



AEROSPACE STANDARD

AS 290B

Society of Automotive Engineers, Inc.
400 COMMONWEALTH DRIVE, WARRENDALE, PA. 15096

Issued 7-20-65
Revised 11-1-78

SEATS FOR FLIGHT DECK CREWMEN-TRANSPORT AIRCRAFT

1. PURPOSE

This Aerospace Standard (AS) establishes the minimum requirements for, and provides for standardization of, seats for flight deck crewmen in transport-type aircraft. In the preparation of this standard, consideration was given to the requirements of the FAA, the military specifications, and the recommendations of the airline operators and the aircraft manufacturers.

2. SCOPE

The requirements listed in Section 4 shall apply to all regularly assigned flight crew members. Due to limitations that it would place upon basic airplane design, it is not considered practical for these requirements to apply fully to the so-called jump seat. However, it should be emphasized that every effort should be made to provide the jump seat position with an equivalent level of comfort and safety.

In drawing up the requirements for the crew members' seats, the following items should be considered at all times:

- 2.1 If the crew member is comfortable in flight, he will be less susceptible to fatigue and can perform his duties in a safer and better manner.
- 2.2 It is to be considered that when the crew member is occupying his seat, he is on duty. Therefore, all seat adjustments are for the purpose of fitting the seat to the different sizes and shapes of personnel in order to enable the occupant to do his work in the most efficient and comfortable manner. Seat designs in general should be designed for 5 to 95 percentile population of airline pilots. HUMAN SCALE 1, 2, 3 (Calculator and Booklet), MIT PRESS 1975 CAMBRIDGE, MA, HENRY DREYFUSS ASSOC.

3. DEFINITIONS

- 3.1 **Seat Reference Point:** The term "seat reference point", as used in this text and figures, is defined as the intersection of a line tangent to the surface of the seat bottom cushion and a line through the seat back cushion representative of a back tangent line, when in a compressed state under a load of a 50th percentile person.

4. REQUIREMENTS

4.1 Vertical Adjustment:

- 4.1.1 **Pilot Seats:** The pilot seats shall be adjustable vertically through a range of at least 179 mm (7 in.) in increments of no greater than 12.7 mm (1/2 in.) throughout the entire range. The lowest adjustment shall place the neutral seat reference point at least 876 mm (34.5 in.) below the reference eye point as shown in Fig. 1, and the highest adjustment point no more than 699 mm (27.5 in.) below the eye reference point. It must be possible to achieve the eye level position equivalent adjustment with the seat cushion depressed.

CANCELLED

The vertical adjustment shall incorporate a means of raising the seat freely to the maximum up-position. If a mechanical system is employed, it shall not require a lifting force of greater than 22.7 kg. (50 lb) (less is desirable) to lift a 91 kg (200 lb) person, and no additional force to lower a 57 kg (125 lb) person. Up and down travel shall be free with no binding and the mechanism shall be of such a design that it is easy to keep free.

- 4.1.2 Other Flight Crew Seats: For crew members, such as a flight engineer and navigator seated at a desk, the vertical adjustment may be reduced to 127 mm (5 in.), with the lowest position such that the reference point is 330.2 mm (13 in.) above the footrest level. Seats which move to serve more than one area in the flight deck shall have adequate vertical adjustment range to permit crew members to sit comfortably at any assigned location.
- 4.2 Angular Adjustment of Back: The seat back shall be adjustable throughout an angle of from at least 95° from seat bottom to 115° as shown in Fig. 1. The back shall be adjustable in no greater than 2° increments from the most erect position to the 105° position, and in no greater than 5° increments for the remainder for the total aft adjustment range. If the seat is to be used for rest purposes, the incline shall be 135°.
- 4.3 Angular Adjustment of Seat: The seat pan angle shall be installed to a fixed position so that the bottom shall be inclined upward with its forward edge high at an angle of 7° from a plane parallel to the visual ref. plane as defined by ARP 268E.
- 4.4 Fore and Aft Adjustment:
- 4.4.1 Pilot Seats: The seat shall be adjustable in the fore and aft direction for a distance of not less than 152 mm (6 in.) (10 in. is desirable) in increments of not more than 25.4 mm (1 inch). In all cases, the travel shall be sufficient to permit easy access to the seat and clearance with normal control movements in cruise for a 305 mm (12 in.) flight manual place on the lap. Inbd-outbd adjustment may be included to improve access to the seat. Such adjustment will occur only at the most aft position.
- 4.4.2 Other Crew Members' Seats: Seats for crew members seated at a desk with no instrument dials, etc., in front of them need not be furnished with any fore and aft adjustment provided that easy access to the seat is possible. It is desirable to provide 203 mm (8 in.) of fore and aft adjustment, perpendicular to the operator's main instrument panel, for crew members who are seated at a desk having an instrument panel and/or controls before them. The minimum acceptable adjustment shall be 102 mm (4 in.).
- 4.5 Power Operated Seats: The speed of movement should not exceed 42 mm (1.65 in.) per sec. when motorized. An immediately accessible master on/off or stall force clutch switch should be provided or other means to rapidly stop a runaway seat.
- 4.6 Arm Rests: Arm rests shall be provided on each side of the seat and shall fold to a position and remain where they will minimize interference with egress or ingress of the occupant. When in the folded position, the arm rests shall not interfere with the normal movements of the pilot in the operation of the aircraft.
- 4.6.1 Arm Rest Adjustment: The arm rest adjustment shall be a facile one-hand operation.
- 4.7 Head Rest: None required, but provisions should be made for a vertically adjustable head rest for recline angles > 30°. A head rest should be installed if the seat is to be used for crew rest.

