



**European Aviation Safety Agency  
Rulemaking Directorate**

**EXPLANATORY NOTE**

**CS-E Amendment 2**

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**1. GENERAL**

Executive Director Decision 2009/018/R amends Decision No 2003/09/RM of 24 October 2003 (CS-E Initial Issue) as last amended by Executive Director Decision 2007/15/R of 3 December 2007 (CS-E Amendment 1). It represents Amendment 2 of CS-E Engines and incorporates the output from the following EASA rulemaking tasks:

<b>Rulemaking Task No.</b>	<b>TITLE</b>	<b>NPA No.</b>
25.015/25.016	Engine & Auxiliary Power Unit (APU) Failure Loads And Sustained Engine Windmilling	2007-15

Each Notice of Proposed Amendment (NPA) has been subject to consultation in accordance with Article 52 of the Basic Regulation<sup>1</sup> and Article 15 of the Rulemaking Procedure established by the Management Board<sup>2</sup>. For detailed information on the proposed changes and their justification please consult the above NPAs which are available on the Agency's website.

The Agency has addressed and responded to the comments received on each of the NPAs. The responses are contained in a comment-response document (CRD) which has been produced for each NPA (CRDs 2007-15) and which is also available on the Agency's website.

**2. CRD REACTIONS**

In response to the CRD 2007-15, the Agency received the following substantive comments related to proposed changes to CS-E, which are reproduced below together with the Agency's responses:

<sup>1</sup> Regulation (EC) No 216/2008 of the European Parliament and of the Council of 20 February 2008 on common rules in the field of civil aviation and establishing a European Aviation Safety Agency, and repealing Council Directive 91/670/EEC, Regulation (EC) No 1592/2002 and Directive 2004/36/EC (OJ L 79, 19.03.2008, p. 1).

<sup>2</sup> Management Board decision concerning the procedure to be applied by the Agency for the issuing of opinions, certification specifications and guidance material ("Rulemaking Procedure"), EASA MB 08-2007-03, 13.6.2007.

CRD Comment No.	Commenter	Comment	EASA Response
5	Francis Fagegaltier Services	<p>If we understand the response correctly, the EASA position is that the likelihood of suffering a 1 IDF condition and having to complete a diversion of greater than 180mins is considered Extremely Improbable. There is, therefore, no requirement under CS-25.1309 for the Aircraft Constructor to demonstrate acceptable aircraft characteristics for such events since the Aircraft Catastrophic effect will occur at an acceptably low rate. This was the conclusion of a substantial effort expended by both Industry and Authorities in developing FAA AC25-24.</p> <p>However, this seems contrary to the Engine regulation (CS-E525):</p> <p><i>If any of the Engine's main rotating systems will continue to rotate after the Engine is shutdown <b>for any reason while in flight</b>, and means to prevent that continued rotation, are not provided, any continued rotation <b>during the maximum period of flight</b> and in the flight conditions expected to occur with that Engine inoperative must not result in effects that would be unacceptable under CS-E 510.</i></p> <p>...and its associated advisory material (AMC E525):</p> <p><i>Conditions that should be considered and addressed...should include... Rotor unbalance resulting from <b>blade loss and subsequent rotor damage</b>. Consideration should be given to <b>extended periods of continued rotation</b> under these conditions in conjunction with the assumed flight envelope with one Engine shut down, including, where applicable, supersonic and supersonic to subsonic transition flight conditions.</i></p> <p>Unlike the proposed AMC25-24 §5 (c)(1), CS-E525 assumes that the failure (in this instance, a 1 IDF</p>	<p><b>Partially Accepted</b></p> <p>The duration of the windmilling event to be considered should cover the expected diversion time of the aeroplane. In the event that the diversion time exceeds 180 minutes then, for a 1 IDF failure condition, it has been determined based on service data that this equates to a probability of less than 10<sup>-9</sup> /flight hour. The failure condition is therefore extremely improbable and consideration of diversion times greater than 180 minutes is unnecessary as the failure condition is so unlikely to occur during the entire operational life of the fleet. This was the position taken by the WG who developed these proposals and is fully harmonised with FAA.</p> <p>It is recognised that this approach creates an inconsistency with current engine design philosophy which assumes blade loss as a particular risk (probability=1) and requires the engine applicant to demonstrate that no hazardous engine effects are present throughout the full duration of the diversion. This has developed from an historical difference in approach and will create an additional margin on the engine structure. However, the impact on engine applicants of maintaining this additional margin for diversion times beyond 180 minutes is considered to be insignificant in terms of engine design or costs.</p>

