U. S. DEPARTMENT OF COMMERCE
CIVIL AERONAUTICS ADMINISTRATION
WASHINGTON 25, D. C.

TECHNICAL STANDARD ORDER

Regulations of the Administrator
Part 514

SUBJECT: Aircraft Seats and Berths **TSO–C39**

Part 514—Technical Standard Orders for Aircraft Materials, Parts, Processes, and Appliances

Under section 601 of the Civil Aeronautics Act of 1938 and the delegation of authority from the Civil Aeronautics Board in §§ 3.18, 4a.31, 4b.18, 6.18, and 7.18 of the Civil Air Regulations, the Administrator of Civil Aeronautics is authorized to adopt performance standards and specifications of materials, parts, processes, and appliances used in aircraft as he may find necessary to implement provisions of the Civil Air Regulations. The Administrator adopted the Technical Standard Order system as a means to carry out this delegated authority. This system, in brief, provides for CAA-industry cooperation in the development of these performance standards, and a form of self-regulation by industry in demonstrating compliance with these standards. Since the original adoption of this part, which contains the C series TSO's, it has been found desirable to make clarifying editorial and format changes. Hence, Part 514 of the Regulations of the Administrator is being amended to provide two subparts. Subpart A contains the general requirements applicable to all Technical Standard Orders, such as "Method of Conformance," "Marking," and "Deviations." Subpart B contains the technical specifications to which a specific product must conform.

SUBPART A—GENERAL

§ 514.1 *Basis and purpose*—(a) *Basis.* Section 601 of the Civil Aeronautics Act of 1938, as amended, and §§ 3.18, 4a.31, 4b.18, 6.18, 7.18 of the Civil Air Regulations.

(b) *Purpose.* The purpose of this part is to establish minimum performance standards for aircraft materials, parts, processes, and appliances which are to be used on civil aircraft of the United States, and to prescribe the manner by which the manufacturer must show compliance with such performance standards.

§ 514.2 *Method of conformance.* A manufacturer of an aircraft material, part, process, or appliance for which standards are established in Subpart B of this part, prior to distribution for use on a civil aircraft of the United States, shall furnish a written statement of conformance certifying that the material, part, process, or appliance meets the applicable performance standards established in this part. The statement of conformance shall be signed by a person duly authorized by the manufacturer, and shall be furnished to the Chief, Aircraft Engineering Division, Office of Aviation Safety, Civil Aeronautics Administration, Washington 25, D. C.

If complaints of nonconformance with the requirements of this Order are brought to the attention of the CAA and investigation indicates that such complaints are justified, the Administrator will take appropriate action to restrict the use of the product in civil aircraft.

§ 514.3 *Marking.* Materials, parts, processes, and appliances for which a statement of conformance has been submitted, shall be legibly and permanently marked with the following information:

(a) Name and address of the manufacturer responsible for compliance,

(b) Equipment name, or type or model designation,

(c) Weight to the nearest pound and fraction thereof,

(d) Serial number and/or date of manufacture, and

(e) Applicable Technical Standard Order (TSO) number.

§ 514.4 *Deviations.* No deviation will be granted from the performance standards established in Subpart B. Requests for deviation from other requirements of this part should be addressed to the Aircraft Engineering Division, Office of Aviation Safety, Civil Aeronautics Administration, Washington 25, D. C.

Technical Standard Orders are obtainable without charge from the Civil Aeronautics Administration, Aviation Information Office, Washington 25, D. C.

SUBPART B — MINIMUM PERFORMANCE STANDARDS

§514.36 Aircraft seats and berths—TSO-C39—(a) Applicability—(1) Minimum performance standards. Minimum performance standards are hereby established for aircraft seats and berths of the following types which are to be used in civil aircraft of the United States:

Type I	Transport (9g forward load)
Type II	Normal and utility
Type III	Acrobatic
Type IV	Rotorcraft

New models of seats and berths manufactured for installation in civil aircraft on or after the effective date of this order shall meet the standards of National Aircraft Standards Specification 809, dated January 1, 1956,1/ with the exception in subparagraph (2). Seats and berths approved by the Civil Aeronautics Administration prior to the effective date of this order may continue to be manufactured under the provisions of their original approval.

