International Aircraft Materials Fire Test Working Group Meeting

Development of New Flammability Test for Magnesium-Alloy Cabin Components

Presented to: International Aircraft Materials Fire Test Working Group, Savannah, GA

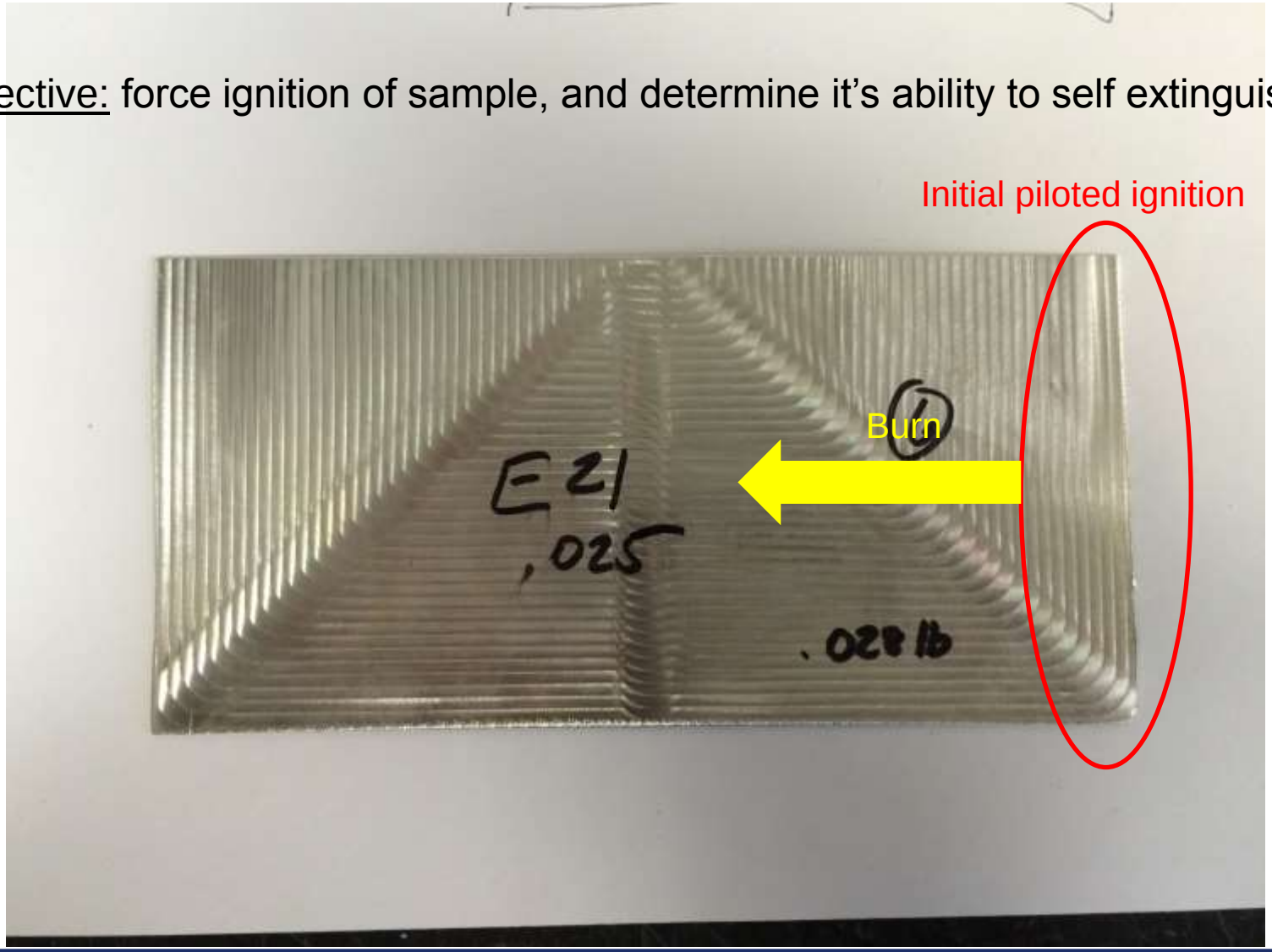
By: Tim Marker, FAA Technical Center

Date: March 6-7, 2018

Federal Aviation Administration

3- by 6-inch Thin Magnesium Sample

Objective: force ignition of sample, and determine it's ability to self extinguish



Development of Flammability Test for Magnesium Components Located in Inaccessible Areas (Update)

Status:

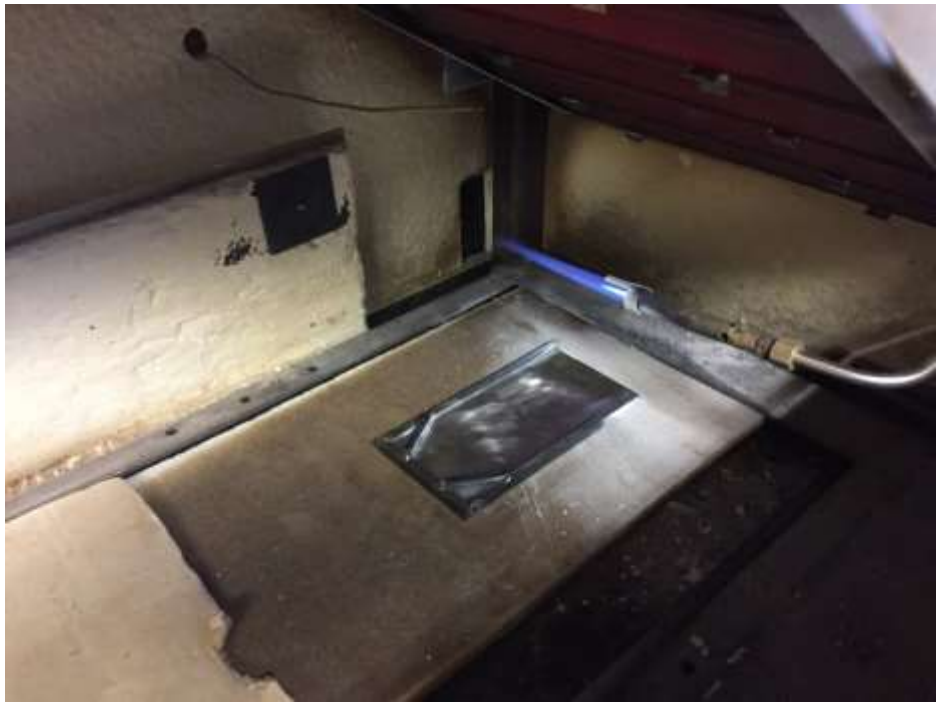
283 tests completed using radiant panel apparatus (13 since last meeting)

Milling Process:

