

**Exemption No. 6707**

**UNITED STATES OF AMERICA  
DEPARTMENT OF TRANSPORTATION  
FEDERAL AVIATION ADMINISTRATION  
RENTON, WASHINGTON 98055-4056**

In the matter of the petition of

**Imi-Tech Corporation**

for an exemption from 14 CFR  
§ 25.853(c)

**Regulatory Docket No. 28951**

**PARTIAL GRANT OF EXEMPTION**

By letter dated June 6, 1997, Michael O'Donnell, Technical Sales Manager Imi-Tech Corporation, 307 S. First St., Suite C, Mt. Vernon, Washington, petitioned for a temporary exemption from the requirements of 14 CFR § 25.853(c) to permit use of seat cushion materials that do not comply with the weight loss portion of that requirement.

**Sections of the FAR affected:**

Section 25.853(c) requires that seat cushions comply with the requirements of Appendix F, part II, in addition to the requirements stipulated elsewhere in that section.

Appendix F, part II, requires that seat cushions withstand two minutes exposure to an oil burner while experiencing 10% or less weight loss, and not exceeding a specified burn length.

**Related sections of the FAR:**

Section 121.312 incorporates by reference § 25.853(c). Section 25.853(c) requires that seat cushions comply with the requirements of Appendix F, part II, in addition to the requirements stipulated elsewhere in that section.

**The petitioner's supportive information is as follows:**

‘Imi-Tech is a producer of polyimide foams, marketed under the trade mark of Solimide® Polyimide Foam. When this rule was instituted we were in the early

**ANM-97-036-E**

days of the development of these foams, primarily sponsored by NASA. At that time Imi-Tech was unable to meet the deadline to produce an acceptable product to meet the Airline life cycle requirement and Traveling Public comfort requirement.

“Recently, certain developments have allowed Imi-Tech to move the technology forward to where a polyimide foam has been produced that appears to meet both the airline and public's needs. During the development of the rule Imi-Tech commented that the rule was weight biased towards dense materials and did not allow for light weight materials that are in the best interest of the public. Imi-Tech has now produced a foam that has virtually no smoke or toxicity when exposed to a direct flame. However, this is an extremely light foam and thus when tested to Appendix F part II it fails in the weight loss requirement. This is not because of the foam, but as a direct result of the weight loss of the slip cover and dress cover. Attached you will find the test results of the base foam as produced at .4 lb./ft<sup>3</sup> which shows a weight loss overall of 12.1% but, the foam only loss would pass if it was not for the loss of weight in slip and dress covers. To show the difference the weight of the foam makes, Attachment 2 shows the identical base foam mechanically Densified which indicates the weight bias of the test. This test shows that the system passes extremely well with a weight loss of only 7%. This is because the foam becomes the dominant part of the weight of the system. The weight of the slip cover and dress cover remained identical to the .4 lb./ft<sup>3</sup>. These tests were run by Accufleet a certified FAA laboratory in Houston, Texas, and a video tape is available for viewing if requested. Also attached are data sheets on the foam and typical foams being used today in the industry showing the difference in the weight, smoke, and toxic gasses that evolve when exposed to heat and flames.

“It would be in the best interest of the Public, if materials can show improvements:

1. Overall physical weight loss reduction of materials
2. Lower levels of Smoke and Toxic gases
3. Reduction in weight and thus life cycle cost to fly the aircraft
4. Reduced risk to the public

that an exception to the rule be granted. The weight bias of the test can be overcome by adding weight to the seat. This is counter productive to the public interest as it adds weight and cost that is not required to meet the spirit of the rule. The spirit of the rule is to prevent the materials from becoming involved and contributing to the fire, if one should occur, in the aircraft. Not only does this material reduce the risk to the public, it reduces the potential fuel load to contribute to the fire. The majority of the weight loss can be attributed to materials that are used in everyday seat construction and meet the FAR as stated. Attachment III shows the data on the materials used in these tests.

“Polyimide foams were developed for NASA because of the Apollo fire. The goal to reduce the level of heat release of polymeric materials, smoke evolved, and toxic level of the gases was met. It is now time to apply that development to the best interest of the Public. It is anticipated that several densities of materials will be needed to meet the comfort levels demanded by the traveling public. The .4 lb. per cu. foot material would be the lightest of these and it is anticipated that the 1 lb./ft<sup>3</sup> material would be at the heavier of the requirements.

“There are a number of interested parties that want to put the materials on active test flights for durability and passenger comfort testing. Therefore, we request a temporary exception to the rule for no more than 10 seats on a narrow body aircraft, and 20 seats on a wide body aircraft, for flight tests. These seats will be continuously monitored as to wear and deterioration to the material. This temporary exception to the rule is to improve the safety of the seat cushion systems in the interest of the public. The permanent exception to the rule would only be applied for when the product definition is complete to meet both an improved safety level and the best interest of the public. Prior to such permanent application, the product must be tested in an environment that demonstrates it will also meet the rigorous in service requirements of airline industry.”

