

B747-8	CERTIFICATION REVIEW ITEM	C- xx
 European Aviation Safety Agency	<p style="text-align: center;">[Applicant]</p> <p style="text-align: center;">(EASA project reference xxxxxxxx)</p> <p style="text-align: center;">Seat to Floor Interface Structure</p> <p style="text-align: center;">Primary Panel : 03 (Structures)</p>	<p>Issue: Draft</p> <p>Date: 14.07.2016 Page: 1 of 4</p> <p>Support Panel : ---</p>

STATUS: Open

CATEGORY: Acceptable Means of Compliance / Interpretative Material

REQUIREMENTS: CS 25.307, CS 25.561, CS 25.562

ADVISORY MATERIAL: ---

Next Action: **[Applicant]**

IDENTIFICATION OF ISSUE:

[Applicant] has applied for EASA approval of a **XXX** Interior Installation, utilising for some seat installations adapter plates or other forms of new interface structure between the seat and the existing aircraft floor. The intent of this CRI is to ensure a similar level of safety as would be achieved by the installation of the same seat to the original type design standard of seat track and floor.

There is evidence that typical aircraft floor structure will deform under minor crash conditions, so the requirements for seats under emergency landing dynamic conditions have consequently been developed to prevent detachment of the seat under floor deformation and for the seats to help absorb the energy developed in crash conditions. The 10° roll and 10° pitch required by CS 25.562 therefore helps ensure that the seat and the floor attachments will be designed to accommodate deformation.

Introducing a stiff adapter plate can move the problems created by floor deformation from the seat to track interface to the adapter to floor interface. The same level of safety is appropriate for the occupant of the seat whether it is installed in the aircraft with or without an adapter plate. The floor structure itself is not subject to the dynamic requirements of CS 25.562, therefore when additional structure such as an adapter plate is introduced to fix the seat to the floor it is very important to determine if that structure should be considered as part of the seat or part of the floor. The installation of any interface between the existing floor and the seat should not create a weak element between the seat and the existing airframe. This has successfully been assured for many VIP, first class and business class seat installations by testing the adapter with the seat according to the requirements of CS 25.562.

EASA accepts means of compliance for adapter plates based on FAA AC 25.562-1B, which allows classification of seat adapters as plinths or pallets. Plinths are subject to CS 25.562 compliance and pallets (traditionally defined as large adapters) are not, except for the attachment of the seat to the pallet. FAA Policy Memo PS-ANM100-2000-00123 suggests it may also be possible to classify some smaller adapters as an integral part of the floor as follows:

“Generally speaking, adapters of the size that contain a single row of seats (whether they are individual seat places or a common assembly), and mount into seat tracks, should be treated as part of the seat for purposes of certification in accordance with § 25.562. Larger, or more integrally mounted adapters, should be assessed to determine whether they should be treated as part of the floor for purposes of certification in accordance with § 25.561.”

To treat an adapter or other new interface structure as part of the floor when it does not appear to be similar to conventional floor structure, the applicant must substantiate that the adapter plate or any other structure installed between the existing floor and the seat attachment will not constitute a weak element under minor crash conditions. As also stated in the FAA policy memo, the issue is whether the critical interface is between the seat and the adapter, or between the adapter and the aircraft. No further detail guidance is provided in the FAA Policy Memo to assist with the assessment required to make the classification of an adapter as part of the floor.

Where the proposed floor design utilises a plate above the existing floor or otherwise significantly differs in concept from the type design’s existing methods of floor construction, geometries and utilisation of load paths, it is not adequate to rely on compliance with CS 25.561 alone, to determine if the adapter plate may be considered as part of the floor. EASA has therefore developed some general guidance on an acceptable process to use in these circumstances. EASA does not intend to request a complete crash scenario evaluation, but requires evidence that the adapter plate and associated new under floor structure will not degrade the level of protection compared to that offered by the seat if it were installed directly on the existing OEM seat track and floor construction. For the adapter plate to be considered sufficiently integrated to be part of the floor, the adapter plate should be capable of accommodating floor deformation and be able to safely react and distribute the seat loads into the aircraft.

EASA POSITION (Issue 1 dated xxxxx)

There are three options provided for the seat to floor interface with corresponding means of compliance. In each case the applicant is requested to show that any interface between the existing floor and the seat will not create a weaker element between the seat and the existing airframe than would exist for a CS 25.562 compliant seat attached directly to the standard floor e.g. seat track.

