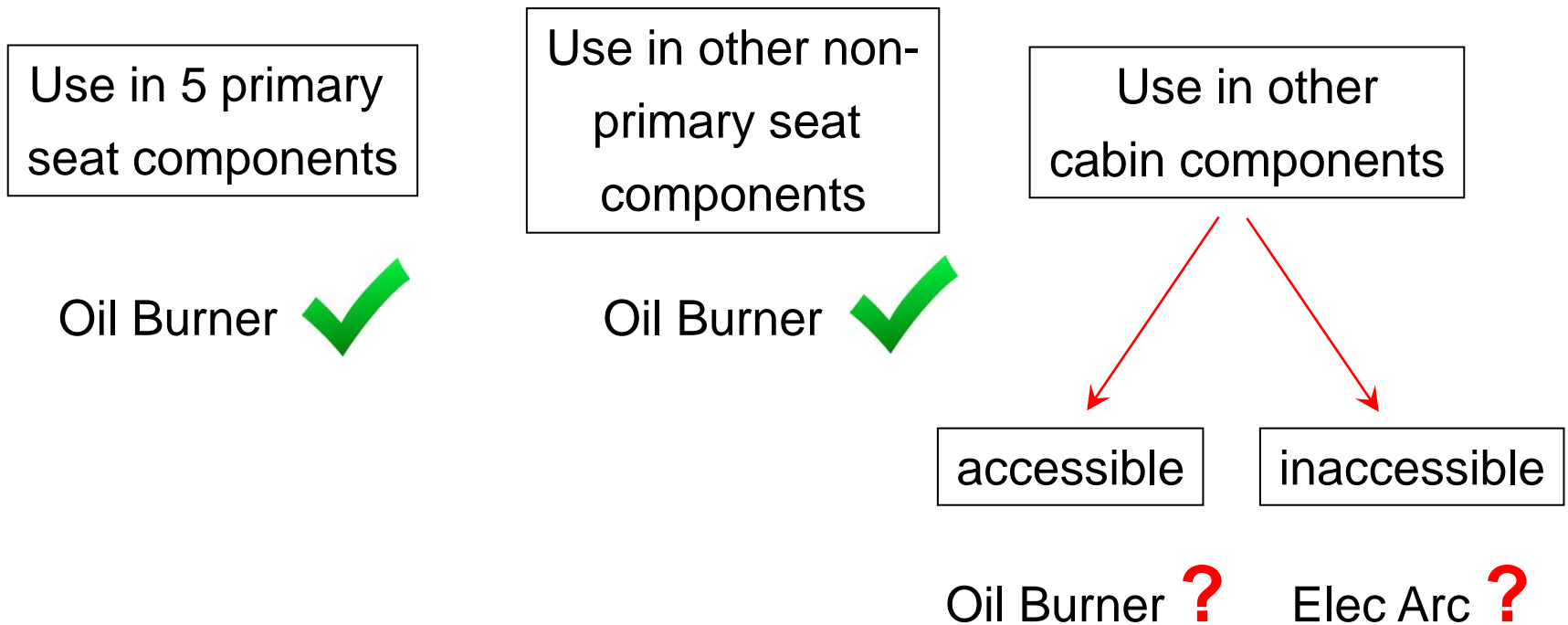


SAV ratio solid ≤ 20

SAV ratio hollow ≤ 40

The Use of Magnesium Alloy in Other Cabin Areas

What is the appropriate method of test?

