

SUBJECT : **Expandable Pelvic Restraint**

REQUIREMENTS incl. Amdt. : CS 25.561, CS 25.562, CS 25.785, CS 25.1529 Amendment 26

ASSOCIATED IM/MoC¹ : Yes / No

ADVISORY MATERIAL : SAE AS8043 "Torso Restraint Systems", March 1986
FAA AC 21-34 "Shoulder harness-safety belt installation", 4th June 1993

INTRODUCTORY NOTE:

The following Special Condition (SC) has been classified as important and as such shall be subject to public consultation in accordance with EASA Management Board decision 12/2007 dated 11 September 2007, Article 3 (2.) 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."

IDENTIFICATION OF ISSUE:

EASA has received an application for an STC on a large aeroplane that includes in its scope the installation of premium economy class seats. The seats are equipped with an expandable pelvic restraint including a design feature designated as Rotary Length Adjuster (RLA).

When the passengers bring the seat from the position for taxi, take-off and landing (TTL) into the recline position, the seat pan slides forward ("slouching"). As the pelvic restraint is attached to the seat spreader and not the seat pan, the pelvic restraint needs to be adjusted (lengthened) in order to avoid the application of excessive load on the passengers belly/ hip/torso while seated. The RLA provides this function and can be activated and deactivated by the seat occupant by pressing and releasing the recline button.

From the review of the design of the restraint system it is clear how certain functions of a typical restraint system, e.g. self-alignment capability, can be provided only in combination with the geometry and the design of the seat model under certification.

The minimum performance standards of ETSO C114 A1, ETSO C22g and, in turn, of ETSO C127b have not been developed taking into account a similar design.

Both ETSO C114 A1 and ETSO C22g prohibit that a pelvic restraint system incorporates an Emergency Locking Retractors (ELR) while they allow the use of Automatic Locking Retractors (ALR). The definition of ALR is given in paragraph 2.4.4.1 of SAE AS8043:

'A retracter incorporating adjustment hardware by means of a positive self-locking mechanism which is capable, when locked, of withstanding restraint forces.'

Paragraph 2.4.3 of SAE AS8043 includes the definition of 'adjustment hardware':

¹ In case of SC, the associated Interpretative Material and/or Means of Compliance may be published for awareness only and they are not subject to public consultation.

'Any hardware designed for adjusting the size of a torso restraint system to fit the user, including such hardware that may be integral with a buckle, attachment hardware, or retractor.'

The RLA is compatible with the definition of ALR and of adjustment hardware but has the novel feature of being activated by the passenger by pressing the button of the recline system.

The specifications of CS-25 are not adequate to address this novel feature, and therefore, as per point 21.B.75 of Part 21 (Annex I to Regulation (EU) No 748/2012), special conditions have to be introduced to ensure that the installation of a seating system equipped with an RLA on large aeroplanes provides a level of safety equivalent to that of the applicable certification specifications.

Considering all the above, the following Special Condition is proposed:

Special Condition

Expandable Pelvic Restraint

1. The harness system must meet the Technical Conditions specified in Section 3 of ETSO C114 A1, Torso Restraint System, dated 12th July 2013.
2. Protection of Occupants other than 50th Percentile
A range of stature from a two-year-old child to a ninety-five percentile male shall be considered in the design and evaluation of the torso restraint system. In addition, it shall be demonstrated that the expandable pelvic restraint does not introduce any hazard when:
 - i. The seat occupant is holding an infant, including the case where a supplemental loop infant restraint is used;
 - ii. the seat occupant is a child in a child restraint device;
 - iii. the seat occupant is a pregnant woman.
3. The seating system must be designed to ensure that the activation of the Rotary Length Adjuster (RLA) is prevented during taxi, take-off, turbulence and landing.
4. The effects of manufacturing tolerances and of wear and tear on the RLA mechanism must be considered with respect to performance of the system in dynamic testing conducted to meet CS 25.562.
5. The Aircraft Flight Manual must include any limitations and procedures that may be necessary to ensure that proper use is made of the torso restraint system provided with the expandable pelvic restraint.

Interpretative Material to Special Condition SC-D25.785-01

The associated Interpretative Material is published for awareness only and is not subject to public consultation.

1. All the components of the seating system that contribute to meeting the Technical Conditions specified in Section 3 of ETSO C114 A1 should be considered as part of the harness system when demonstrating compliance with the special conditions SC-D25.785-01.
2. In order to evaluate the effects of wear on performance of the torso restraint system in dynamic testing, the RLA should undergo cyclic testing before being exposed to CS 25.562 test conditions. **The cyclic tests should be performed on the seating system equipped with the expandable pelvic restraint system rather than at component level.** In the cyclic tests, the RLA should be operated in the range between maximum extension and retraction of the pelvic restraint. The minimum number of cycles to be performed should be established considering the likely use of the system in service and the frequency of the applicable maintenance tasks. **Design review of the RLA is an acceptable method to review the impact that the manufacturing tolerances may have on the RLA performance in dynamic testing.**
3. **The intent of SC 3 is to ensure that the installation of the expandable pelvic restraint system does not result in any degradation of the level of safety with respect to what is offered by a conventional restraint system. A design that allowed the deactivation of the RLA during taxi, take-off, turbulence and landing would clearly meet the intent of the special condition.**
An alternative compliance approach could be based on the demonstration that the design of the expandable pelvic restraint system is robust enough to:
 - a) allow the occupant of the seat to detect any slack of the restraint system;
 - b) allow the cabin crew members to easily detect any manipulation or improper use of the restraint system during the checks that are made before take-off, before landing and whenever the ‘fasten seat belts’ signs are illuminated;
 - c) prevent inadvertent actuation of the RLA by the passenger during taxi, take-off, turbulence and landing.**The AFM should include the limitations and procedures that may be necessary to meet SC 3. In no case should limitations and procedures compensate for deficiencies in the design of the expandable pelvic restraint system.**
4. The torso restraint system should pass the relevant environmental tests of DO-160G. In particular, the RLA should be protected from external contamination that could occur on or around passenger seating.
5. The installation of seating systems including torso restraint system equipped with RLA has an impact on the Operational Suitability Data – Cabin Crew Data (OSD-CCD). It should **therefore** be ensured that:
 - a. cabin crew members receive training on how to ensure safe operation of the system and
 - b. every occupant of a seat equipped with an expandable pelvic restraint is briefed on how to make proper use of the system by means of placard, **safety** briefing card or briefing provision.