

Seats and Restraint Systems for the Flight Deck

RATIONALE

This document has been reaffirmed to comply with the SAE 5-Year Review policy.

FOREWORD

Changes in this reaffirm are format/editorial only.

1. SCOPE:

This document establishes the minimum requirements for seats and restraint systems for the flight deck.

Due to limitations that it would place upon basic aircraft design, it is not considered practical for these requirements to apply fully to the observer seat. However, it is emphasized that every effort should be made to provide the observer seat position with an equivalent level of comfort and safety.

This document is also intended to make recommendations for flight crew restraint systems. A properly designed crew restraint system will minimize injury or debilitation during a survivable crash and enable post crash assistance to occupants and escape from the aircraft.

Crew member safety is the primary objective, with appropriate provisions for crew comfort taken into consideration. The criteria established herein are designed to standardize restraint systems without hindering the development of new, improved systems.

2. REFERENCES:

2.1 Documentation:

- ARP4101, Flight Deck Layout and Facilities
- ARP4102, Flight Deck Panels, Controls and Displays
- ARP4105, Nomenclature and Abbreviations for Use on the Flight Deck
- AS8043, Torso Restraint Systems
- MIT PRESS 1975 Cambridge, MA, Henry Dreyfuss Association, "Human Scale 1, 2, and 3"
- JAR/FAR 25.853(b), Fire Blocking Requirements

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2.2 Definitions:

- 2.2.1 Seat Reference Point: The intersection of a tangent to the surface of the bottom of a seated person's buttocks and a line through the seat back cushion representative of a back tangent line when in a compressed state under the load of a 50th percentile, 175 cm, 77 kg (5'9", 170 lb) person.

3. OPERATIONAL REQUIREMENTS:

3.1 Construction:

The surfaces of the seat shall be free from sharp edges or 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 while moving his/her arms about the sides of the seat to handle equipment within reach to the rear and to the sides, and to operate the seat-adjustment mechanisms.

No seat position or portion of the seat shall in any way interfere with the full range of any flight control handle, column, or other controlling device.

3.2 Cushion:

The cushion shall be constructed to provide optimum comfort (either by contouring and/or by variation of stiffness of the cushion material) and durability. Cushion material shall also provide adequate ventilation to minimize discomfort due to body perspiration and meet the requirements of JAR/FAR 25.853(b), with respect to fire blocking. The cushion material should be of such firmness as to provide a stable platform for seating. It should not be possible to feel any structure through the cushion. The cushion shall not touch the control column when it is in the full rear position and the seat is fully forward. The combination of the seat bottom and seat cushion shall be such that the seat will not "bottom" while occupied by a 90 kg (198 lb) person.

It is desirable that the cushion be covered by a material such as sheepskin to optimize comfort.

3.3 Dynamics:

The seat cushions, seat and seat-to-aircraft attach structure shall be designed such that for all reasonable crew member weights (using normal lap restraint and shoulder harness restraint provisions), there is no resulting amplification of crew member motion particularly at the basic aircraft response frequencies generated by turbulent flight conditions. The cushion material shall be selected for resistance to permanent deformation and excessive compaction.

3.4 Seat Adjustment:

- 3.4.1 Vertical Adjustment: The seat shall be adjustable vertically through a range of at least 180 mm (7 in) in increments of no greater than 12 mm (1/2 in) throughout the entire range. The lowest adjustment shall place the seat reference point at least 876 mm (34.5 in) below the design eye position as shown in Figure 1, and the highest adjustment point no more than 700 mm (27.5 in) below the design eye position. It shall be possible to achieve the eye level position equivalent adjustment with the seat cushion depressed. The vertical adjustment shall incorporate a means of raising the seat freely to the maximum up-position. If a mechanical system is employed, it should not require a lifting force of greater than 23 kg (50 lb) (less is desirable) to lift a 90 kg (198 lb) person, and no additional force to lower a 57 kg (125 lb) person. An appropriate hand-hold should be installed. Up and down travel shall be free with no binding and the mechanism should be of such a design that it is easy to keep free. Adjustment through the full vertical range shall be easy while seated and shall not restrict the fore or aft adjustment range.
- 3.4.2 Angular Adjustment of Back: The seat back shall be adjustable throughout an angle of from at least 95 degrees from seat bottom to 115 degrees as shown in Figure 1. The back should be adjustable in no greater than 2 degree increments from the most erect position to the 105 degree position, and in no greater than 5 degree increments for the remainder for the total aft adjustment range.
- 3.4.3 Head Rest: None required, but provisions should be made for a vertically adjustable head rest for recline angles greater than 30 degrees.
- 3.4.4 Angular Adjustment of Seat: The seat shall support the body so that there is no tendency to slide forward. The angle between the body and the upper leg should not be less than 90 degrees to prevent cramping of the anterior muscles.
- 3.4.5 Fore and Aft Adjustment: The seat shall be adjustable in the fore and aft direction for a distance of not less than 150 mm (6 in) [250 mm (10 in) is desirable] in increments of not more than 25 mm (1 in). 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 315 mm (12.4 in) flight manual place on the lap. Inboard-outboard adjustment may be included to improve access to the seat. Such adjustment should occur only at the most aft position.
- Emergency egress shall be possible when the seat is jammed in any position. Movement through the total fore and aft adjustment range shall not restrict the full vertical adjustment range. The seat in the full forward and up position shall not restrict the full range of the primary flight controls.
- 3.4.6 Kidney Support: Kidney support in the lumbar area, curved slightly to fit across the back of the seat occupant, shall be provided. It should be easily adjustable while seated. Both forward and rearward adjustment relative to the seat back and 76 mm (3 in) of vertical adjustment should be provided.