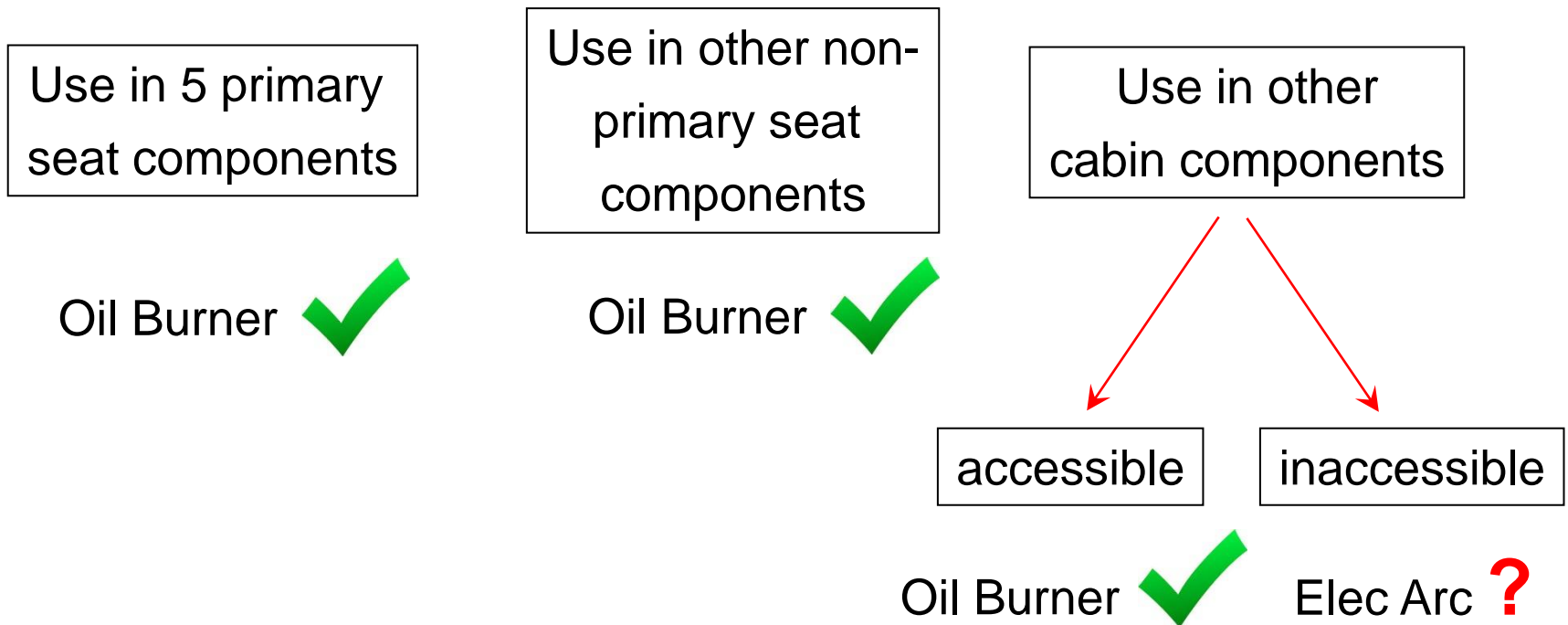


Possible Criteria for Allowing Substantiation of non-Seat Components Using the Oil Burner per Chapter 25

1. Component is accessible
2. Surface Area-to-Volume (SAV) Ratios (≤ 20 solids, ≤ 40 hollow)
3. Component is Located at Height Comparable to Seat Height
4. Proximity to Electrical Components is Minimized