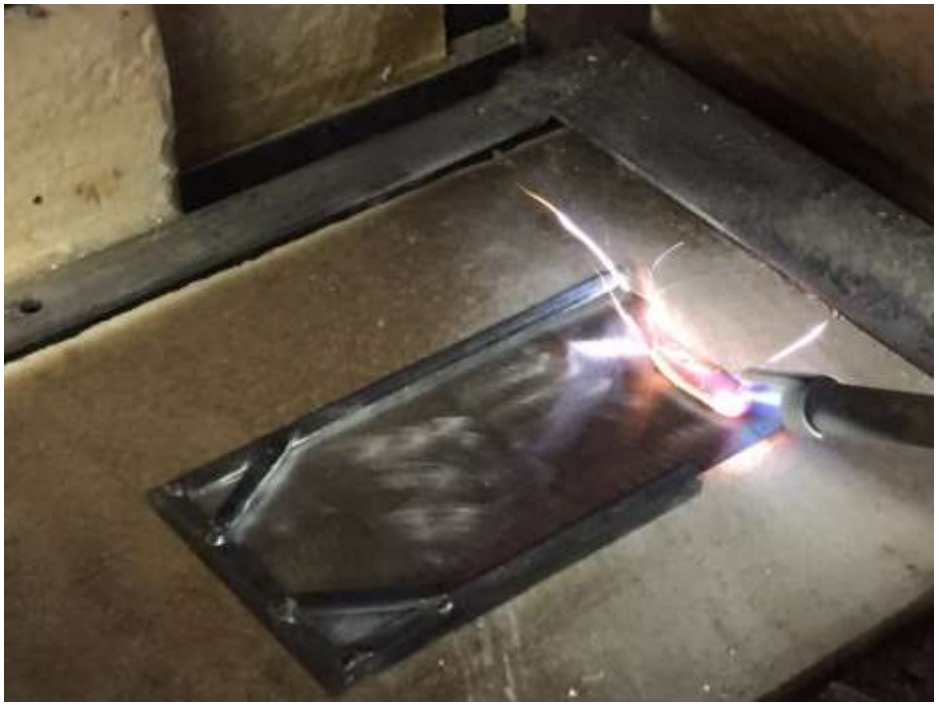
Samples manufactured in 0.125-inch thickness, and must be milled down to 0.025-inch thickness for test

