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AEROSPACE RECOMMENDED PRACTICE

ARP 750

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Revised

PASSENGER SEAT DESIGN

1. PURPOSE

The purpose of this Aerospace Recommended Practice is to provide design criteria that will lead to seat designs providing maximum safety and utility for air transportation passengers.

NOTE: It is not the purpose of this Aerospace Recommended Practice to specify design methods or specific designs to be followed in the accomplishment of the stated objectives.

2. INTRODUCTIONS

2.1 Definitions (As defined in this recommended practice)

2.1.1 Seat Assembly - One complete passenger seat unit, whether for single or multiple passenger occupancy normally removable as a unit from the aircraft. The seat assembly shall include the seat structure, cushions, trim panels, armrests, dress covers, ash trays, footrests, accessory pockets, and tray tables (when attached to the passenger seat or when plug-in type and stowed in seat-back), as applicable. It shall not include passenger seat belts, air sickness containers, literature and literature packets for passenger use, life jackets, headrest covers (antimacassar), or other loose equipment not normally supplied by aircraft seat manufacturers.

2.1.2 Seat Structure - That seat structure which provides the ultimate support and restraint link between the passenger and passenger seat belt and the aircraft fuselage structure under the conditions in paragraph 2.2.

2.1.3 Seat Secondary Structure - That structure required to meet the seat comfort utility and appearance requirements.

2.1.4 Seat Dress Up - That design feature of a reclinable seat-back which permits returning the seat-back from any angle to recline to the normal upright position by mere application of a force in the direction of travel to the seat-back.

2.1.5 Seat-Back Breakover - The design feature which permits folding the seat-back forward from the normal upright position by the mere application of a force to the seat-back. Seat-back breakover may or may not permit the seat-back to fold flat on the seat-bottom.

2.1.6 Seat Ultimate Load - Under any specified set of conditions, is as defined in NAS 809 and is the highest load to which the seat may be subjected for a minimum of three seconds without failure.

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2.1.7 Seat Separation Load - The static or dynamic load for which the seat is actually designed and is the highest load required to cause seat failures of a nature that will permit the passenger(s) to become detached from the aircraft structure. In designing and testing for the separation load, it may be assumed that the aircraft seat mounting structure is indestructible.

2.2 Scope - In addition to those aspects of a passenger seat such as comfort and appearance, the passenger seat, whether aft, forward, or side-facing is the basic link that supports and ties the air transport passenger to the aircraft structure. It is essential that the support and tiedown functions be accomplished in a manner that will provide maximum safety and security during all normal conditions of flight, emergency flight maneuvers and crash landings, whether on land or sea and that these functions not be compromised to attain the comfort and appearance features.

3. RECOMMENDATIONS

3.1 General Provisions

3.1.1 The Civil Air Regulations and technical standards order requirements for air transport passenger seats should be considered as minimum requirements only.

3.1.2 The strength relationship of the passenger seat to the aircraft should be such that the seat separation load for which the seat is designed exceeds the strength of the aircraft fuselage seat mounting structure.

3.1.3 When the seat ultimate load is exceeded, the seat assembly basic structure should be designed to fail progressively and during failure to absorb as much energy as possible.

3.1.4 Failure of the seat secondary structure under crash landing conditions should not affect the strength of the seat basic structure, nor on failing should it leave projections which could cause incapacitating or fatal injuries to the passengers.

3.1.5 In addition to the C.A.R. requirements, the seat assembly separation load requirements and C.A.R. ultimate load requirements should be met with the forward load applied anywhere within 30 degrees to left, right, or above the airplane fore and aft axis and anywhere within 45 degrees below the airplane fore and aft axis under the following special conditions:

3.1.5.1 Seat eccentrically loaded due to one or more passenger places not occupied in addition to all passenger places occupied.

3.1.5.2 Aircraft floor and sidewalls deflected under crash landing conditions. These deflections may be of considerable magnitude and should be determined by the air-

frame manufacturer with due consideration being given to both forward and side load as well as lower fuselage shell disintegration.