(2) Exception. The sideward loads as specified in 4.1.2 Table I need not exceed the requirements of the applicable Civil Air Regulations.

(b) Marking. The weight required in §514.3 need not be included.

(c) Effective date. January 15, 1957.

1/ Copies may be obtained from the National Standards Association, 616 Washington Loan and Trust Building, Washington 4, D. C.

NATIONAL AIRCRAFT STANDARDS COMMITTEE
AIRCRAFT INDUSTRIES ASSOCIATION OF AMERICA, INC., 610 SHOREHAM BUILDING, WASHINGTON 5, D. C.

SPECIFICATION - AIRCRAFT SEATS AND BERTHS

INDEX OF CURRENT SHEETS

1. SCOPE

1.1 Scope - This specification defines the minimum performance and safety standards for seats and berths to be installed in certificated aircraft.

1.2 Types - This specification covers all types of crew and passenger seats and berths for civil aircraft use in the following categories:

Type I	Transport
Type II	Normal & Utility
Type III	Acrobatic
Type IV	Rotorcraft

2. APPLICABLE SPECIFICATIONS

2.1 The latest issue and amendment of the following documents are made a part of this specification:

SAE Aeronautical Material Specification AMS 3852, "Flame Resistant Properties for Aircraft Materials"

3. MATERIAL AND WORKMANSHIP

3.1 Materials shall be of a quality which experience and/or tests have demonstrated to be suitable for use in aircraft seats and berths. Workmanship shall be consistent with high-grade aircraft manufacturing practice.

3.1.1 Protection: All members of the structure shall be protected against deterioration or loss of strength in service due to weathering, corrosion, abrasion or other causes where the type of material used requires such protection.

3.1.2 Fire Protection: The covering and upholstery and all other exposed material used in the seat or berth shall have flame-resistant properties as specified in Aeronautical Material

PREPARED BY THE AIRWORTHINESS REQUIREMENTS COMMITTEE

APPROVAL DATE 1 JAN. 1956 REVISION

Specification (SAE) AMS 3852. If ash trays are installed in or attached to the seat or berth, they shall be of a self-contained, completely removable type.

4. DETAIL REQUIREMENTS

4.1 Design

4.1.1 General: The seat shall be designed so that in any of its adjustable positions and when installed facing in a specified direction or directions, it will provide protection for the occupant, i.e., pilot, cabin attendant, check pilot or passenger.

4.1.1.1 Accommodation for Parachutes: Types II and III seats shall be designed to accommodate passengers wearing parachutes, except that Type II seats designed specifically for NORMAL CATEGORY AIRCRAFT need not comply with this requirement but shall be identified in the marking required in 4.2 as, "FOR NORMAL CATEGORY AIRCRAFT ONLY."

4.1.1.2 Aft Facing Seats: The seat back height shall be sufficient to provide 36-1/2 inches support for the occupant as measured from the point of maximum seat cushion depression to the top of the seat back. This dimension may be determined with the seat statically subjected to the loads specified in Table I. Padding for the back of the head should prevent "bottoming" on the seat structure unless this structure is designed to absorb the remaining energy.

4.1.2 Strength: All seats and berths intended for single occupancy shall be designed for the ultimate loads specified in Table I. The loads shall be considered as acting separately and shall be based on a passenger weight of 170 pounds for Types I and IV seats and 190 pounds (includes parachute) for Types II and III seats. The weight of the seat or berth times the approximate "g" value shall be added to the ultimate loads specified in Table I. For seats intended for multiple occupancy the loads must be increased accordingly. Ultimate loads are 1.5 times the limit loads.

TABLE I

Load Direction	Type I	Type II**	Type III	Type IV
Forward	1530 lbs. (9.0g)	1710 lbs. (9.0g)	1710 lbs. (9.0g)	680 lbs. (4.0g)
Sideward***	510 lbs. (3.0g)	570 lbs. (3.0g)	570 lbs. (3.0g)	340 lbs. (2.0g)
Upward	340 lbs. (2.0g)	570 lbs. (3.0g)	855 lbs. (4.5g)	255 lbs. (1.5g)
Downward	1020 lbs. (6.0g)*	1330 lbs. (7.0g)*	1710 lbs. (9.0g)	680 lbs. (4.0g)

* The reason for the down loads exceeding those prescribed in the emergency landing conditions of the applicable Civil Air Regulations is to provide for the reduced weight gust-load-factor or special landing requirements which, in some cases, may be greater than the emergency landing loads.

