The Use of Magnesium in Airplane Interiors

Use of Magnesium in Airplane Cabins

The FAA has had several recent inquiries regarding the use of magnesium in airplane cabins. Specifically, magnesium alloys have been suggested as substitute for aluminum alloys in seat structure. The FAA's central concern regarding the use of magnesium in the cabin is flammability. The current regulations do not address the potential for a flammable metal to be used in large quantities in the cabin. Therefore, if such a material were introduced to the cabin, the FAA would have to be convinced that the level of safety was not reduced. Special conditions may be required to establish appropriate criteria. While the FAA are aware that there have been changes in magnesium alloys over the years, magnesium remains a material that, once ignited, presents a fire hazard that is almost impossible to cope with.

If there is widespread interest in assessing the potential requirements and data necessary to demonstrate that the level of safety is not reduced, the FAA will work with industry to do that. Both the post crash, as well as inflight, fire scenarios should be addressed. At this point, the FAA does not have any research underway to address the use of magnesium in the cabin.

Magnesium Use in Aircraft Interiors

Points of Discussion

Possible Locations of Magnesium Use

Potential Threats from Various Use Scenarios

Development of Test Protocol Based on Threats

Magnesium Use in Aircraft Interiors

Possible Locations of Magnesium Use

seat components

overhead ducts

galley components

lavatory components

floor components, seat track

Magnesium Use in Aircraft Interiors

Potential Threats from Various Use Scenarios

In-Flight

Electrical arc to magnesium component

Hidden fire adjacent to magnesium component

O_2 canister fire next to magnesium component

Intact components, or shavings?

Consider terroristic threat?

Magnesium Use in Aircraft Interiors

Potential Threats from Various Use Scenarios

Postcrash

External fuel fire entering cabin

Primary concern – safety of passengers

Secondary concern – safety of firefighters?

Magnesium Use in Aircraft Interiors

Development of Test Protocol Based on Threats

Clearly defined threat

Full-scale test findings

Lab-scale test development

Magnesium Use in Aircraft Interiors

Development of Test Protocol Based on Threats

In-Flight Test

Electrical Arc

Size, power, of electrical arc?

Size, shape of test sample?

Pass/Fail criteria?

Magnesium Use in Aircraft Interiors

Development of Test Protocol Based on Threats

Postcrash Test

Oil burner apparatus, what heat flux?

Duration of test, 2-min or 5-min?