Truncated Perimeter Sample Holder

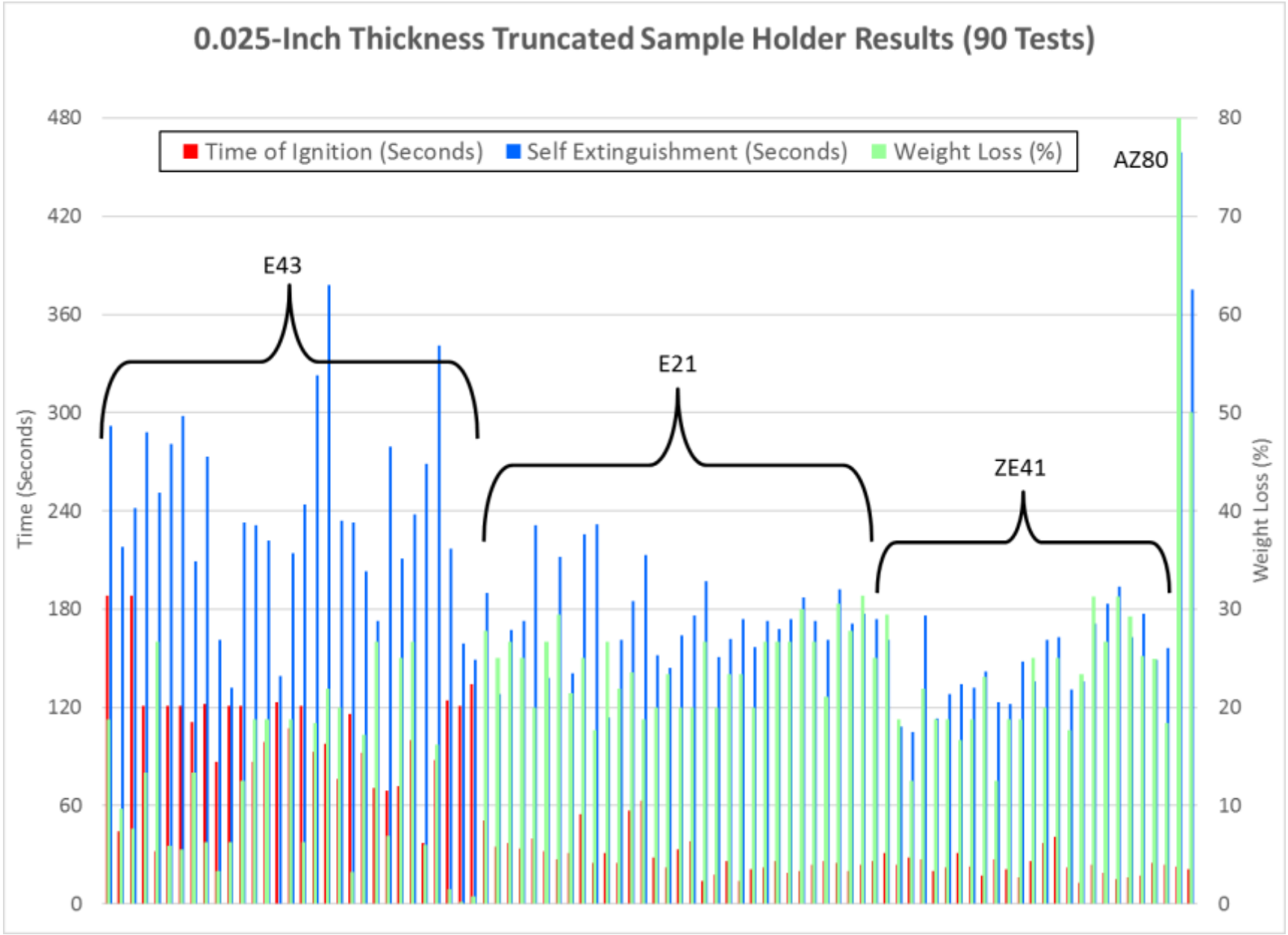
Truncated Perimeter Sample Holder

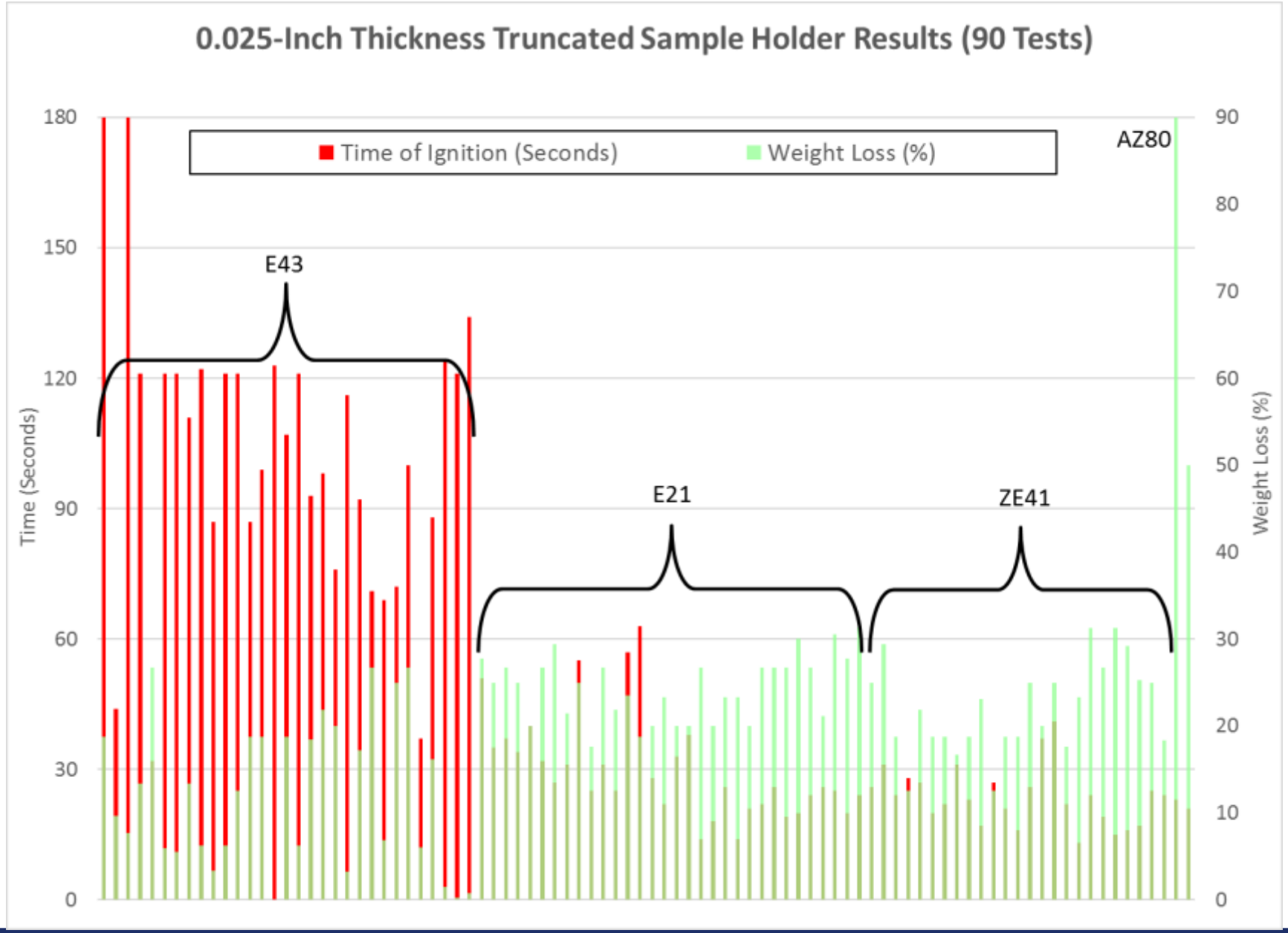


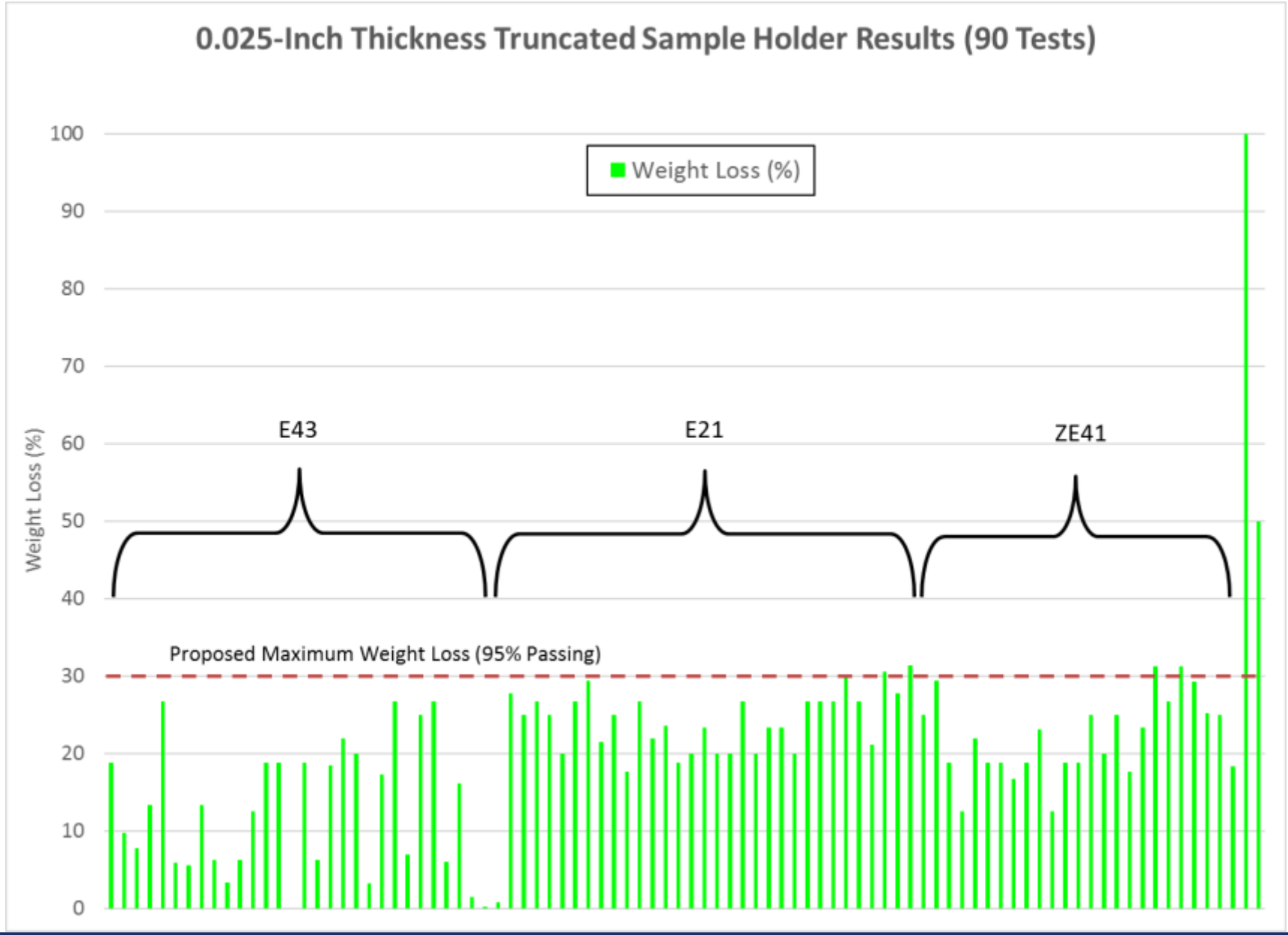
Truncated Perimeter Sample Holder

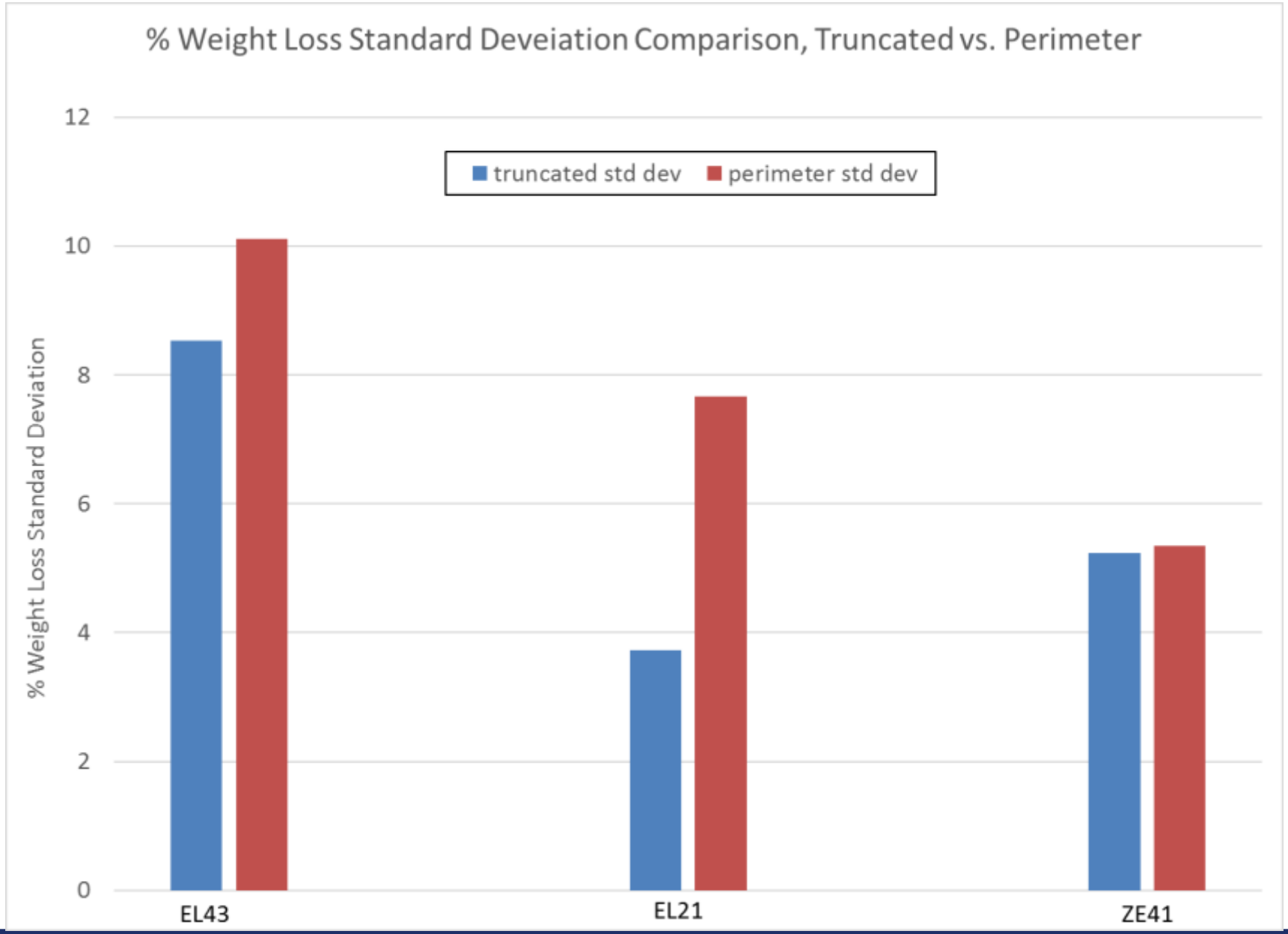


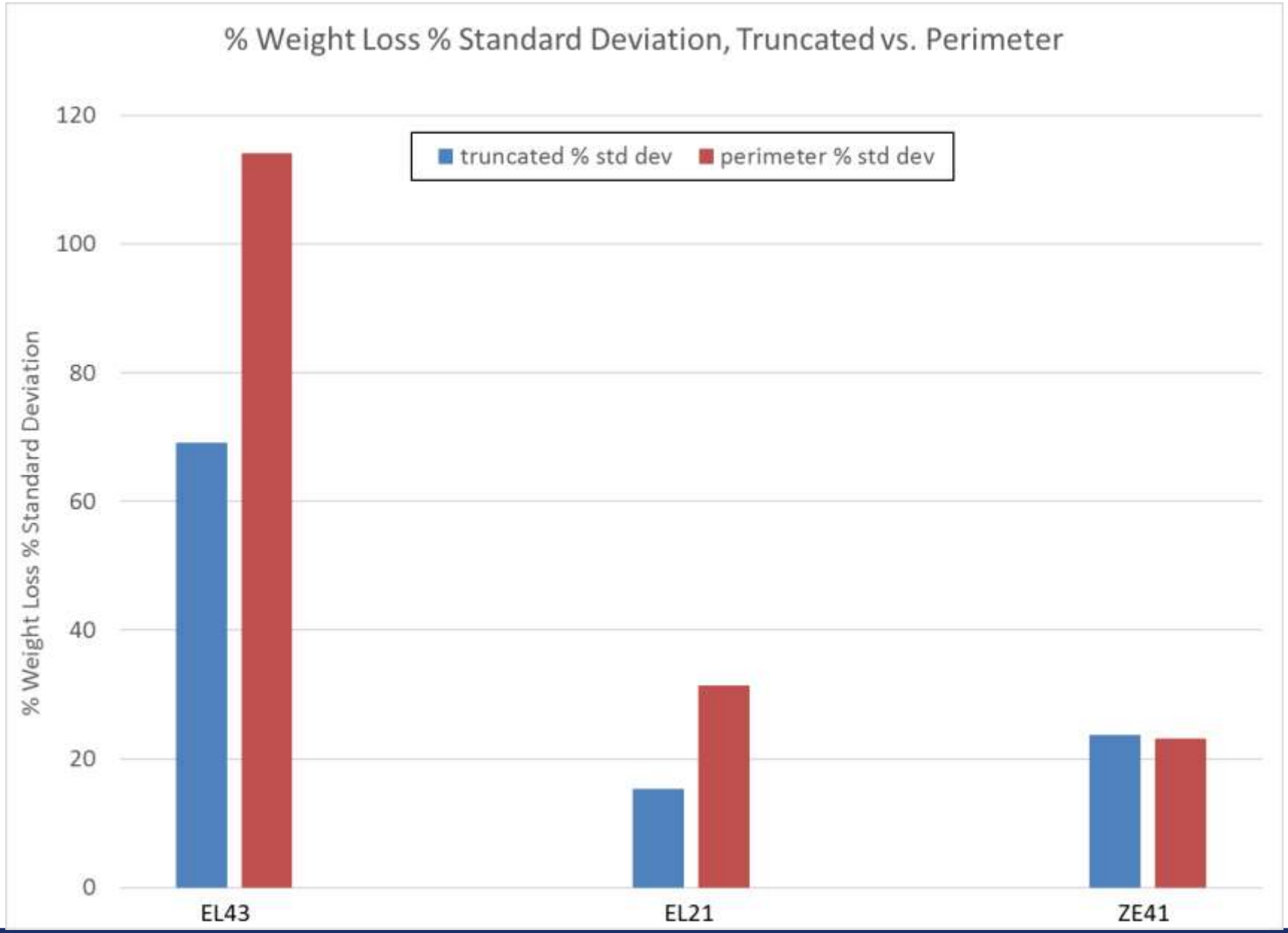
Truncated Perimeter Sample Holder


0.025-Inch Thickness Truncated Sample Holder Results (90 Tests)
Time of Ignition (Seconds)
Self Extinguishment (Seconds)
Weight Loss (%)
AZ80
E43
E21
ZE41
Time (Seconds)
Weight Loss (%)
480
420
360
300
240
180
120
60
0
80
70
60
50