- 4.8 Seat Adjusting and Locking Controls: All adjusting and locking controls shall be easily accessible to the occupant and these controls shall be grouped together on one side of the seat. For pilots' seats, adjustment controls should be on the access side of each seat. These controls shall be easily operable with the use of only one hand while seated in the seat, or from outside the seat when occupied or not occupied. All adjustment controls shall be positive actuating to prevent unlocking or slipping. The controls shall not interfere with ingress or egress.

Individual adjusting levers should be appropriately labeled and shape coded to indicate their function to the seat occupant (e.g., fore-aft, up-down, recline). When a mechanical lever-type control is utilized, the movement of the lever shall not exceed 50° and the mechanism shall automatically lock when the lever is released. This type of locking mechanism shall be released by an upward movement of the lever. Remotely actuated devices must have the controls located so as to permit convenient access to the seat.

For electrically adjusted seats, the control shall be protected from inadvertent operation and the direction of movement of the control switch(es) shall result in seat movement in the same direction. Means shall be provided to permit adjusting the pilots' seats in case of failure of the electrical adjusting device(s). Such alternate means shall be readily accessible to the pilot although they need not necessarily be located in accordance with this paragraph. An immediately accessible on/off power switch shall provided.

For either mechanical-or electrical-type locking mechanism, the location of the actuating handle or switch shall be as follows (except that in case of an electrically adjusted seat, a unitary-type control switch control may be used, in which case it shall be centrally located on the side of the seat bottom):

- 4.8.1 Fore and Aft Adjustment: At approximately the fore and aft midpoint of the seat and as high as possible so as to minimize the need for bending in order to reach the controls.
- 4.8.2 Vertical Adjustment: Towards the forward corner of the seat bottom.
- 4.8.3 Back Adjustment: Towards the back edge of the seat bottom.
- 4.8.4 Angular Adjustment: The most forward control.

These mechanisms shall positively lock the seat in position without seat wobble or fore and aft motion.

- 4.8.5 Seat Position Index Reference: The pilot and copilot seats shall have position reference marks plainly visible to pilot while seated in seat to indicate the position of the seat in the fore and aft adjustment range and in the vertical adjustment range to permit consistent repositioning of the seat to the desired position.
- 4.9 Shoulder Harness: Seat back height specifications of Fig. 1 are based on considerations of comfort and convenience. If the seat back incorporates provision for shoulder harness attachment, this attachment height shall be great enough to prevent the shoulder harness from imposing dangerous down loads on the occupant under survivable crash conditions, and from imposing uncomfortable down loads under routine operating conditions. The shoulder harness leads from the seat back area shall be such that the harness will not slide off the pilots' shoulders. (Refer to ARP 998, crew restraint system.)
- 4.10 Safety Belt: Provision shall be made to unlock the shoulder harness without unlocking the seat belt. Provisions shall also be made to unlock the harness and seat belt simultaneously. Either of these shall be a single-handed actuation. (Refer to ARP 682, Safety Lap Belts (for Civil Transport Aircraft).)

Provisions shall be made for easy stowage of the shoulder harness, leg straps, and seat belts to prevent entanglement with seat, controls, and structure and to prevent straps and belts from dropping to the floor. Such stowage facilities should be automatic.

- 4.11 Cushion: The cushion shall be constructed to provide optimum comfort (either by contouring and/or by variation of strength of the cushion material) and durability. Cushion material should also provide adequate ventilation to minimize discomfort due to body perspiration. The cushion material that is provided for the purpose of resilience shall be of such firmness as to provide a stable platform for seating. It shall not be possible to feel any structure through the cushion.

The combination of the seat bottom and seat cushion shall be such that the seat will not "bottom" while occupied by a 91 Kg (200 lb) person after 2 years of use.

- 4.12 Construction: The surfaces of the seat shall be free from sharp edges or any projections which may cause damage to the safety belt, shoulder harness or the clothing of the occupant. The exterior surfaces of the seat shall be free from sharp edges or any projections which might scratch the hands or the clothing of the occupant as he moves his arms about the sides of the seat to handle equipment within his reach--to the rear and to the sides, and to operate the seat-adjustment mechanisms. The general construction shall be such as to provide the utmost in rigidity to prevent objectionable flexing of seat.

The seat pan contours should not create too much bucket effect.

- 4.13 Kidney support in lumbar area, curved slightly to fit across the back of the seat occupant, shall be provided. It shall be easily adjustable while seated. Both forward and rearward adjustment relative to the seat back, and 76 mm (3 in.) of vertical adjustment shall be provided.

- 4.14 Thigh Support: Crew member seats should have an adjustable thigh support on the forward part of the seat. It should have an adjustable range of 4 in. (101.6 mm) in 1/2 in. (12.7 mm) increments.

- 4.15 Flight Deck Seat Dynamics: The crew members' seat cushions, seats and seat-to-airplane attach structure shall be designed such that, for all reasonable crew member weights (using normal seat belt and shoulder harness restraint provisions), there is no resulting amplification of crew member motion particularly at the basic airplane response frequencies generated by turbulent flight conditions.

- 4.16 Fig. 1 gives the general dimensional outlines of the seat. These figures are for dimensional purposes only and not to fix the actual shape of the seat. All general dimensions shall have tolerances of $\pm 1/4$ in. (± 6.35 mm) or $\pm 1^\circ$ unless otherwise shown.

The cut-out for the control column shall not exceed the dimensions given in Fig. 1.

5. NOTES

- 5.1 Marginal Indicia: The phi ϕ symbol indicates technical changes from the previous issue of this document.

PREPARED BY

SAE COMMITTEE S-7, FLIGHT DECK & HANDLING
STANDARDS FOR TRANSPORT CATEGORY QUALITIES AIRCRAFT