Acceptable means of assessing seat installations using adapter plates and floor modifications to determine the substantiation approach required for certification:

Option 1

- The adapter is classified as a plinth following AC 25.562-1B.
- Compliance with CS 25.561 & CS 25.562 must be shown.
- The plinth must be tested as part of the seat according to CS 25.562.
- Guidance of AC 25.562-1B and CS-25 AMC 25.307 may be used to reduce the number of tests based on design similarity.

Option 2

- The adapter is classified as a pallet due to its size following AC 25.562-1B.
- The seat and its attachments to the pallet only are tested according to CS 25.562
- The pallet is justified against CS 25.561

Option 3

- The new seat to floor interface structure is proposed to be classified as an integral part of the floor based on one of the methods described below.
- If classification as part of the floor is agreed with the Agency, the seat and its attachments to the new structure are tested according to CS 25.562 and compliance to CS 25.561 is shown for the whole installation.

Acceptable methods to be used in support of Option 3, allowing classification of new seat to floor interface structure as an integral part of the floor structure:

- Method 1 A design review showing the new floor design for seat installation uses the same or equivalent design principle as the original floor provided in the Type Design. If the pre-existing floor design used seats directly attached to seat track independently of the floor panel then the introduction of a structural floor panel to which a seat is attached would represent a change in design philosophy and a different method (e.g. 2 or 3) would need to be used to support Option 3.
- Method 2 A detail design review showing the level of integration of the plate to the floor, including the redundancy and strength of the attachments are acceptable to the Agency based on the experience of the applicant and the Agency with similar designs.
- Method 3 Analysis supported by test. This method is not a requirement, being at the option of the applicant; nor does it infer the need for multiple tests as may be necessary under Option 1. If selected as a method, the evaluation should address the most critical installation as agreed with the Agency. If successful, this assessment will allow the applicant to justify a family of interface designs to be integral floor structure provided they remain similar in design and load level. If neither Method 1 nor 2 is applicable, further evaluation of the adapter plate and attachments may be performed by the applicant according to a plan agreed by the Agency to determine if the adapter can be considered integral to the floor. Analysis supported by test should be performed accounting for floor deformation and the stiffness of the seat (10° pitch and 10° roll maximum, unless the existing floor design is shown to fail sooner) combined with the 16g seat test measured peak dynamic load applied statically. The contribution of the new interface structure to the stress levels of the existing floor structure during floor deformation should be evaluated first. The strength of all new attachments must be evaluated in a rational or conservative manner considering local out of plane bending effects and detailed load distributions in bolt groups. It should be noted that unless the analysis is demonstrably conservative by comparison to similar designs, testing will be required as previous investigations have shown that analysis alone of adapter plate interface attachments can be unreliable.

General

When assessing the design the following points should be considered by the applicant and the Agency.

The modified structure may be evaluated using AMC 25.307 to categorise the structural elements as new, similar-new or similar. Comparison can be to the existing TCH floor design (Method 1) or to designs that the applicant has previously substantiated according to methods 2 or 3.

An adequate number of appropriately distributed attachments between the adapter plate and the aircraft floor structure must be provided to assure that the additional structure behaves as an integral part of the aircraft floor. The appropriate number, strength and degree of redundancy of the attachments will depend on the design of the adapter plate and positioning of the seats on the plate.

Method 3 is not providing an alternative means of compliance with CS 25.562(b) even if the evaluation borrows from the concepts of that requirement. Some may question whether this approach to the classification of the adapter could also be used to also show compliance with CS 25.562. However, if an adapter is classified as a plinth then there are other considerations to be made before static analysis and test of the adapter plate can be used in place of dynamic test. EASA has accepted static testing of some forms of plinth in support of compliance of certain seat installations with CS 25.562(b) under the control of a CRI and may develop more guidance material on that subject in the future. EASA has not adopted FAA Policy Memo PS-ANM100-2000-00129, Acceptable Interim Approach for Near Term Executive Interior Deliveries for Multiple Single Seats Mounted to an Adapter-Plate.

Clearly a considerable degree of engineering judgement is required when making the classification of the structure and when there is any doubt about the capability of the proposed adapter design to act as an integral part of the floor it will be classified as a plinth and dynamic testing of the seat and adapter plate together will be required according to the normal practice of CS 25.562(b) and AC 25.562-1B.

[APPLICANT] POSITION (Issue xxx):

CONCLUSION:

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