U.S. Department
of Transportation

Federal Aviation
Administration

Advisory Circular

Subject: APPROVAL OF MODIFIED SEATING SYSTEMS INITIALLY APPROVED UNDER A TECHNICAL STANDARD ORDER

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Initiated by: AIR-120

AC No: 21-25A
Change:

1. **PURPOSE.** This Advisory Circular (AC) provides information, clarification, and procedural guidance concerning the approval and installation of modified Technical Standard Order (TSO) seating systems in U.S. type certificated aircraft.

2. **CANCELLATION.** AC 21-25, Approval of Modified Seats and Berths Initially Approved Under a Technical Standard Order, dated 4/24/89, is canceled.

3. **RELATED REGULATIONS.** Title 14 of the Code of Federal Regulations (14 CFR) parts and sections: 14 CFR part 21, sections 21.101, 21.303, 21.305, 21.601, 21.607, and 21.611; 14 CFR part 23, sections 23.561, 23.562, 23.785 (former CAR 3.390), and 23.853; 14 CFR part 25, sections 25.561, 25.562, 25.785 (former CAR 4b.358), and 25.853; 14 CFR part 27, sections 27.561, 27.562, 27.785, and 27.853; 14 CFR part 29, section 29.561, 29.562, 29.785, and 29.853; 14 CFR part 43, section 43.13; 14 CFR part 45, section 45.15; Subpart D of 14 CFR parts 23, 25, 27, and 29; and 14 CFR part 25, appendix F, parts I and II.

4. **BACKGROUND.**

a. **Types of Design Approvals.** The design of seating systems (seats and berths) must be approved by the Federal Aviation Administration (FAA). According to section 21.305, this approval may be obtained under a parts manufacturer approval (PMA), under a TSO authorization, in conjunction with type certification procedures (in an original type certificate, by supplemental type certificate, or by amendment to the type certificate), or in any other manner approved by the Administrator. A seat or berth (article) approved as part of an aircraft type design or under a PMA is approved for installation in an aircraft type with an associated approved interior arrangement; however, an article initially approved under TSO procedures is approved for design and production of the article only, and a separate approval is required for installation of that article in an aircraft.

b. **TSO Approvals.** Seating systems produced by a manufacturer holding a TSO authorization must have met the performance standards described in either TSO-C39, TSO-C39a, or TSO-C39b which incorporate part of National Aircraft Standard (NAS) 809, or TSO-C127, which incorporates the available design criteria, tests, and acceptance criteria of the Society of Automotive Engineers (SAE) Aerospace Standard (AS) 8049.

c. **Modified Seating System Approvals.** Many aircraft owners and operators choose to alter seating systems by incorporating such features as different upholstery. Any change to these articles constitutes a modification that must be separately approved by the FAA, regardless of whether the original article had a TSO approval or was approved as part of the aircraft type design. It is the modifier's responsibility to ensure that the modified article is approved by the FAA. It should be emphasized that replacement of a component of a seat cushion system with a component of a different design constitutes a modification requiring further approval. The local FAA engineering or flight standards office should be contacted regarding approval of the modified article and the basis for the approval. It is recommended that the initial approval be obtained for all anticipated combinations of dress cover, foam, and fire-blocking layer in the seat cushion system design so that the entire seating system will continue to be in an approved configuration after removal of the dress cover or foam for cleaning or replacement.

5. DISCUSSION.

a. Approval Considerations.

(1) Applicable Regulations. Each applicant seeking approval of a modified TSO article for installation in an aircraft must show that the alteration of the article is done per the design alteration performance requirements of section 43.13, the applicable airworthiness requirements for that aircraft type design as specified in paragraphs (a) and (b) of section 21.101, or the requirements of section 21.611 if the applicant is the article manufacturer and elects to show that the modified article still meets the TSO standards.

(2) General Design. The person modifying an aircraft seating system should evaluate two aspects of design: the design of the article itself and the design of its installation.

(a) Design of the Article. Compliance with the standards of TSO-C127, TSO-C39, TSO-C39a, TSO-C39b, or the applicable airworthiness standards may not, alone, ensure that the article has no unsafe features that experience has shown to be hazardous. The persons modifying the article should determine that the design contains no hazardous features.

(b) Design of the Installation. An article which, of itself, has no unsafe design features may still create a hazard as installed (for example, if it blocks an exit). The design of the article's placement in an interior arrangement should be evaluated to ensure that it results in no hazard.

(3) Materials and Workmanship. Subpart D of parts 23, 25, 27, or 29 describes the standards for materials and workmanship to be used in fabricating or modifying aircraft articles. The materials used for the modified articles should continue to be of a quality that meets those standards or the TSO standards. Any component of the modified article requiring protection because of the type of material used should be protected in service against deterioration, loss of strength, or reduction in flame-retardant coating effectiveness that may result from weathering, corrosion, abrasion, or other causes. Workmanship should also be consistent with high-grade manufacturing practices.