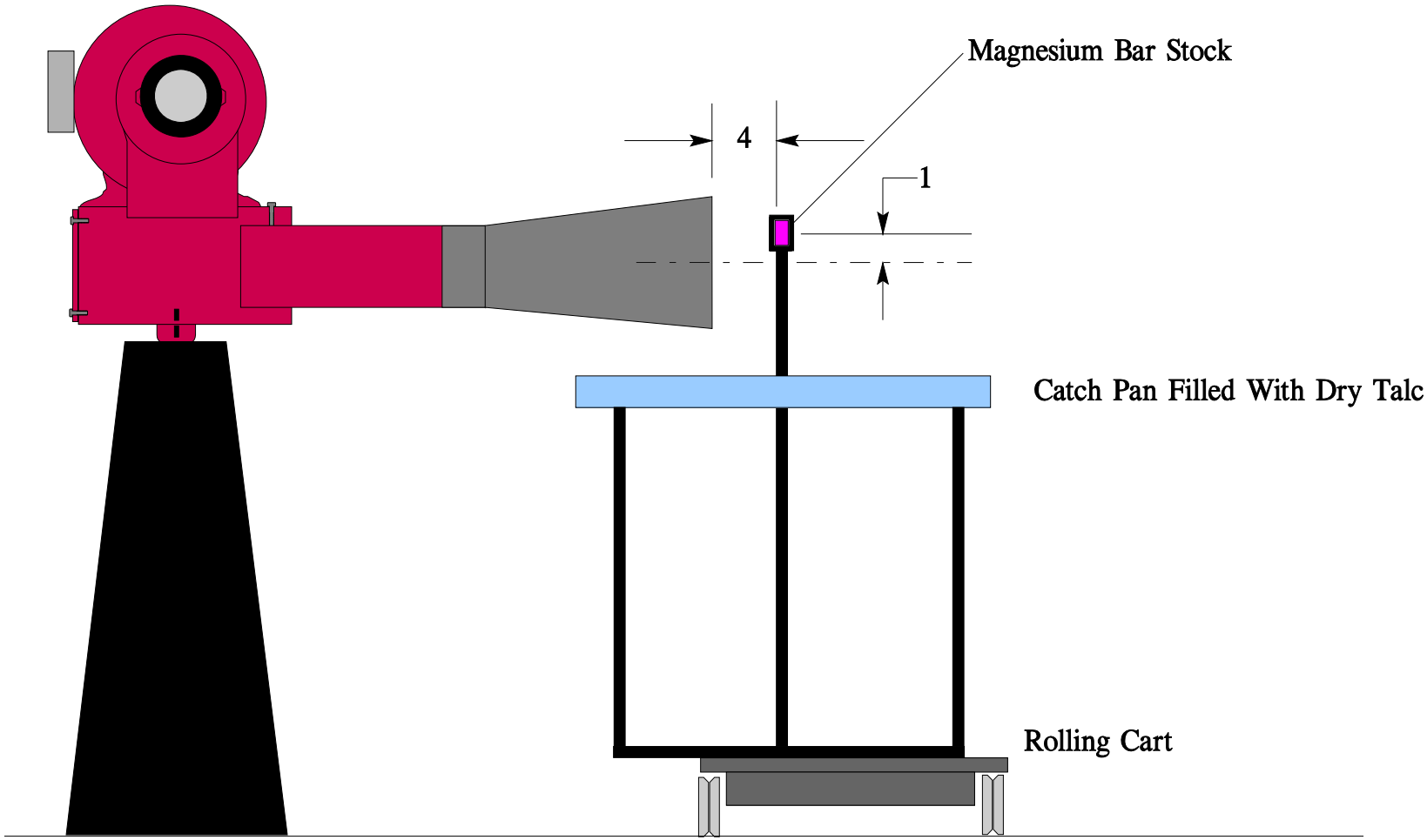
Size, shape of test sample?

