Society of Automotive Engineers, Inc.
TWO PENNSYLVANIA PLAZA, NEW YORK, N.Y. 10001

AEROSPACE STANDARD

AS 290 A

Issued 7-20-65
Revised 3-15-71

SEATS FOR FLIGHT DECK CREWMEN - TRANSPORT AIRCRAFT

1. PURPOSE

This document 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.

3. DEFINITIONS

3.1 Neutral Seat Reference Point: The term "neutral 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 ø a line through the seat back cushion representative of a back tangent line, under a no-load condition essentially as shown in Figure 1.

4. REQUIREMENTS

4.1 Vertical Adjustment:

4.1.1 Pilot Seats: The pilot seats shall be adjustable vertically through a range of at least 7 in. in increments of no greater than 1/2 in. throughout the entire range. The lowest adjustment shall place the neutral seat reference point at least 34.5 in. below a 41 in. design eye reference point ø located as shown in Figure 1, and the highest adjustment point no more than 27.5 in. below the design eye reference point. It must be possible to achieve the same eye level position equivalent to the 27.5 in. adjustment with the seat cushion fully depressed. This may require a higher adjustment with respect to the neutral seat reference point than the 27.5 in. point.

The vertical adjustment shall incorporate a means of raising the seat freely to the maximum up position. If a bungee-type mechanism is employed the bungee load shall not exceed 150 lb when the seat is in the lowest position or be less than 50 lb when the seat is in the highest position. If a mechanical advantage type mechanism is employed it shall not require an operational force of greater than 50 lb (less is desirable) to lift a 200-lb man. Up and down travel shall be free with no binding and of such design that it is easy to keep free.

4.1.2 Other Flight Crew Seats: For crew members, such as the flight engineer, radio operator, and navigator, seated at a desk, the vertical adjustment may be reduced to 5 in., with the lowest position such that the reference point is 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 deg from seat bottom to 125 deg as shown in Figure 1. The back shall be adjustable in no greater than Ø 2 deg increments from most erect position to the 105 deg position, and in no greater than 5 deg increments for the remainder of the total aft adjustment range.

4.3 Angular Adjustment of Seat: The seat angle shall be adjusted to a fixed position so that the bottom shall be inclined upward with its forward edge high at an angle of 7 deg from the plane of the track.

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 6 in. (10 in. is desirable) in increments of not more than 1 inch. In all cases, the track travel shall be sufficient to permit easy access to the seat. With the seat back adjusted to its maximum aft inclination, a minimum of 5 in. of fore and aft travel should be available.

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. For members who are seated at a desk having an instrument panel, and/or, controls before them, it is desirable to provide 8 in. of fore and aft adjustment perpendicular to the operator's main instrument panel. The minimum acceptable adjustment shall be 4 inches.

4.5 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 the 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. The arm rests shall be adjustable in the vertical plane in increments of not more than 1/2 in. from a position 8 in. to 12-1/2 in. above the neutral seat reference point throughout a range of seat back adjustments from vertical to 15 in. aft. The arm rests shall be padded for a minimum length of 11 in. forward of the vertical plane through the neutral seat reference point. The top surface of the arm rests shall have a flat or slightly concave padded elbow bearing surface not less than 3 in. wide.

4.5.1 Arm Rest Adjustment: The arm rest adjustment shall be a facile one-hand operation.

4.6 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 while seated in the seat, or from outside the seat when occupied or not occupied. All adjusting controls shall be positive actuating so as to prevent unlocking or slipping.

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

For electrically adjusted seats, 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 Ø 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.

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):

4.6.1 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.

4.6.2 Vertical Adjustment: At the forward corner of the seat bottom.

4.6.3 Back Adjustments: At the back edge of the seat bottom.

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

4.6.4 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 Ø range and in the vertical adjustment ranges to permit consistent repositioning of the seat to the desired position.

4.7 Shoulder Harness: Seat back height specifications of Figure 1 are based on considerations of comfort and convenience. If the seat back incorporates provision for shoulder harness attachment, this attachment Ø 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)

4.8 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 problems should be automatic.

4.9 Cushion: The cushions shall be constructed to provide optimum comfort (either by contouring 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 durable and shall not pack due to use. The cushion 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" when subjected to the maximum flight limit load factor while occupied by a 200 lb man.

4.10 Construction: The surfaces of the seat shall be free from sharp edges or any projections which may cause damage to the safety belt 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.

4.11 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 frequency. Maximum attenuation of crew member body motion at frequencies generated by turbulent flight conditions is highly desirable.