

Deviation on CS 25.1193 - “Engine cowl retention”

Applicable to Boeing 737-8 and 737-9

Introductory note:

The following Deviation 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

In-service experience on large transport airplanes shows a large number of events of fan cowl loss separation and prompted EASA to introduce a Special Condition (see appendix 1).

On the B737-7 / B737-8 / B737-9 programmes, this specific requirement (Special Condition and associated Interpretative Material) was introduced by CRI E-05/MAX.

Design, test and certification of the final concept to show compliance with the Special Condition cannot be synchronized with completion of certification activities of the B737-8 and B737-9. Therefore those latest aircraft models cannot be compliant at time of type certification.

Boeing has then requested EASA to grant a Temporary Deviation to allow the B737-8 and B737-9 aircraft models and future design changes being certified.

Temporary Deviation E-30MAX - CS 25.1193 amended by Special Condition E-05/MAX - “Engine cowl retention”

Applicable to Boeing 737-8 and Boeing 737-9

In order to comply with the following requirement :

CS 25.1193

(f) The retention system for each removable or openable cowling must— ...

(3) Have a reliable means for effectively verifying that the cowling is secured prior to each take-off. ...

Note 2: typically, for turbofan, the cowling addressed under this Special Condition are fan cowling; thrust reverser cowls have shown a satisfactory in-service experience and are not intended to be addressed under the requirements of this special condition.

Boeing has modified the design of the fan cowl latches for the 737-8 and 737-9 to significantly improve indication of opened fan cowl by introducing an extended fan cowl latch handle.

Nevertheless, this design improvement is deemed not sufficient to show compliance with the Special Condition and additional design features need to be implemented to improve awareness of a non-closed and latched fan cowl.

At this point in time it is not possible for Boeing to design, test and certify those additional design features as part of the 737-8 or 737-9 type certificates or future planned design changes.

Boeing 737-7 being chronologically certified later than B737-8 and B737-9, the B737-7 TC will include all design features achieving the full compliance with the Special Condition at entry into Service.

The final design solution defined for the 737-7 aircraft model will be embodied on the B737-8 and B737-9 with the objective to have all B737-8 or B737-9 (newly produced or already in-service) fully compliant before 30 June 2021.

In conclusion, the Temporary Deviation, identified E-30MAX, against CS 25.1193 (f)(3) requirement, is granted by EASA for the B737-8 and B737-9 aircraft models until 30 June 2021.

Appendix 1

Disclaimer : *This appendix is not intended to be commented. It is reproduced to give background to the Temporary Deviation.*

Special Condition on CS 25.1193 - "Engine cowl retention"

Issue 1

Applicable to Large Aeroplane

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

In-service experience shows a number of events of fan cowl loss separation. Most of the time, it has been possible to trace the initiating factor of the cowl separation as being a maintenance error, generally resulting from failure of maintenance crew to properly close the fan cowl latches. Flight crews were not able to detect this situation during their pre-flight walkaround or check, the cowl being liberated due to air scooping during the subsequent take-off run or during climb.

Such events are not unique to the Airbus Single Aisle family, and similar records exist on other aircraft. FAA had issued NPRM 89-25 proposing the introduction of cowl latch retention requirements, including cockpit indication for unclosed latches. The final rule was however never published.

Considering this adverse in-service experience and the potential consequences associated with fan cowl separation, EASA made the determination the most appropriate course of action was to introduce a Special Condition, as per the provision of 21A.16B(a)3, introducing specific requirements for fan cowl retention.

In developing this Condition, the following items have been considered :

- Fan cowl liberation constitutes an unsafe condition.

Fan cowl door separation can result in hazards to third parties (on ground or as a result of part liberation on airport surface including runways) and to the event aircraft itself, damaging structure and systems. It cannot be excluded the cowl will become wrapped around the engine pylon, the wing or tailplane leading edge, causing unforeseen aerodynamic perturbations, or cause severe damages on the airframe as a result of the impact, including depressurisation.