3.1.6 Seat strength under dynamic loading should be considered. This should include consideration of the following:

3.1.6.1 The effect of seat belt tightness and the flexibility of the seat occupants when subjected to high dynamic loads of short time duration.

3.1.6.2 The actions of all latches, closure devices, and quick release type mechanisms.

3.1.6.3 The overall natural frequency of the occupied seat assembly relative to that of the airplane under predictable crash conditions.

3.1.6.4 In an aft facing seat, the fact that the seat-back may not be in either the full upright or the full recline position.

3.1.7 It should be recognized that the passenger seat will be subjected to wear through use on the aircraft and in handling. Seat assembly conditions as a result of this wear should be considered in designing the seat basic structure to meet the load conditions. (In the case of aft facing seats special consideration should be given to the recline control mechanism and seat back pivot points.)

3.1.8 Materials selection and strength criteria and construction techniques should be such as to provide 100% compliance with the structural strength requirements.

3.1.9 Loads likely to be applied to the basic structure of one seat (and the deflections caused by the application of the loads) by the occupants of the seat ahead or behind should be considered in designing for the separation load conditions.

3.1.10 All areas of the seat which are exposed to occupants of the same or adjacent seats should be designed to minimize the snagging of wearing apparel and the likelihood of injury under the conditions described in paragraph 2.2, with the seat-back and components in all positions of recline and broken forward. Special consideration should be given to the seat-backs, and exposed structure beneath the seat bottom where head or leg contact is likely. (See ARP 767.)

3.1.11 The seat basic structure should be suitably protected against corrosion of all types to which it may be subjected in service and the design should avoid trapped areas where spilled liquids can accumulate and cause corrosion.

3.1.12 Seat-assembly flameability requirements should comply with the C.A.R., plus the following additional requirements:

3.1.12.1 Seat and armrest cushions and dress cover combinations should be self-extinguishing when subjected to a cigarette burn.

3.1.12.2 Seat trim material and finishes, except for those covered by 3.1.12.1 should meet the requirements for fire-resistant materials as defined by Flight Standards Service release No. 453, dated 11-9-61, except that penetration of the material during application of the flame or subsequent should be permissible.

3.1.12.3 Seat structure should be designed and constructed so it will not be possible to drop a lighted cigarette, cigar, etc. down into the seat structure or between the seat and aircraft fuselage structure where it cannot be easily removed with the seat installed in the aircraft.

3.1.12.4 In the selection of seat materials and finishes, those which generate excessive amounts of toxic gases, or dense smoke should be avoided.

3.1.13 Forward facing seats should be equipped with seat-back breakover to minimize the likelihood of injury to the occupants of the seat behind under the loads imposed by the crash landing conditions. Force to actuate breakover should not exceed a forward-load factor of three. The angle of breakover should be as great as practical, but in any case, great enough to minimize the likelihood of injury to the occupants of the seat behind at the minimum anticipated seat pitch.

3.2 Detailed Provisions

3.2.1 Seat-belt anchor fittings should be of a type that will accommodate all combinations of the seat-assembly design loads without preloading the seat-belt end fittings. (Anchor fittings should be so designed that the seat-belt end fittings will be self-aligning.)

3.2.2 Seat-belt anchor fitting routing should be as direct as possible to the seat basic structure, but where seat-belt anchor fitting position clamps are required, seat-belt slack should not be introduced when the clamps release under seat-belt load. The point of attachment of the seat-belt anchor fittings to the basic structure should be chosen to minimize the motion of the passenger relative to the seat when aircraft deceleration loads are applied.

3.2.3 Where seat-backs are equipped with integral passenger food tray tables, closure latches should be adequate to retain the table in the closed position under all design load conditions at all possible angles of back recline and breakover.

3.2.4 Where quick-release type fittings are used in the seat basic structure the fittings should be of the indicating positive action type and suitably protected against inadvertent actuation. Inadvertent misinstallation of the fittings should not be possible.