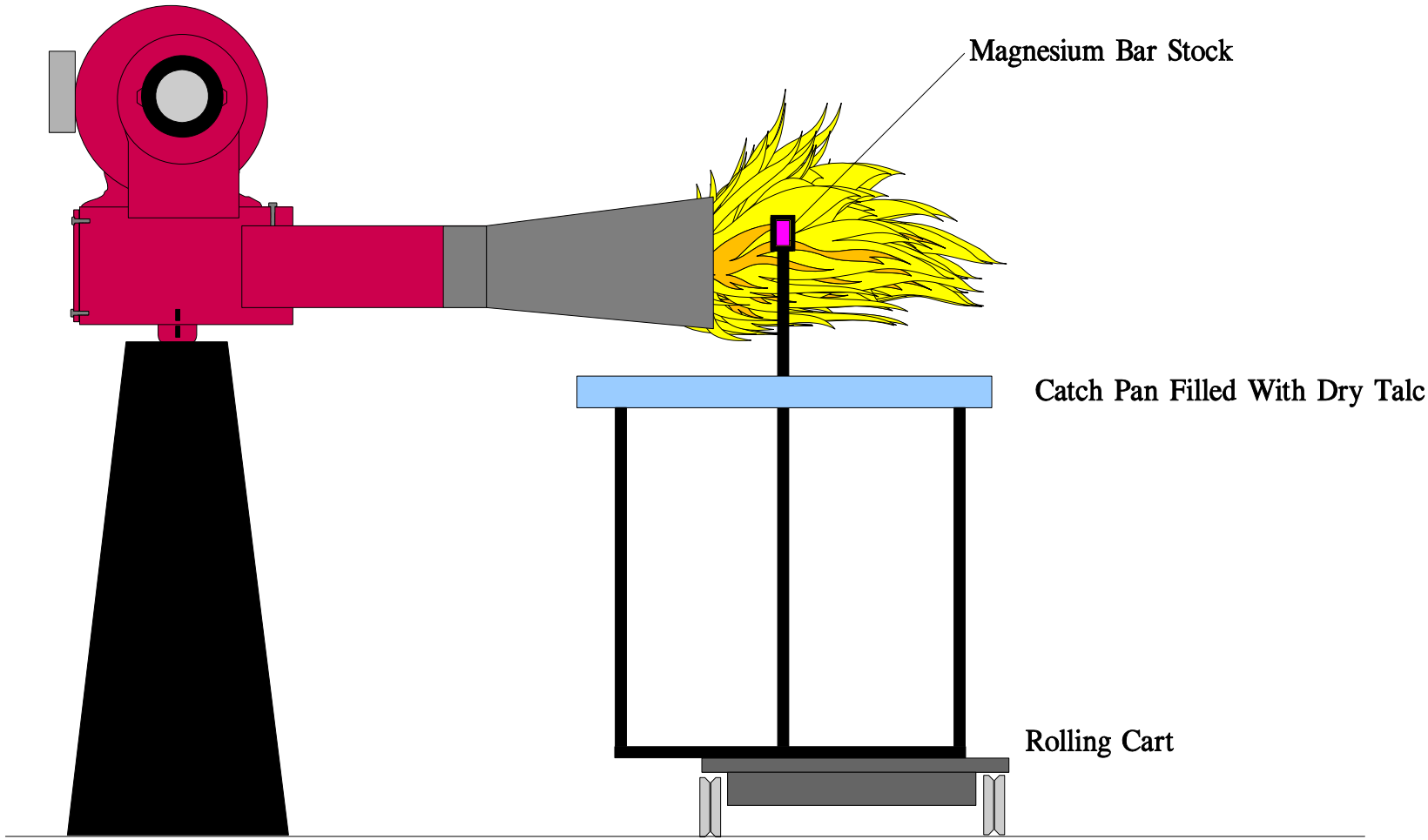
Pass/Fail criteria?