Subsequent to this input, the FAA received additional data from Imi-Tech in letters dated August 19 and September 30, 1997. These data describe testing done comparing the Solimide® seat foam only, with an assembled cushion including dress cover and scrim, and with a higher density, fire resistant foam seat cushion assembly. These data indicated that the foam alone had less than 10% weight loss at a 0.5 lbs/ft<sup>3</sup> density. Tests with an assembled cushion were slightly above the 10% limit in one configuration, and actually under 10% using another dress cover. Tests run with 0.6 lbs/ft<sup>3</sup> foam also passed the weight loss criteria, with an average of 8.39%. The assembled cushions were approximately 3.5 times heavier than the foam alone. In comparison with the higher density fire resistant foam, the absolute weight loss measurements were fairly similar (on the order of 0.2 to 0.3lbs), but with the higher density foam this resulted in only a 2.9% weight loss.

A summary of the petitioner’s request for exemption was published in the Federal Register on August 1, 1997 (62 FR 41475). No comments were received.

**The FAA's analysis/summary is as follows:**

The petitioner is requesting temporary relief from the requirements of the regulation to enable market studies to be conducted, and to establish the in-service durability of the product. These are not sufficient reasons to warrant an exemption; however, the petitioner has provided data to support the request, and these data do tend to support the petitioner’s request.

When Amendment 25-59 to § 25.853 was adopted, it was recognized that the particular pass/fail criteria chosen could bias the results in favor of heavier (denser) materials, if the

materials exhibited a relatively consistent absolute weight loss during the certification test. Since operators and manufacturers tend to favor light weight components over heavier components that perform the same function, this possible test artifact tended to be self-correcting. In addition, no other rational pass/fail criteria were forthcoming.

In order to establish a viable laboratory certification test method, the FAA conducted numerous full-scale fire tests, and correlated the performance of seat cushions with survivability in the cabin. Seat cushions that pass the FAA certification test were shown to provide significantly longer survivability times than those that did not. It is important to note that almost all of the work was done with a fire resistant shell (“fire blocking”) encapsulating the seat cushions. Foams that would pass this test without a fire blocking layer were very heavy and in very limited use.

The data provided by the petitioner indicate that the foam material in question loses very little weight, in absolute terms, when tested under the certification conditions of part 25. Data provided with, and without, decorative upholstery covers show that the bulk of the weight loss can be attributed to the upholstery cover and not the foam itself. Burn length data are within the requirements of the regulation in any configuration. However, the FAA notes that other, higher density foams, had approximately one half the burn length as the Solimide® foam. The effect of this difference in performance is not known.

While these data are generally encouraging, the FAA does not have full-scale data with which to support the findings in the laboratory scale test. This is a concern, since it is possible that the aggregate performance of a given material in a full-scale environment, could be different than in a laboratory test, using a test specimen. Since the laboratory test method was derived from data acquired in full-scale testing with known materials, the introduction of new types of materials should ideally be validated by full-scale testing as well. Nonetheless, if the performance of the foam in the full-scale environment does correlate with the laboratory results, there is the potential to improve fire safety in the cabin even further. Furthermore, as noted by the petitioner, simply adding weight to the assembled cushion would probably result in a successful test. While this is counter to the intent of the rule (and not likely on an economic basis, as noted above), literal compliance could be achieved this way.

Considering that the data provided support the petitioner’s contention that the test method and pass/fail criteria discriminate against lighter weight materials, and that the petitioner could not reasonably be expected to produce full-scale fire test data, the FAA considers that a temporary exemption is warranted. However, the FAA feels that before any permanent exemption could be granted, full scale testing to validate the conclusions drawn on the basis of the laboratory tests will be needed. For the following reasons the FAA intends to carry out full-scale testing, using material provided by the petitioner (as well as other suppliers): (1) to advance the state of the art, (2) to contribute to a higher level of fire safety, and (3) to address other approaches to seating that may not be adequately addressed by the current test method. It is expected that

these tests will be completed in about six months, and will establish a more accurate assessment of the overall fire performance of different kinds of seat cushions. If the results of these tests indicate the full-scale performance of the foams correlates with the laboratory performance, the FAA will consider permanent exemptions at that time.

In consideration of the foregoing, I find that a grant of exemption is in the public interest, and will not significantly affect the overall level of safety provided by the regulations. Therefore, pursuant to the authority contained in 49 US 40113 and 44701, formerly §§ 313(a) and 601(c) of the Federal Aviation Act of 1958 as amended, delegated to me by the Administrator (14 CFR 11.53), the petition of Imi-Tech Corporation for a temporary exemption from the flammability requirements of 14 CFR § 25.853(c), to the extent necessary to permit operation with Solimide® polyimide foam, is granted until May 31, 1998, with the following provisions:

1. Seats utilizing this foam are limited to no more than 10 seat places per airplane.
2. Each seat cushion assembly utilizing this foam is to be marked with the expiration date of this exemption.

Since § 121.312(b) incorporates § 25.853(c) by reference, this exemption from § 25.853(c) also constitutes corresponding relief from the provisions of § 121.312(b).

Issued in Renton, Washington, on December 12, 1997

/s/ Gilbert L. Thompson  
Gilbert Thompson  
Acting Manager, Transport Airplane Directorate,  
Aircraft Certification Service, ANM-100