APPROVAL DATE 1 JAN. 1956 REVISION

4.1.2 (Cont'd.)

** Civil Air Regulations require use of parachute in UTILITY CATEGORY AIRCRAFT operated in acrobatic flight.

*** See 4.3 pertaining to side load for arm rests, Item (c).

4.1.2.1 Pilot and Co-Pilot Seat Loads: In addition to the loads specified in Table I above, pilot and co-pilot seats shall be designed to withstand the following rearward loads applied 8 inches above the intersection of the seat back and seat bottom to provide for the application of pilot forces to the flight controls:

Type I seats	450 pounds
Type II and III seats	300 pounds for aircraft weighing 5000 pounds or under, and 450 pounds for aircraft weighing over 5000 pounds.
Type IV seats	195 pounds

4.1.2.2 Back Rest Loads: The back rest of rearward facing seats, when in the most vertical position, shall withstand the following airplane forward loads applied separately:

Type I Seats - 1530 pounds distributed over the seat back with the load C.G. located 10.5 inches up from the base of the seat back as described in the note in Section 4.3.1.

Types II and III Seats - 1710 pounds distributed over the seat back with the load C.G. located 10.5 inches up from the base of the seat back as described in the note in Section 4.3.1.

4.1.2.3 Casting Factors: If castings are used in the construction of the seat the castings shall have a factor of safety of 2.0 where only visual inspection is employed except that it need not exceed 1.25 with respect to bearing stresses. A safety factor of 1.25 is satisfactory if the casting is substantiated by testing at least three samples and if visual and radiographic inspection is employed on all production castings to assure that they are at least equivalent to the test specimens. The samples shall withstand the ultimate loads multiplied by the 1.25 factor and the limit loads multiplied by the factor of 1.15. These loads should be applied separately. Die castings shall not be used in the primary structure of the seat without 100% radiographic inspection. Casting factors other than those

4.1.2.3 (Cont'd.)
specified above shall be acceptable if they are found to be appropriately related to tests and to inspection procedures.

4.1.2.4 Ultimate Load Strength: The seat or berth in any of its adjustable positions, when installed facing in a specified direction or directions and when occupied by maximum number of occupants, shall be capable of withstanding ultimate loads without failure for at least three (3) seconds.

4.1.2.5 Limit Load Strength: The seat or berth in any of its adjustable positions shall be capable of withstanding the limit loads without suffering detrimental permanent deformation. At all loads up to these limit loads the deformation shall be such as not to interfere with safe operation of the airplane. (Note: this limit load requirement is not applicable to the forward or the 3 "g" side loading since it is an emergency condition.)

4.1.3 Attachments: For Types I, II and III seats and berths the strength of the seat or berth attachments to the structure and safety belt or shoulder harness attachments to the seat or structure, shall be 1.33 times the ultimate loads specified in Table I except that the down load need not be considered for the safety belt or shoulder harness attachments. When anchorages for safety belts are provided, they should be of a type which will permit self-aligning of the belt or fitting. For berth belt attachments, the factor shall be 1.15.

4.1.4 Projections: The surfaces of the seat shall be free from sharp edges or projections which may chafe the safety belt or shoulder harness webbing. Projections, sharp corners, and other hazardous features, against which the seat occupant may be thrown during a crash, shall be avoided insofar as possible. Any unavoidable features of this nature shall be padded to prevent serious head, neck or chest injury to the occupants.

4.2 Marking: Each seat or berth shall be legibly and permanently marked with the following information:

Manufacturer's Name
Model Number or Name
Seat and Facing Direction (e.g., forward, aft, sideward, swivel)
Serial Number or Date of Manufacture
National Aircraft Standard Number (NAS_____)

4.3 Qualification Tests: Tests shall be conducted as necessary to demonstrate:

(a) that the seats or berths are capable of supporting the limit loads without detrimental permanent deformation;

(b) that, at all loads up to limit loads, the deformation shall be such as not to interfere with the safe operation of the aircraft;

4.3 (Cont'd.)