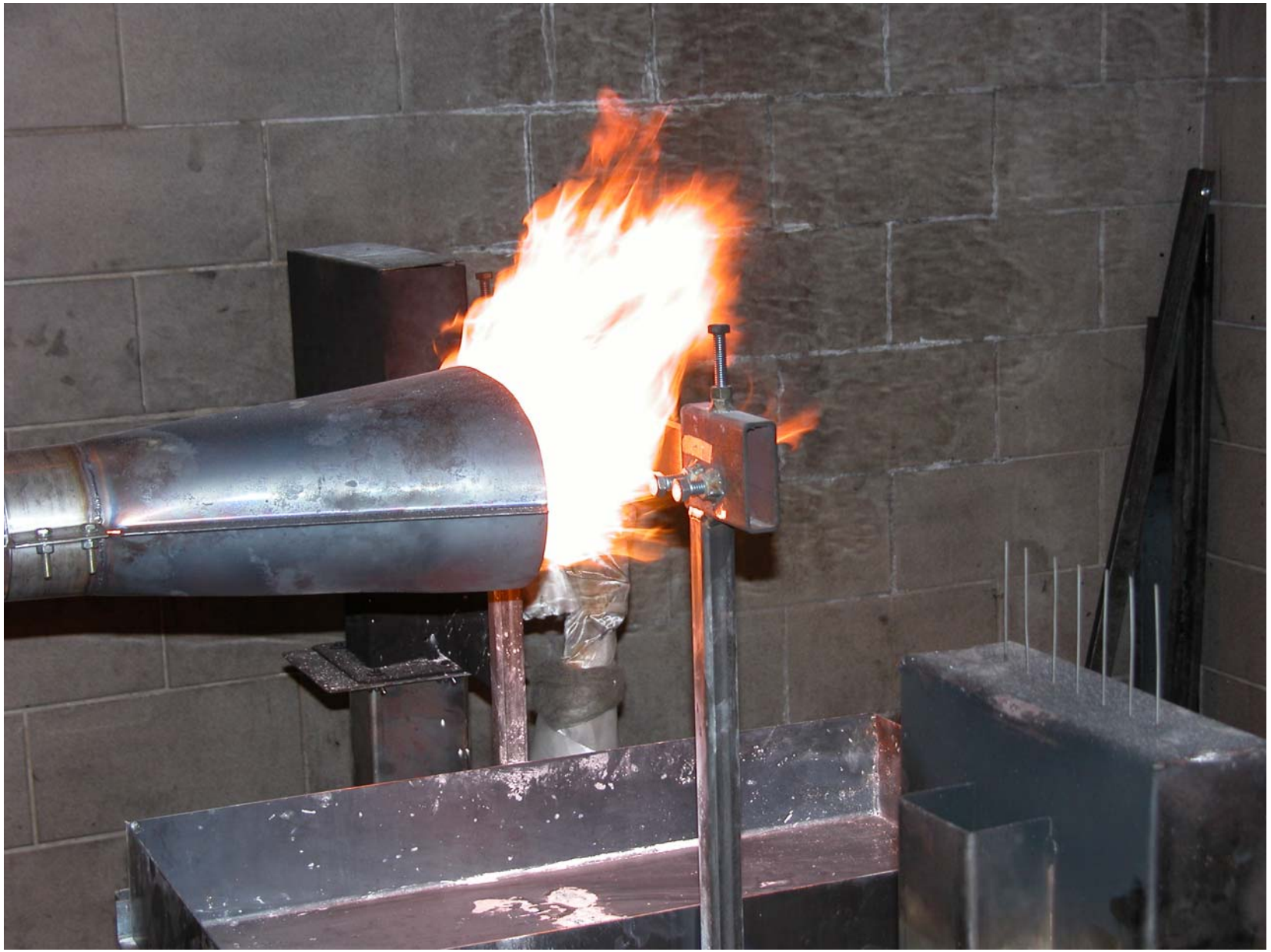
Magnesium Use in Aircraft Interiors

Discussion?

Transport Airplane Directorate Comments?


