

F to Part 25, and do not change the scope or intent of the test. As noted above, a significant clarification is the use of a standard stator vane assembly for the burner draft tube.

With respect to the calibration requirements, the test method prescribes the use of a highly dynamic fire source, the characteristics of which are highly transient. Testing has shown that the set-up (configuration) of the test burner plays a major role in the performance of many materials. The parameters with which to control the burner flame, (namely fuel flow rate, air intake velocity, as well as the positioning of the components necessary for firing the fuel/air mix (stators and igniter set)) must be very tightly controlled in order to minimize error between testing facilities. A tolerance of ± 1 gallon per hour fuel flow rate is well beyond the limit that is necessary to eliminate fluctuation between testing facilities. Similarly, a tolerance of ± 100 ft/min air velocity is excessive, and will only result in increased fluctuation of test results between testing facilities.

The accuracy of the heat flux measurement of the burner flame is highly dependent on the condition of the heat flux transducer, its position, and its accuracy. However, we agree that a minimum heat flux value (rather than a range, as proposed) is sufficient to establish whether a material performs acceptably, and have revised the test method accordingly.

The term "assembly processes" is intended to address the way in which the thermal/acoustic insulation components are built up. For example, for a traditional batting encapsulated in a moisture barrier, there may be seams that are heat sealed, or stitched, or utilize a hook and loop type closure. These must be included in the test sample. However, features added to the surface of the thermal/acoustic insulation would not need to be included in the test sample if they do not affect the fire penetration resistance. For example, use of tapes on the moisture barrier will not require assessment in the fire penetration test. Note that these same features will require assessment in the flame propagation test of part VI of Appendix F to Part 25.

Some commenters proposed that the burnthrough time be increased to five or six minutes to provide a margin for the desired four minutes, or to account for more fire resistant materials. Other commenters questioned the heat flux value specified, and proposed that it be reduced.

The FAA does not agree that the burnthrough time should be extended to

five or six minutes. In the benefit study conducted on behalf of the FAA by Cherry & Associates,¹ a four-minute extension in evacuation time is shown to provide a measurable improvement in survivability. Beyond four minutes, there is little benefit. Although a product may provide more than four minutes of burnthrough protection, this does not justify a requirement if no additional benefit is provided.

Regarding comments that the time should be extended to provide a margin of safety that will ensure four minutes of protection, we agree that a certification requirement cannot assure that every material lot and batch will perform identically. However, this would be true regardless of the time specified in the regulation. We consider that the rule should not account for variation in material lot or batch. The certification requirement is intended to address the basic material and installation scheme in accordance with the type design. The manufacturer will need to develop quality control procedures to ensure consistent performance of the material.

The heat flux measurement provision is included in the pass/fail criteria to account for materials that behave similarly to a flame arrestor, and do not inhibit heat transfer. The heat flux measurement provides an indication of the hazard inside the airplane, but supplements, rather than replaces, the basic requirement to resist flame penetration. Flame penetration time is the fundamental concern. This can be described as the time at which the test burner flames directly cause a breach to form in the insulation material, thereby allowing the flames to pass through from the front to the back face. For some materials, the failure event is catastrophic and the occurrence can be measured quite accurately. However, it can be difficult to measure the event for other longer-lasting materials, as the failure does not occur instantaneously, but rather gradually over time. These materials typically allow a very small breach to occur initially, and the breach gradually increases in size as the test progresses. As a guideline, a material can be considered to fail when the size of the breach reaches 0.25 inch in diameter.

There have been instances where tested insulation materials (insulation and film) have ignited on the back face

and caused surface propagation to occur. This surface propagation is not considered a burnthrough and would be acceptable, provided the heat flux level measured behind the sample does not exceed 2.0 Btu/ft² sec at any time during the test. However, since the same materials will also be required to meet the flame propagation standard of part VI of Appendix F to Part 25, it is likely that a material exhibiting this type of back face ignition would be screened out by that test.

There have been other instances whereby flames can reach the back side of the insulation materials by passing through passageways created between blankets or between the sample and the test frame. This typically occurs between clamping locations, and is generally not a function of the material's flame penetration resistance, but rather a result of improper mounting. This occurrence should not be considered a failure, provided the material is not breached when inspected after the test. We will address issues related to material overlap and installation in a forthcoming Advisory Circular.

Several commenters addressed the issue of attachment of thermal/acoustic insulation to the fuselage. Some commenters noted what they consider to be a conflict between proposed § 25.856 and proposed part VII of Appendix F to Part 25, since the regulation requires that the means of attachment comply, but the appendix specifies an attachment scheme for test. Several commenters state that advisory material is needed to establish acceptable means of attachment, and stress its importance in providing burnthrough protection.

The FAA does not agree that the wording of proposed § 25.856 and part VII of Appendix F to Part 25 are in conflict. As noted in the NPRM, the test fixture is intended to test the material system in a manner that will ensure its retention since, for the sake of simplicity, the fixture does not replicate any specific airplane. In other words, the installation must meet the requirement, but, for simplicity, the test method does not include installation details. We have participated in a research program with the Civil Aviation Authority (CAA) in the United Kingdom to assess acceptable installation methods. Acceptable methods can only be established using representative airframe structure, since the interaction between the attachment and the airframe will influence the performance of an otherwise acceptable material. In addition to the collaborative effort with the CAA, we have conducted additional full-scale fire tests to assess

¹ FAA Office of Aviation Research, U.S. Dept. of Transportation, Fuselage Burnthrough Protection for Increased Postcrash Occupant Survivability: Safety Benefit Analysis Based on Past Accidents, DOT/FAA/AR-99/57, Sept. 1999. Available at <http://www.tc.faa.gov/its/worldpac/techrpt/ar99-57.pdf>.