40
30
20
10
0


0.025-Inch Thickness Truncated Sample Holder Results (90 Tests)
Time of Ignition (Seconds)
Weight Loss (%)
AZ80
E43
E21
ZE41
Time (Seconds)
Weight Loss (%)
180
150
120
90
60
30
0
90
80
70
60
50
40
30
20
10
0


0.025-Inch Thickness Truncated Sample Holder Results (90 Tests)
Weight Loss (%)
100
90
80
70
60
50
40
30
20
10
0
Weight Loss (%)
E43
E21
ZE41
Proposed Maximum Weight Loss (95% Passing)


% Weight Loss Standard Deveiation Comparison, Truncated vs. Perimeter
truncated std dev
perimeter std dev
% Weight Loss Standard Deviation
12
10
8
6
4
2
0
EL43
EL21
ZE41


% Weight Loss % Standard Deviation, Truncated vs. Perimeter
truncated % std dev
perimeter % std dev
% Weight Loss % Standard Deviation
120
100
80
60
40
20
0
EL43
EL21
ZE41

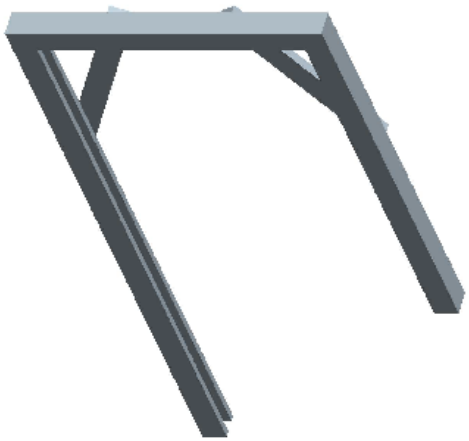
Summary, Future Work

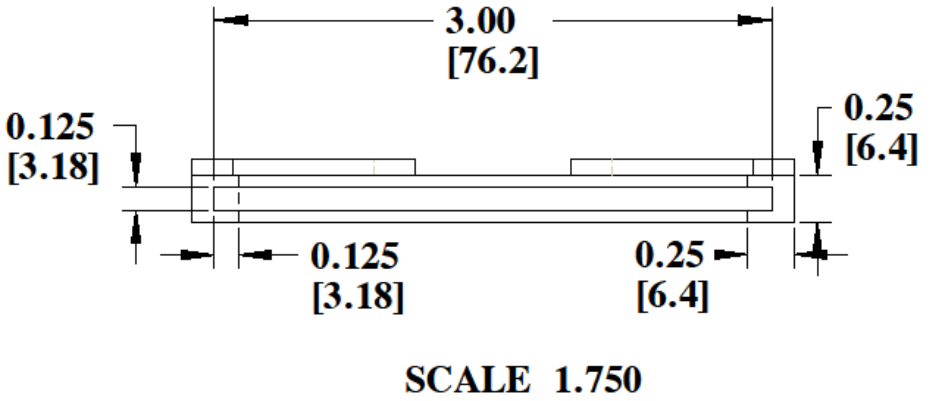
Finalize test parameters and pass/fail criteria for magnesium alloy components located in inaccessible areas:

- *Radiant Panel Apparatus, 3- by 6-inch sample size, 0.025-inch thickness*
- *2-minute pilot ignition*
- *4-minute exposure to radiant heat*
- *Maximum weight loss of 30% (proposed)*