Magnesium Bar Stock
4
1
Catch Pan Filled With Dry Talc
Rolling Cart


Magnesium Bar Stock
Catch Pan Filled With Dry Talc
Rolling Cart



Video Clip of Poor Performing Material

Video Clip of Good Performing Material

Discussion of Orientation of Test Sample on Results

FAR 25 Appendix F Part 2 - Seat Cushion flamability test - Metric Version

Test No.	Alloy	Width	Thickness	Length	Flame On	Sample melted		Sample Continued To Burn	Sample Self Extinguished		Residue Burning	Comments
		mm	mm	mm	Minutes	Mins	Secs		Mins	Secs		
1	WE43	15.21	40.23	500	4	3	45	**No**	n/a	n/a	**No**	
2	AZ80	14.7	40.8	500	3 1/2	3	7	Yes	9	21	Yes	
3	Elektron 21	15.2	39.62	500	5	3	47	Yes	6	7	**No**	
4	ZE41	14.76	39.3	500	4	3	6	Yes	5	45	**No**	
5	ZE10	14.67	39.7	500	4	3	35	Yes	7	29	Yes	
6	AZ31	13.9	40.3	500	4	3	19	Yes	Kept burning		Yes	
7	WE43	15.4	40.2	500	5	3	35	**No**	n/a	n/a	**No**	
8	Elektron 21	15.4	39.6	500	4	3	35	**No**	n/a	n/a	**No**	
9	AZ80	15.8	40.9	500	5	3	0	Yes	6	15	Yes	
10	AZ31	15.09	40.4	500	5	3	1	Yes	6	12	Yes	
11	WE43	10.64	40.43	500	4	2	26	Yes	6	12	Yes	
12	Elektron 21	9.65	39.64	500	4	2	8	Yes	6	8	**No**	
13	WE43	10.8	40.6	500	4	2	30	Yes	5	43	**No**	
14	AZ80	10.6	40.7	500	4	2	9	Yes	8	10	yes	
15	AZ80	9.95	40.8	500	3	1	58	Yes	5	0	Yes	
16	Elektron 21	9.7	39.55	500	3	2	12	Yes	4	8	**No**	
17	WE43	~10*	~40	500	11 3/4	10	37	Yes	13	42	**No**	Intumescent paint coating
18	ZE41	15.18	39.6	500	5	3	51	Yes	6	31		90 degrees to vertical
19	ZE10	15.21	39.5	500	4	No melting		n/a	n/a		n/a	90 degrees to vertical
20	AZ31	10.7	40.3	500	4	3	37	Yes	>10	Kept burning		Bar orientation vertical

* Bare bar thickness could not be measured but was cut to nominal 10mm

FAR 25 Appendix F Part 2 - Seat Cushion flamability test - Imperial Version

Test No.	Alloy	Width	Thickness	Length	Flame On	Sample melted		Sample Continued To Burn	Sample Self Extinguished		Residue Burning	Comments
		inches	inches	inches	Minutes	Mins	Secs		Mins	Secs		
1	WE43	0.6	1.6	19.7	4	3	45	**No**	n/a	n/a	**No**	
2	AZ80	0.6	1.6	19.7	3 1/2	3	7	Yes	9	21	Yes	
3	Elektron 21	0.6	1.6	19.7	5	3	47	Yes	6	7	**No**	
4	ZE41	0.6	1.5	19.7	4	3	6	Yes	5	45	**No**	
5	ZE10	0.6	1.6	19.7	4	3	35	Yes	7	29	Yes	
6	AZ31	0.5	1.6	19.7	4	3	19	Yes	Kept burning		Yes	
7	WE43	0.6	1.6	19.7	5	3	35	**No**	n/a	n/a	**No**	
8	Elektron 21	0.6	1.6	19.7	4	3	35	**No**	n/a	n/a	**No**	
9	AZ80	0.6	1.6	19.7	5	3	0	Yes	6	15	Yes	
10	AZ31	0.6	1.6	19.7	5	3	1	Yes	6	12	Yes	
11	WE43	0.4	1.6	19.7	4	2	26	Yes	6	12	Yes	
12	Elektron 21	0.4	1.6	19.7	4	2	8	Yes	6	8	**No**	
13	WE43	0.4	1.6	19.7	4	2	30	Yes	5	43	**No**	
14	AZ80	0.4	1.6	19.7	4	2	9	Yes	8	10	yes	
15	AZ80	0.4	1.6	19.7	3	1	58	Yes	5	0	Yes	
16	Elektron 21	0.4	1.6	19.7	3	2	12	Yes	4	8	**No**	
17	WE43	~0.4	~1.6	19.7	11 3/4	10	37	Yes	13	42	**No**	Intumescent paint coating
18	ZE41	0.6	1.6	19.7	5	3	51	Yes	6	31		90 degrees to vertical
19	ZE10	0.6	1.6	19.7	4	No melting		n/a	n/a		n/a	90 degrees to vertical
20	AZ31	0.4	1.6	19.7	4	3	37	Yes	>10	Kept burning		Bar orientation vertical

* Bare bar thickness could not be measured but was cut to nominal 0.4"