(4) Structural Tests. For each seating system previously produced, tested, and certified either to structural specifications (i.e., NAS 809) or to dynamic performance standards (i.e., SAE AS 8049), the effect of the modification on the validity of those tests should be addressed. For example, in NAS 809, subparagraph 4.3.1 (governing the static testing of seats and berths), use of the dimensions specified for the locations of the side loads and up loads requires that the seat bottom and back cushion systems be in place and that the seat cushion is compressed 2 inches. If a cushion is removed for the test or if a seat cushion compression varies from 2 inches, the location for applying the loads must be changed accordingly. Modification of a cushion system may necessitate an analysis to verify that the specifications are still met. If the specifications are not met, additional tests or analyses will be necessary. Additionally, modifications which were considered minor modifications under the structural specifications required by TSO-C39b, such as seatbelt replacement, may be considered major modifications on TSO-C127 seats due to the potential effects on dynamic response characteristics. Some examples of modifications to TSO-C127 seats that will require substantiation and likely will require re-testing to verify continued compliance with dynamic requirements are:

(a) Seat cushion replacement, due to possible increase on pelvic and lumbar column compressive loading under the downward and forward combined loading of Test 1.

(b) Seatbelt replacement, due to possible increased stretching of the webbing or slippage in the adjuster which would affect occupant response and retention.

(c) Dress cover replacement on forward facing flight attendant seats equipped with shoulder harnesses, due to the possibility of reduced friction of the fabric and the increased potential for occupant submarining.

(d) Modifications involving passenger entertainment system components, both in-arm and in seat backs, to assess their effect on the dynamic performance of the seating system and head injury criterion (HIC), as appropriate.

(5) Fire and Flammability Tests. The modified seating system should be shown to meet the applicable airworthiness flammability requirements. Depending on the type certification basis or operation in which the aircraft is used, this may include the requirements in part 25, Appendix F, which is incorporated by reference in TSO-C39b and TSO-C127.

(a) The flammability standards, for transport category airplanes, requires an oil burner test of a set of seat cushion test specimens which represent the production seat cushion assemblies. A change to the seat cushion system design might affect the flammability characteristics. Thus, a new configuration or combination of foam, fire blocking layer, and dress cover will require additional testing and approval to further establish compliance with the flammability standards. As described in part 25, appendix F, part II, section (a)(3), dress covers may be qualified by similarity.

(b) AC 25.853-1, Flammability Requirements for Aircraft Seat Cushions, provides additional information on the approval of seat cushion dress covers on the basis of similarity. If there is a question as to whether a design change to a cushion system is significant enough to require re-testing, the local FAA Aircraft Certification Office (ACO) should be consulted.

(6) Marking.

(a) If the modified seating system incorporates only a minor change by the manufacturer holding the TSO authorization, the provisions of section 21.611(a) apply, and the TSO marking need not to be changed.

(b) If the modified seating system incorporates a major change by the manufacturer holding the TSO authorization and if the modified article continues to meet the TSO requirements, the provisions of section 21.611(b) apply. The manufacturer must re-mark the modified article to show the new type or model designation and must obtain a new TSO authorization.

(c) If a modifier other than the original manufacturer incorporates any design change in an existing TSO seating system, the provisions of section 21.611(c) apply. If the modifier is a manufacturer, the manufacturer must apply for a separate TSO authorization to obtain TSO approval under part 21. The modified article would be marked as any other newly authorized TSO article according to section 21.607(d), with all previous TSO markings deleted.

(d) A modifier, other than a manufacturer seeking TSO authorization, may obtain approval for either an alteration under part 43 or a minor design change under the applicable airworthiness regulations (part 23, 25, 27 or 29). The modifier's nameplate should be added without removing the original TSO markings only if the original manufacturer or the modifier has certified to the FAA that the modified article continues to meet all the requirements of the TSO. If the modified article is approved under a PMA, it would be marked according to section 45.15 and the article will have no TSO markings (permanent removal of the TSO number only is sufficient).

(e) If a modified seating system does not continue to meet TSO standards, the TSO identification on the original manufacturer's nameplate should be permanently removed in a manner such that it cannot be restored (permanent removal of the TSO number only is sufficient). A seating system so modified and installed in an aircraft should be approved as part of the aircraft type design interior arrangement in conjunction with the type certification procedures of part 21. The modified article would be marked according to section 45.15 if the modification is made by a manufacturer under a PMA.

(f) A seat cushion system may also receive separate TSO approval as a flotation device under TSO-C72( ). The TSO marking for the flotation device should appear on a nonremovable part of the article and be accessible.

(g) Replacement of the dress cover, foam, or any other seat cushion system component with one of a different design constitutes a modification requiring FAA approval, as discussed in paragraph 4c of this AC. The seat cushion system should be marked on a nonremovable, accessible location, "Complies with 14 CFR section 25.853(c), effective 11/26/84," according to TSO-C39b or TSO-C127, as well as marked with the other information described in section 21.607(d). The individual components should be marked in a manner which will allow verification that only approved configurations of components are installed together.

b. Conclusion.

(1) After successfully showing compliance with the applicable regulations, the modifier should receive approval from the FAA for the design change or alteration.

(2) The modifier may receive manufacturing authorization under one of the methods specified in section 21.305 after successfully showing compliance with the applicable regulations.

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