(c) that the structure is capable of supporting, without failure for at least 3 seconds, the ultimate loads specified herein when applied separately.

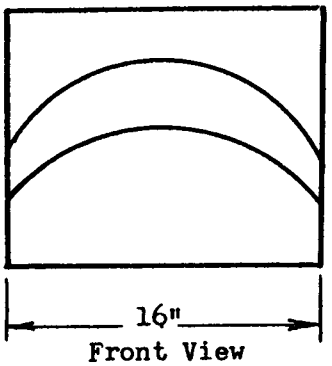
If it can be shown that failure of an arm rest on a seat assembly does not reduce the degree of safety afforded the occupant, such failure will not be cause for rejection.

4.3.1 Detail Qualification Test Requirements: The seat or berth shall be loaded in tests such that the loads imposed on the seat or berth by the occupant(s) in conjunction with the safety belt or belts and their attachments are accurately simulated by means of a block or frame or dummy which is restrained in the seat or berth by the belt or belts attached to their fittings. The tests may be conducted in a jig simulating installation conditions. The ultimate loads, when applied separately, will serve to simulate the loads imposed by the occupant.

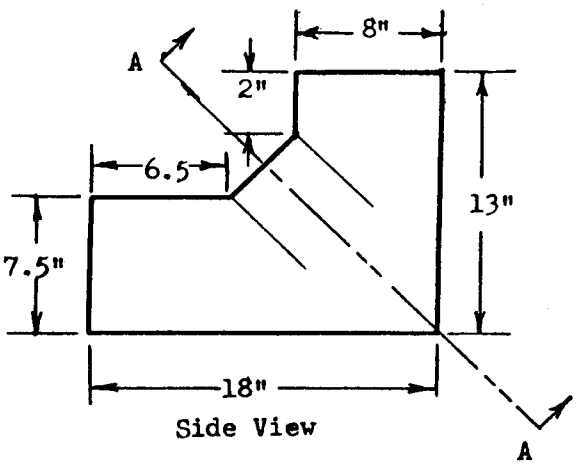
	Forward Facing Seat	Sideward Facing Seat	Rearward Facing Seat
Down Load	Evenly over seat bottom	Evenly over seat bottom	Evenly over seat bottom
Side* Load	10.5" up from base of block and about 8.5" forward from back of block.	10.5" up from base of block and about 8.5" forward from back of block.	10.5" up from base of block and about 8.5" forward from back of block.
Up* Load	"	"	"
Forward Load	"	"	Applied as specified in 4.1.2.2

*Note: These dimensions for the location of load application assume that the seat and back cushion are in place and that the seat cushion is compressed 2 inches. If the cushions are removed for the test or if the seat cushion compression varies from 2 inches, the location for applying the loads shall be changed accordingly.

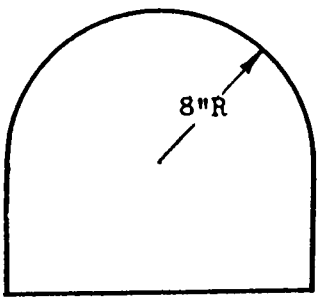
This simplified body block is satisfactory for test purposes. It may be refined or modified if desired; however, the application of all test loads should be modified accordingly if necessary.



Front View



Side View



Section A-A

4.3.1.1 When a seat or berth is to be installed or adjusts to face in other than the forward direction, sufficient tests shall be made to substantiate the seat strength for all intended positions.

4.3.1.2 When testing for a particular load condition of a vertically or horizontally adjustable seat, the most critical seat position associated with that load shall be used for the test.

4.3.1.3 Where the safety belt or belts or harness are not attached to the seat or berth structure, the seat or berth shall be tested for the loads which would be imposed on such installation.

4.3.2 Flame-Resistance Test of Seat Covers: Specimens of the seat covering and upholstery shall meet the applicable tests specified in 3.1.2.