The Use of Magnesium Alloy in Other Cabin Areas

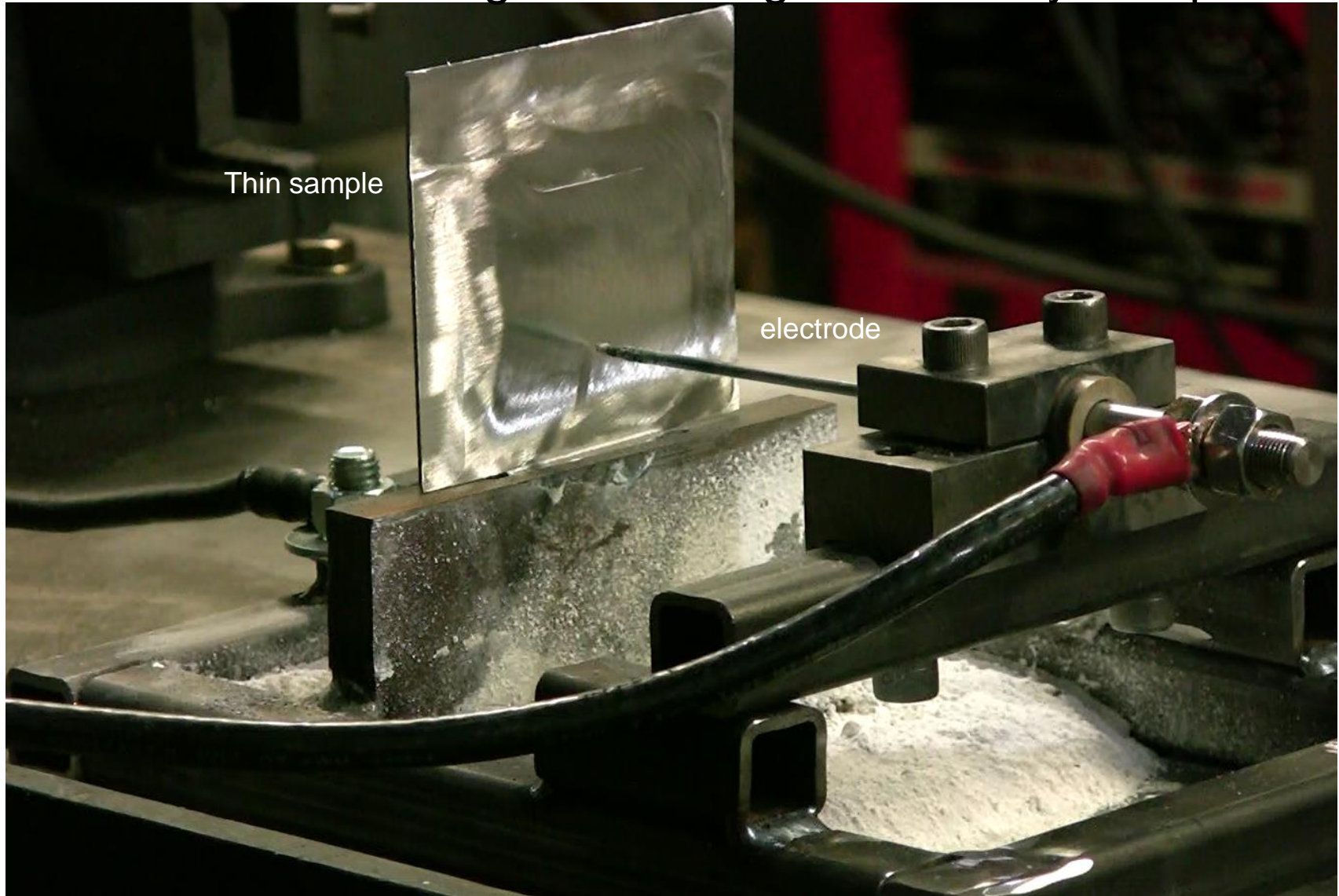
What is the appropriate method of test?



