

Proposed Special Condition on “Normal Load Factor limiting System”

Applicable to Airbus A350-941

Introductory note:

The following 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 12/2007 dated 11 September 2007, 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

Traditional aircraft are limited in the pitch axis regarding load factor capability only by aerodynamic capability of the wings and of the elevator surface. Thus traditional aircraft may have a flight domain (high speed, low altitude, low weight, aft Cg) wherein manoeuvrability in excess of the structural load factor limits defined by CS 25.333 is possible, but have also a flight domain where manoeuvrability is well below the structural load factor limits as defined by CS 25.333 (low speed, high altitude, high weight, forward Cg).

The load factor capability required for conventional aircraft is not explicitly addressed in the CS 25, and the need to define it was not found necessary as considered indirectly addressed through several handling qualities requirements regarding manoeuvrability in the CS 25.

As the A320, A330/A340 and A380, the A350 has a normal load factor limiting feature implemented in the flight control laws within the whole flight domain, which limits the load factor capability within or well inside the structural load factor range defined by CS 25.333 for negative load factors. At high speed the load factor in the negative sense can be limited to values less than -1g due to high speed protections. At low speed, the load factor in the negative sense can also be limited to values less than -1g, as for a conventional aircraft, but due to pitch and stall protections for instance. Nevertheless, the CS 25 including and up to Amdt. 8 does not reflect the use of normal load factor limiting features, and therefore a special condition is used in accordance with Part 21A.16B(a)(1) to address this unusual design feature, and to correctly adapt the requirement at high and low speed in a consistent level of standard with the manoeuvrability that could be expected from a conventional aircraft.

Similar special conditions have already been proposed for previous Airbus aircraft (A320, A330/A340 and A380) but the positive and negative limiting load factors have always been defined in accordance with the flight manoeuvring envelope as defined by JAR/CS 25.333(b). Nevertheless, the experience from recent certification projects (A380) has shown that the maximum reachable negative load factor may be further limited by flight control system characteristics or flight envelope protections other than the load factor limitation as it would be for a conventional aircraft at low speed due to the aerodynamic capability of the horizontal tail plane.

Airbus A350-941 - Special Condition B-06

- Normal Load Factor Limiting System -

Add a new paragraph CS 25.143 (o) to read as follows:

CS 25.143 General

(o) In the absence of aerodynamic limitation (lift capability at AoA max):

- 1) The positive limiting load factor must not be less than:
 - a) 2.5g for the EFCS normal state with the high lift devices retracted up to VMO/MMO. The positive limiting load factor may be gradually reduced down to 2.25g above VMO/MMO.
 - b) 2.0 g for the EFCS normal state with the high lift devices extended.
- 2) The negative limiting load factor must be equal to or more negative than:
 - a) minus 1.0 g for the EFCS normal state with high lift devices retracted.
 - b) 0 g for the EFCS normal state with high lift devices extended.

Maximum reachable positive load factor wings level may be limited by flight control system characteristics or flight envelope protections (other than load factor limitation) provided

- That the required values are readily achievable in turn and
- that wings level pitch up responsiveness is satisfactory

Maximum reachable negative load factor may be limited by flight control system characteristics or flight envelope protections (other than load factor limitation) provided:

- pitch down responsiveness is satisfactory
- From level flight, 0g is readily achievable or at least a trajectory change of 5°/s is readily achievable at operational speeds (From Vls*, to Max speed-10kt**)

Compliance with CS 25.337(d) should be established for positive limiting load factor gradually reduced down to 2.25g above VMO/MMO.

Compliance demonstration with the above requirements may be performed without ice accretion on the airframe.

* Vls is the lowest speed that the crew may fly with auto thrust or auto pilot engaged. It is displayed on primary flight displays as the top of the low speed amber band, and is the lower end of the normal flight envelope.

**Max speed-10kt is proposed to cover typical margin from VMO/MMO to cruise speeds and typical margin from VFE to standard speed in high lift configurations