…Insert Test Method as Chapter 26 in current Fire Test Handbook

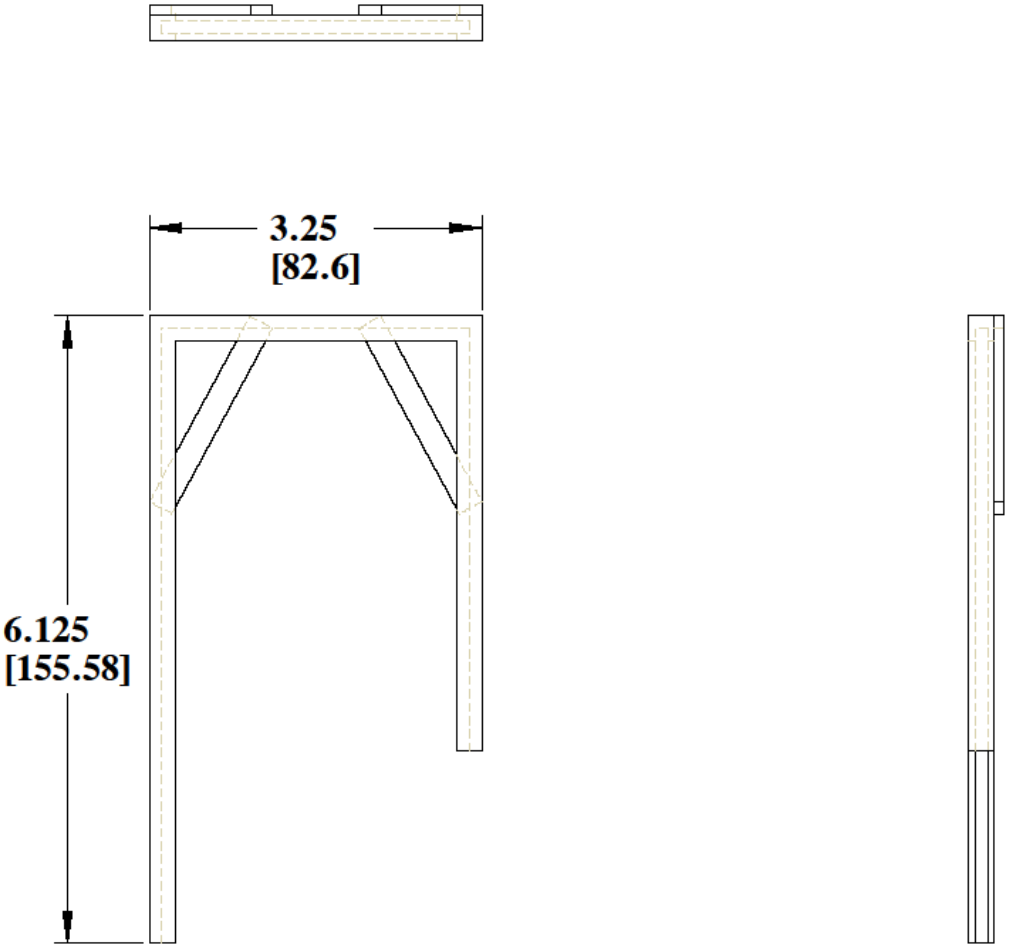
Drawings of Sample Holder



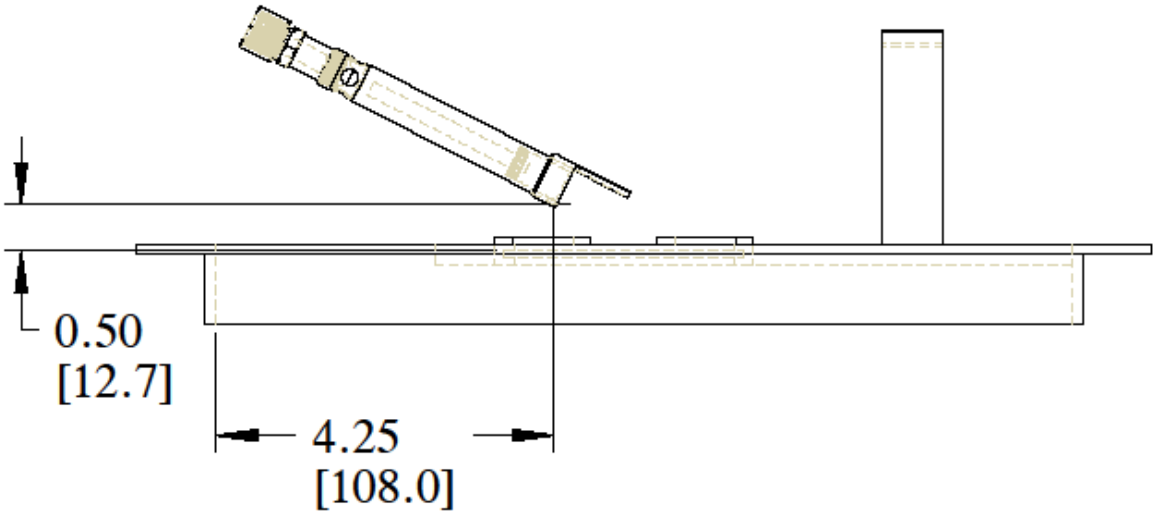


SCALE 1.750

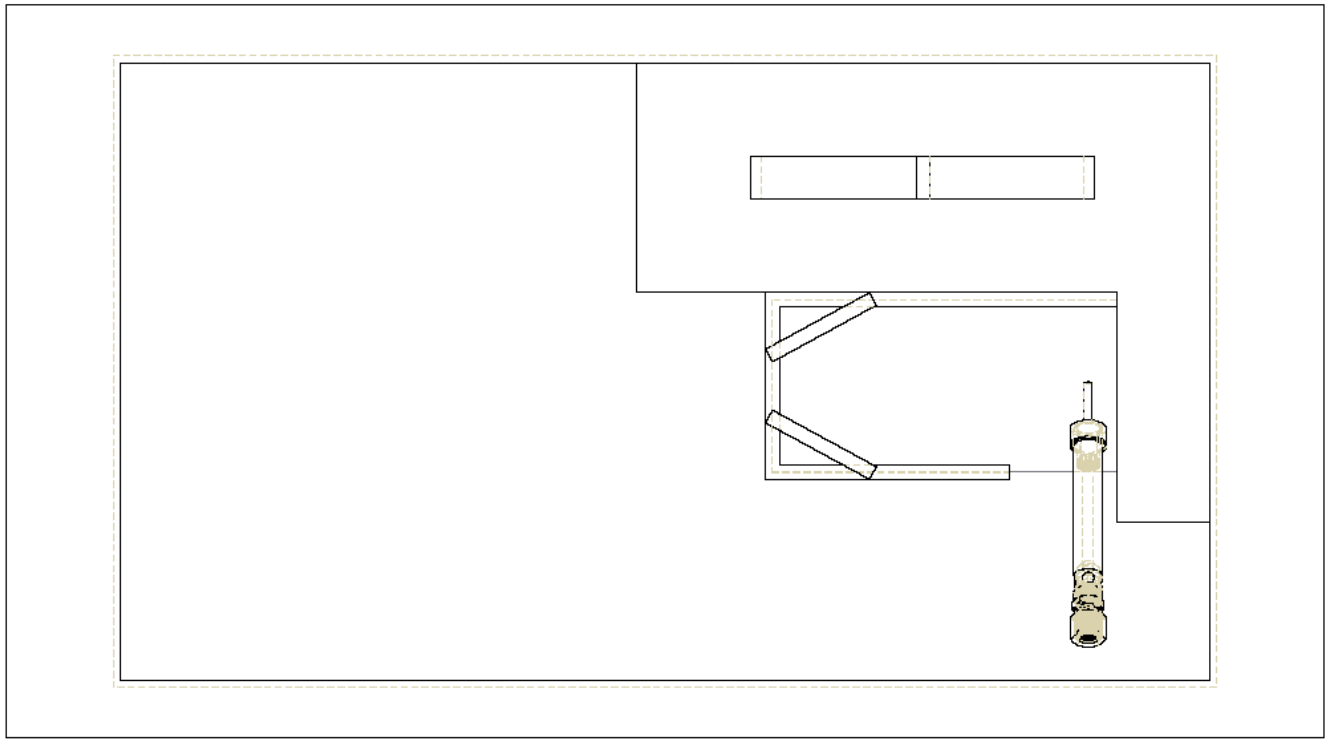
Drawings of Sample Holder



Drawings of Sample Holder



Drawings of Sample Holder



Magnesium Alloy Applications in Aircraft Passenger Cabin

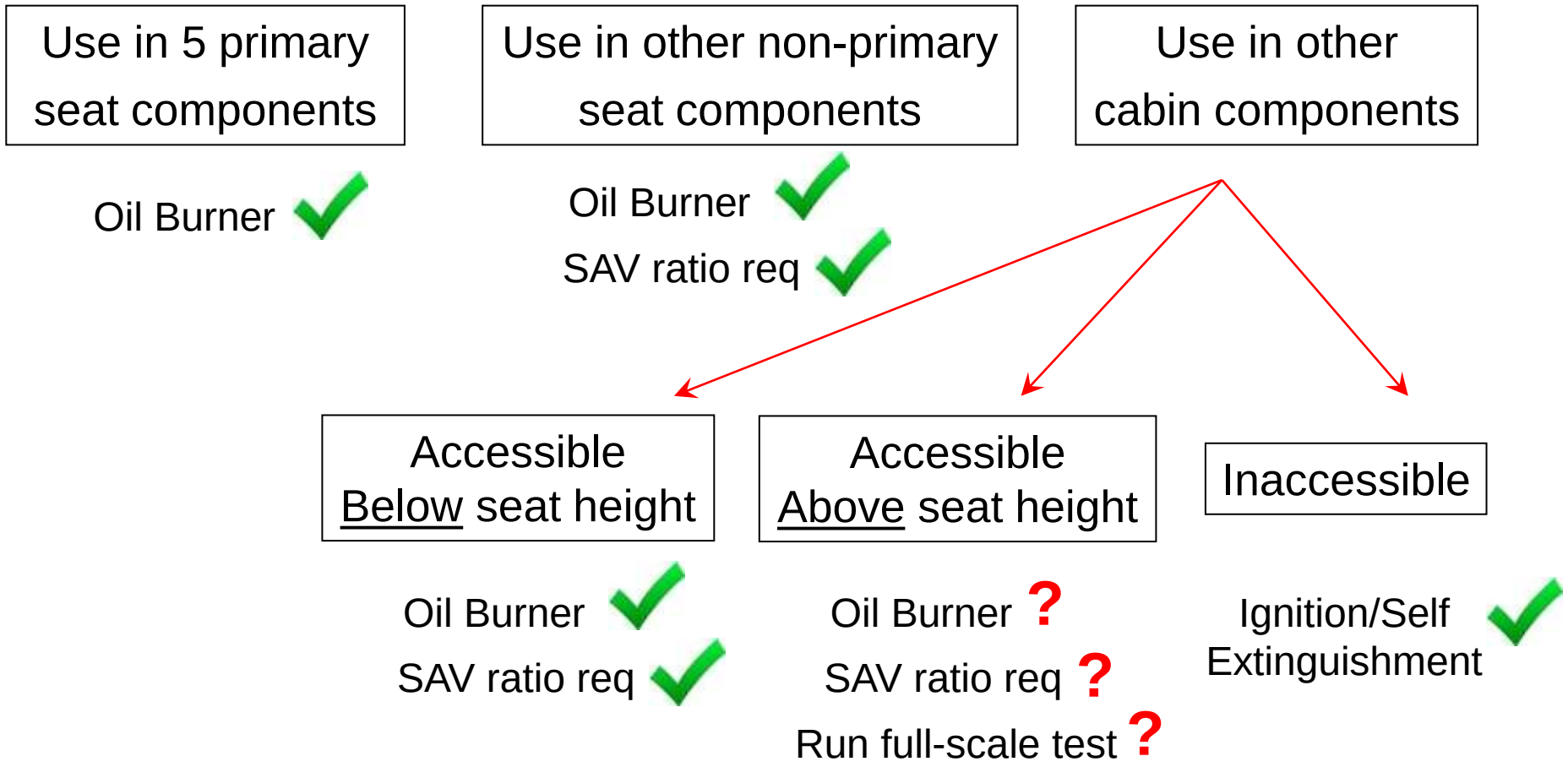
- **Regulatory Process Review**

  - ❖ Passenger Seat Application
  - ❖ Cabin area up to 60inches from floor(below seat back height)
  - ❖ Inaccessible area of Aircraft Cabin & Compartments

NOTE: This is not an official guidance for regulatory approvals and shall not be used in-lieu of regulatory process. This presentation is a general overview of possible tasks required (not exhaustive) for using magnesium alloys in design, engineering and construction of component application in aircraft cabin & compartments. For any official guidance, appropriate regulatory authorities must be contacted.

The Use of Magnesium Alloy in Cabin Areas

What is the appropriate method of test?



Magnesium Alloy Application in Aircraft Seat – Installation Compliance & Approval Process