Small Scale Testing



Electrical Arc Testing of Thin Magnesium Alloy Samples



Testing of Thin Magnesium Samples in VBB

EL43

0.100-inch thickness



Testing of Thin Magnesium Samples in VBB

EL43

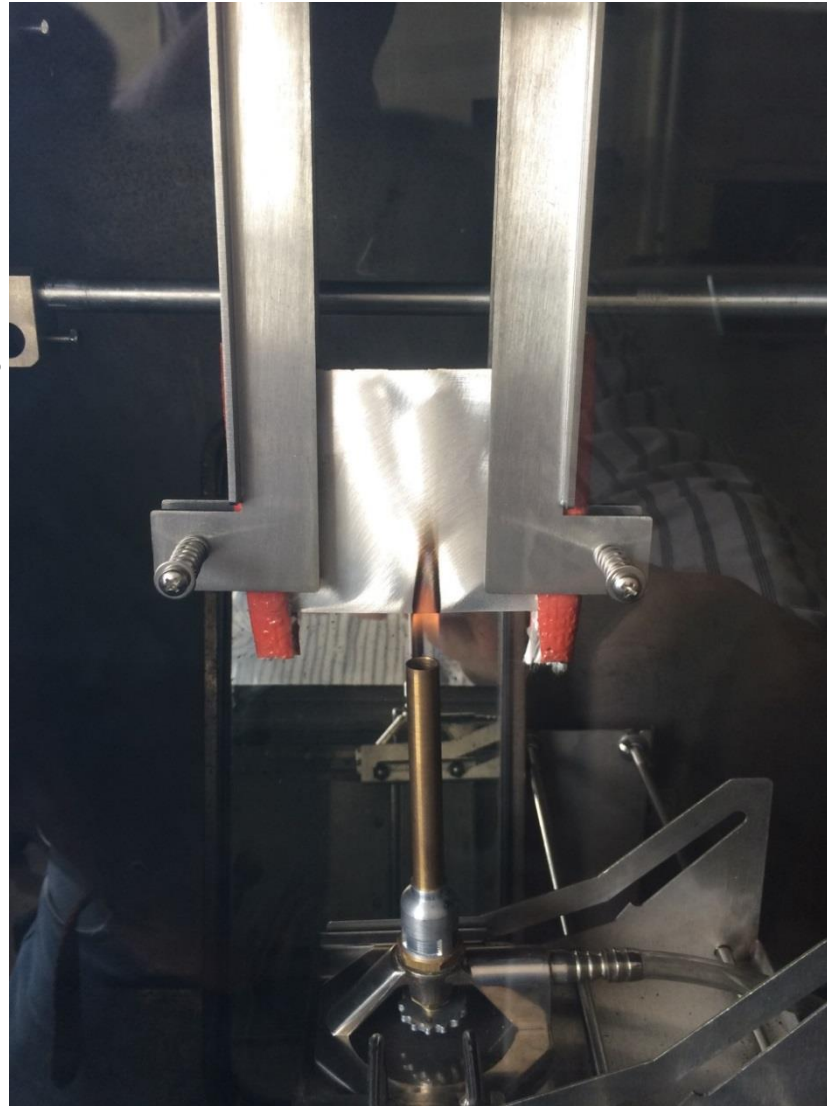
0.050-inch thickness