In-service events are therefore normally considered as potential unsafe condition. For this reason, the EASA (or its ancestors, DGAC or JAA) have issued Airworthiness Directives introducing design improvements, generally intended at increasing the visibility of latches left open for maintenance or flight crews. Other authorities, including FAA, have also issued ADs for the products under their responsibility.

- Human factor considerations.

Since most – if not all – events reported appear associated with “maintenance error”, typically failure to properly and completely close the fan cowl latching system, addressing the issue by reliance on training or improved maintenance procedures and standards could appear as the solution. Indeed, EASA is aware some affected operators have introduced improved procedures and reinforced maintenance staff training and awareness; some operational authorities have mandated double, independent checking of cowl effective closure after any maintenance action involving their opening. Despite those measures, fan cowl separation are still seen in service and it appears that along with proper maintenance practices and procedures, the solution to this issue involves action at the design level. It cannot be expected a design can cope with any maintenance abuse; however, it shall minimise the risk associated with the normal maintenance practices in the current airline environment.

- Practical design solutions.

The in-service experience accumulated with the Airbus Single Aisle family, including with recent airframes or airframes which have been retrofitted with modifications listed above, still shows fan cowl loss separation events, despite the changes introduced. This would tend to indicate individual latches, even if they are maintained open when unlatched by specific design features such as hold open devices or dedicated weight, do not provide a sufficient clue to maintenance and/or flight crews allowing them to detect the fan cowl is partially or totally unlatched, a bigger, more obvious indication is required. Some powerplant installations feature more conspicuous devices, for instance feature doors covering the fan cowls latches (sometime dubbed Latch Access Panel, LAP), and have indeed a much better in-service record. However LAP, or similar design features, might not be feasible on all installations, depending for instance on the nacelle geometry and/or the ground clearance.

Cockpit indications for fan cowl latching/unlatching, as proposed by FAA NPRM 89-25, have not been introduced yet. It might nevertheless prove a viable alternative if the above mentioned design features, such as LAP, are not feasible.

- CS 25 requirements

A review of applicable CS 25 provisions has highlighted the lack of specific requirements addressing cowl latch system or cowl retention. After a thorough review EASA determined the requirements of CS 25.783 might not be adapted for fan cowls. This lack of suitable requirements had prompted the FAA to issue NPRM 89-25, issued on 19 September 1989. This NPRM introduced a full set of cowls retention design criteria, including vibration, inertia loads, overpressure, and also the need for a cockpit indication before take-off that the cowling is not properly closed and locked.

Considering the above (lack of requirement, established need for design feature addressing cowl retention including likely maintenance errors), the Special Condition presented below is proposed.

Large Aeroplane - Special Condition E-xx
- Engine cowl retention – CS 25.1193 (e)(4) & (f)

Add to CS 25.1193 the following material:

CS 25.1193 Cowling and nacelle skin.

* * * * *

(e) Each aeroplane must--

* * * * *

(4) Be designed and constructed to minimize any inflight opening or loss of fan cowling which could prevent continued safe flight and landing.

(f) The retention system for each removable or openable cowling must—

(1) Keep the cowling closed and secured under the operational loads identified in paragraph (a) of this requirement following each of these specific conditions:

(i) Improper fastening of any single latching, locking, or other retention device, or the failure of single latch or hinge; or

(ii) (Reserved)

(2) Have readily accessible means of closing and securing the cowling that do not require excessive force or manual dexterity; and

(3) Have a reliable means for effectively verifying that the cowling is secured prior to each take-off.

Note 1: all dispatch configuration (MMEL and CDL) shall be considered for showing compliance with this Special condition.

Note 2: typically, for turbofan, the cowling addressed under this Special Condition are fan cowling; thrust reverser cowls have shown a satisfactory in-service experience and are not intended to be addressed under the requirements of this special condition.