Magnesium Alloy Applications in Aircraft Passenger Seat

Seat 5 Primary Components Application

YES

Perform Flam Test per FAA Handbook CH25

PASS

FAIL

PASS

NO

Perform Surface Area to Volume [SAV] Ratio Analysis

Solid Component ≤ 20
Hollow component ≤ 40

FAIL

STOP! Analyze the design/requirements/Discuss with Regulatory Authority

Perform all other testing and prepare documentation to meet TSO Standards

Inform your ACO of Intent and Prepare TSO Application

Coordinate with your delegated authority on project & test plans

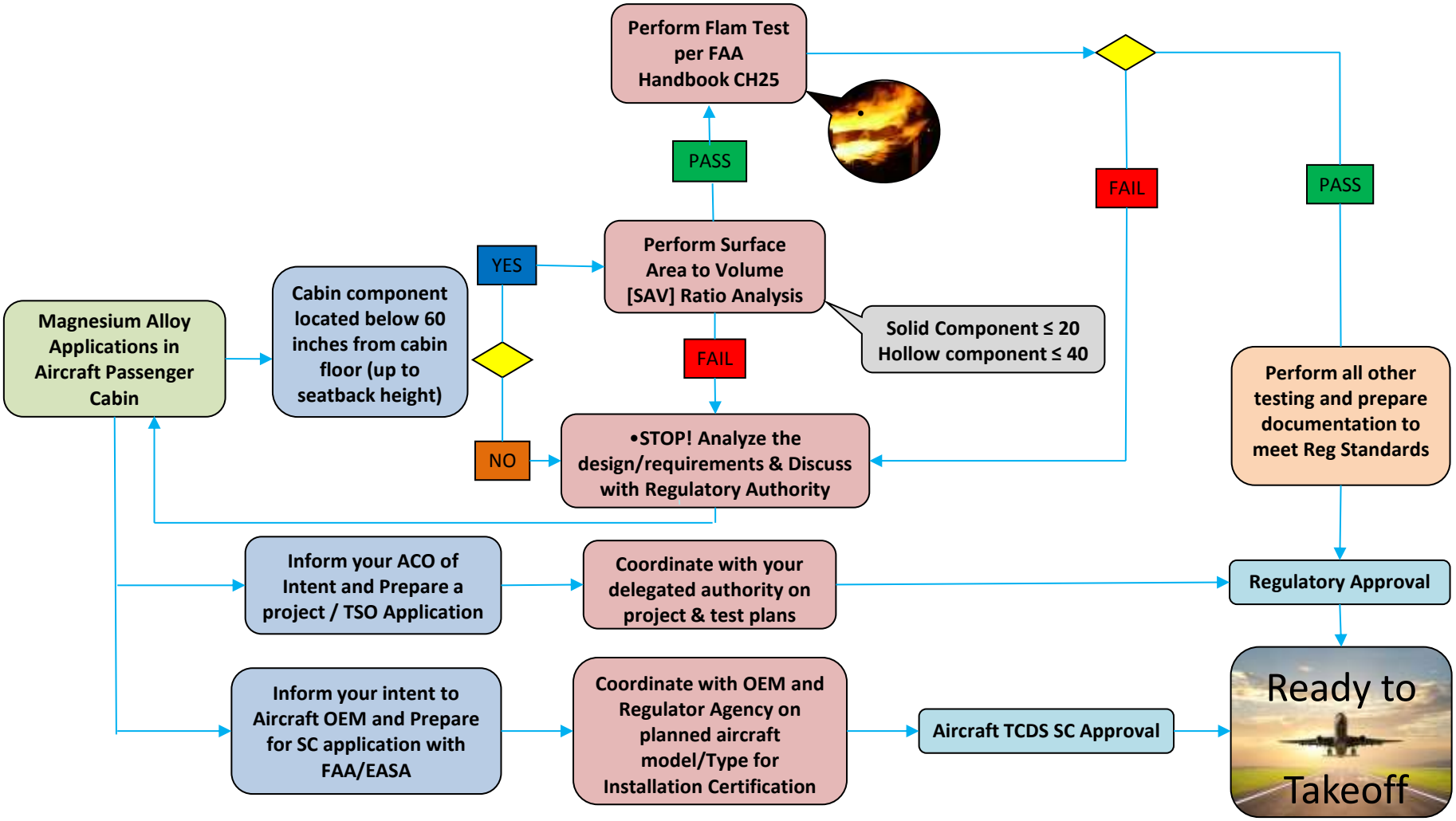
TSO/ETSO - Approval

Inform your intent to Aircraft OEM and Prepare for SC application with FAA/EASA

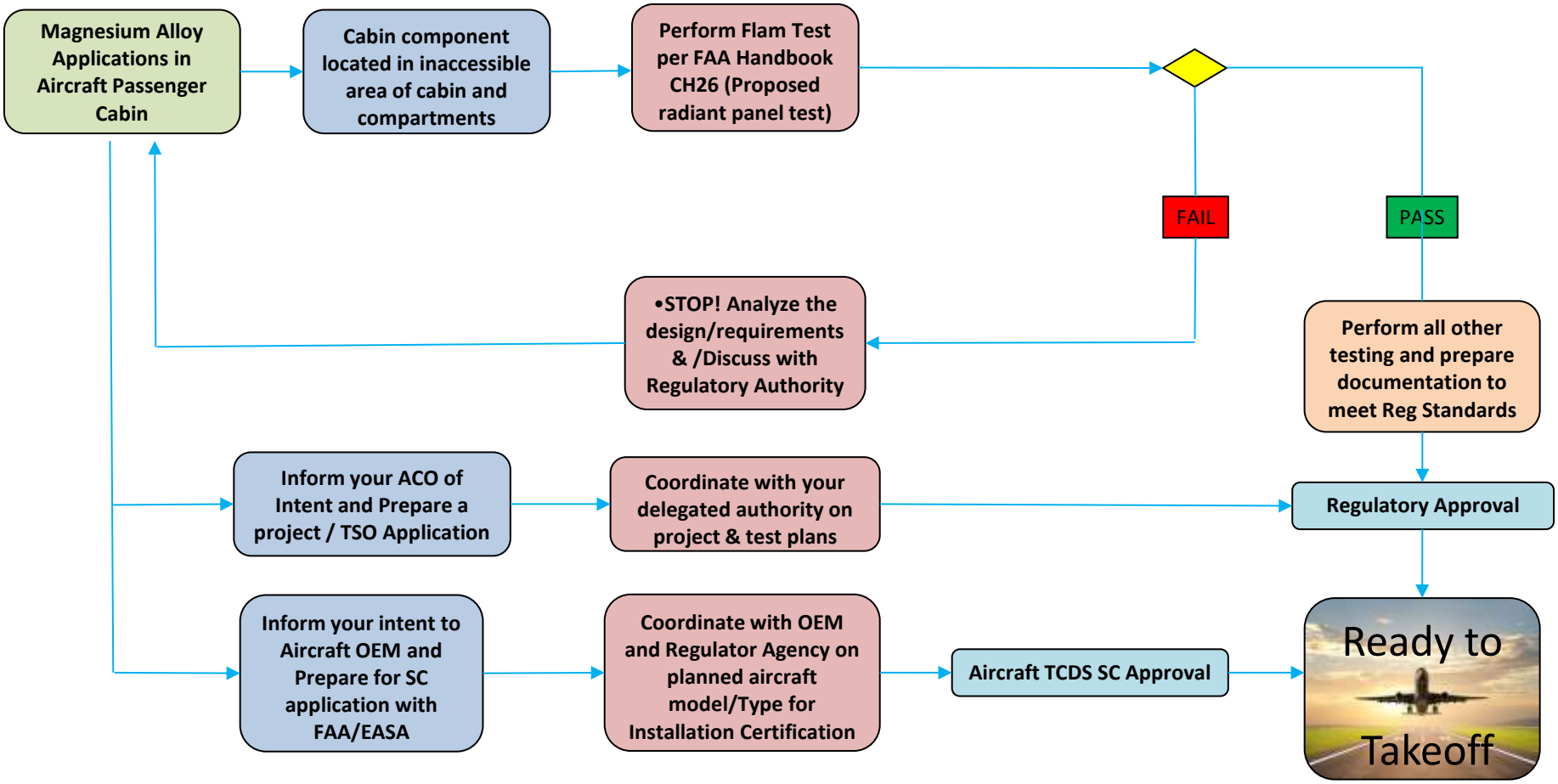
Coordinate with OEM and Regulator Agency on planned aircraft model/Type for Installation Certification

Aircraft TCDS SC Approval

Magnesium Alloy Application in Aircraft Cabin (Accessible Area) – Installation Compliance & Approval Process



Magnesium Alloys Application in Aircraft Cabin (Inaccessible Area) – Installation Compliance & Approval Process



Discussion Items for Task Group

Discuss test method for magnesium alloy components located in inaccessible areas

- Recent testing conducted on thin samples using truncated perimeter sample holder
- Conduct Interlab study (Round Robin)?

Discuss the key elements that need to be included in an Advisory Circular

- What is the appropriate method of test for each application?

Discuss any other items related to the use of magnesium alloy in either seats or other cabin components

Questions?