Testing of Thin Magnesium Samples in VBB

AZ31

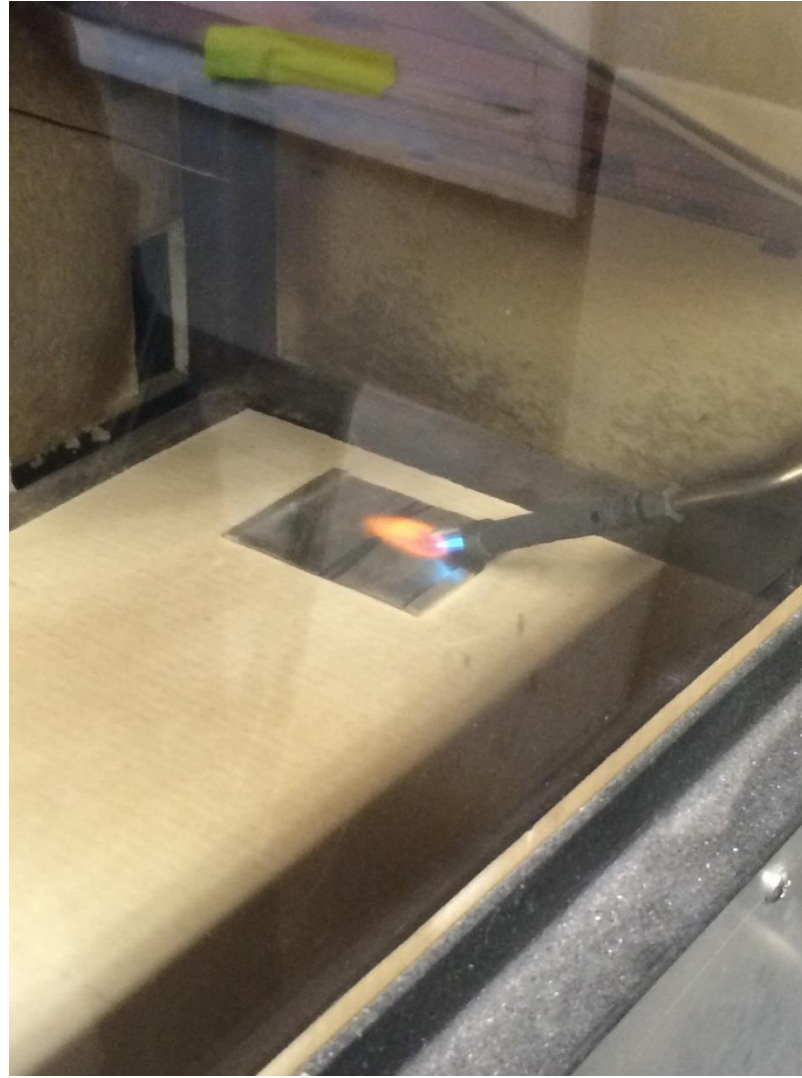
0.125-inch thickness



Testing of Thin Magnesium Samples in Radiant Panel



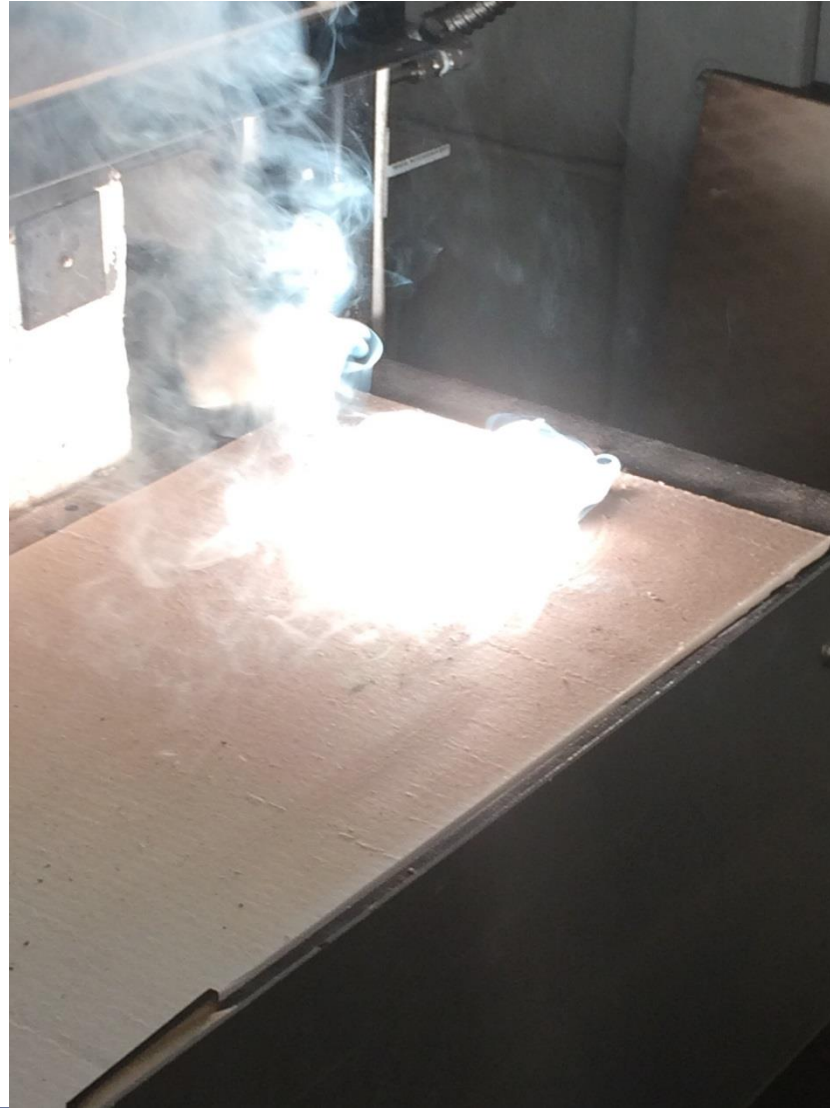
Testing of Thin Magnesium Samples in Radiant Panel



