

**Proposed Special Condition on Incorporation of Inertia Locking Device in Dynamic Seats
Applicable to A380**

Introductory note:

The hereby presented Special Condition has been classified as an important Special Condition and as such shall be subject to public consultation, in accordance with EASA Management Board decision 02/04 dated 30 March 2004, Article 3 (2.) of which states:

"2. Deviations from the applicable airworthiness codes, environmental protection certification specifications and/or acceptable means of compliance with Part 21, as well as important special conditions and equivalent safety findings, shall be submitted to the panel of experts and be subject to a public consultation of at least 3 weeks, except if they have been previously agreed and published in the Official Publication of the Agency. The final decision shall be published in the Official Publication of the Agency."

Statement of Issue

Airbus is allowing the incorporation of an inertia locking device (ILD) in some passenger seats on the A380 as a means to achieve compliance with particular aspects of JAR 25.562. In general, seats designed and tested to show compliance have, up until now, relied on either basic seat structure or in some cases, particular 'passive' energy absorbing features. The inertia locking device constitutes the first known application in commercial aerospace of an 'active' seat moving device to help achieve compliance, i.e. a system which mechanically deploys during the impact event. This is considered a novel design feature and one for which a special condition is needed to address requirements applicable to this feature in a seat.

A380 Special Condition D-39

- Incorporation of Inertia Locking Device in Dynamic Seats -

- 1) Level of Protection Provided by Inertia Locking Device(s) (ILD)
The ILD is a mechanically deploying feature of a seat with a fore/aft tracking system. The ILD will self activate only in the event of a predetermined aircraft loading condition such as that occurring during crash or emergency landing. The ILD will interlock the seat tracking mechanism so as to prevent excessive seat forward translation. EASA considers that a minimum level of protection should be provided if the device does not deploy. It must be demonstrated by test that the seat and attachments, when subject to the emergency landing dynamic conditions specified in JAR 25.562 and with the ILD not deploying, do not suffer structural failure that could result in:
 - separation of the seat from the aircraft floor,
 - separation of any part of the seat that could form a hazard to the seat occupant or any other aircraft occupant,
 - failure of the occupant restraint or any other condition that could result in the occupant separating from the seat. However, failure of the occupant restraint may occur where it can be demonstrated that the seat occupant cannot form a hazard to any other aircraft occupant. This would normally only be agreed

by the Agency on the basis of physical separation of the seat from other seats in the aircraft, for example in a mini-suite type arrangement.

- 2) Protection Provided Below and Above the ILD Actuation Condition
The normal means of satisfying the structural and occupant protection requirements of JAR 25.562 result in a non-quantified but nominally predictable progressive structural deformation and/or reduction of injury severity for impact conditions less than the maximum specified by the rule. A seat using the ILD technology however involves a step change in protection for impacts below and above that at which the ILD activates and deploys to its 'retention' position. This could result in the effects of the impact, for example structural deformation and occupant injury criteria, being higher at an intermediate impact condition than that resulting from the maximum.
It is acceptable for these effects to have such non-linear or step change characteristics provided that they do not exceed the allowable maximum at any condition at which the ILD does or does not deploy, up to the maximum severity pulse specified by the requirements. Tests must be performed to demonstrate this taking into account any necessary tolerances for deployment.
- 3) Intermediate Pulse Shape
The existing ideal triangular maximum severity pulse is defined in FAA AC 25.562.1B. EASA considers that for the evaluation and testing of less severe pulses, a similar triangular pulse should be used with acceleration, rise time, and velocity change scaled accordingly.
- 4) Protection over a range of crash pulse vectors
The device will be tested at the EASA 25.562 specified crash pulse vectors of 14g at 30 degrees to the vertical and 16g at the horizontal. In addition it shall be shown that the device will also operate at a range of crash pulse vectors between those specified.
- 5) Protection during Secondary Impacts
The design of the ILD shall be such that if there is more than one impact, for the final impact that is above the severity at which the device is intended to deploy, the maximum protection of the device must be provided.
- 6) Protection of Occupants other than 50th Percentile
The ILD shall not affect compliance of the seat and installation with CS 25 requirements, or those of this Special Condition, with respect to protecting the specified range of occupant sizes.
- 7) It must be shown that any inadvertent operation of the device, for example during extreme flight manoeuvres, does not affect the performance of the seat during a subsequent emergency landing.
- 8) The installation of the ILD on the seat shall be physically protected from any contamination likely to occur during operation, e.g. drink, food etc. The installation should also be protected against other foreign object ingress.
- 9) The effects of wear and criticality of manufacturing tolerances should be considered with respect to reliability and adverse effect on operation of the ILD. In addition other possible effects that may render the device inoperative must be taken into account such as aging/drying of lubricants and corrosion.
- 10) The design, installation and operation of the ILD shall be such that it is possible, by maintenance action, to check the functioning, i.e. movement, of the device in-situ.

- 11) A method of functional checking and a maintenance check interval should be established (if applicable).
- 12) If there is a need to include any means to release an inadvertently operated device (i.e. that has engaged in a non-crash condition where the seat could otherwise remain in-situ on the aircraft), this function shall not introduce additional hidden failures.