Testing of Thin Magnesium Samples in Radiant Panel



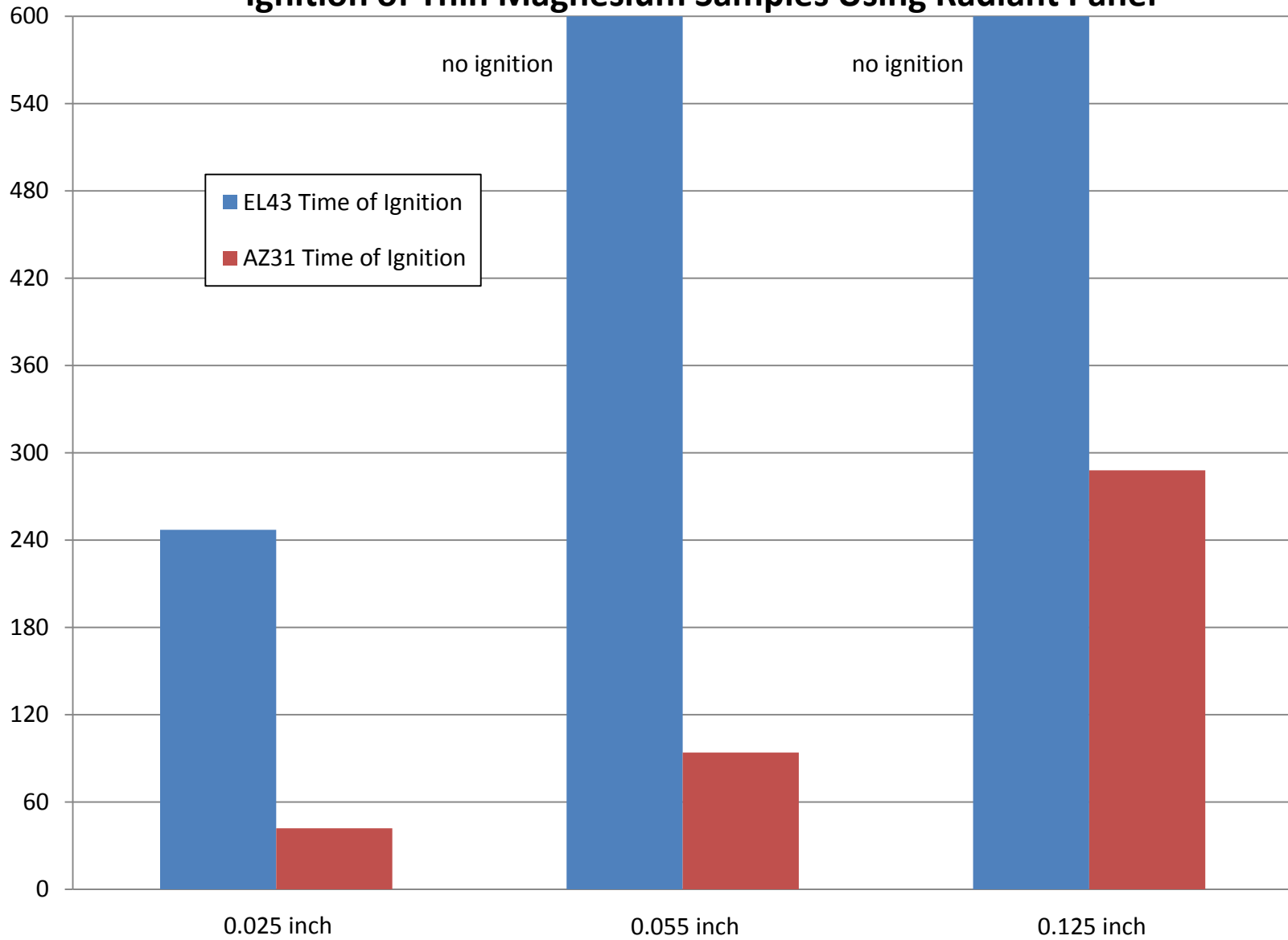
Testing of Thin Magnesium Samples in Radiant Panel



Testing of Thin Magnesium Samples in Radiant Panel



Ignition of Thin Magnesium Samples Using Radiant Panel



Discussion Items for Task Group

Continue the development of substantiation criteria for allowing the use of the oil burner for non-primary seat components (ex: tray table arms)

Continue the development of substantiation criteria for allowing the use of the oil burner for non-seat components (ex: galley carts)

Continue radiant panel testing of thin magnesium alloy samples, develop pass/fail criteria for inaccessible area components

Questions?