	<p>blade release [in accordance with CS-E810]) has already taken place. It is now incumbent on the Engine Applicant to demonstrate that no Engine Hazardous effect occurs (in this case, the most likely effect of concern would be separation of the engine from the airframe) for the full duration of any declared diversion capability, regardless of the likelihood of the event.</p> <p>There appears, therefore, to be a disparity between the obligations of the Engine and Aircraft constructors. This could lead to the unsupportable situation where the Aircraft side of an engine mount has to be designed only to survive &lt;180min diversion at 1 IDF whilst the Engine side of the same mount has to be designed to survive 345min (from a recently Approved example) diversion at 1 IDF. It is not unusual that the engine requirements are set so as to provide some margin but this difference does not seem justifiable.</p> <p>We also note the draft decision amending CS-25 (as proposed in NPA 2008-01) which states...</p> <p><i>CS 25.1535 ETOPS approval</i></p> <p><i>Each applicant seeking approval for ETOPS must:</i></p> <p><i>(a) Comply with the requirements of CS-25 considering the maximum mission time and the longest diversion time for which approval is being sought...</i></p> <p>We would appreciate the Agency's views and advice on:</p> <ol style="list-style-type: none"> <li>1. Whether or not the apparent discrepancies between Engine and Aircraft requirements are genuine and, if so, are felt to be justified (and why).</li> <li>2. Whether or not the proposed text for CS-25.1535 is consistent with the proposed text for AMC25-24 §5 (c)(1).</li> </ol> <p>If the above reveals an inconsistency which is not justified:</p>	<p>For ETOPS approval under proposed CS 25.1535, the windmilling condition is not specifically referenced. However, this will be clarified through a new AMC 25.1535(a).</p> <p>Responding to the specific questions, the following can therefore be summarised:</p> <ol style="list-style-type: none"> <li>1) The discrepancy has arisen from an historical difference in approach between engine and airframe regulation.</li> <li>2) The text of proposed CS 25.1535 will be clarified through an addition to AMC 20-6.</li> <li>3) The difference is considered to be insignificant in terms of its impact on engine design or costs.</li> <li>4) See 2).</li> </ol>
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		<p>3. What action will be taken to reach a position which imposes common/consistent requirements on both Aircraft and Engine constructors?</p> <p>4. Assuming the Decisions from NPAs 2008-01 and 2007-15 are accepted into the CSs as written, how are these requirements to be interpreted in the meantime?</p>	
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**3. EDITORIAL CORRECTIONS IN CS-E AMENDMENT 2**

Apart from the changes that resulted from the above NPA, this Amendment 2 of CS-E also incorporates several changes aimed at removing certain editorial errors and inconsistencies identified. Their description/justification is as follows:

- In book 2 AMC E 140, the incorrect reference to CS-E 140(d)(3), which does not exist, is amended to CS-E 140(d)(1).
- For piston engines, the definitions of "Maximum Recommended Cruising Power Conditions" and "Maximum Best Economy Cruising Power Conditions" were deleted from JAR-E (Change 6) in 1990, with the intent of introducing them into JAR-1. However, the change to JAR-1 never took place and therefore the definitions do not appear in the current CS-Definitions. As these terms are still used in CS-E (CS-E 440), and only CS-E, they are therefore introduced into CS-E 15(d) using the original definitions.
- For piston engines, the definition of "Critical Altitude" was not transferred from JAR-1 Change 5 to the initial issue of CS-Definitions. As "Critical Altitude" is still used in CS-E (CS-E 440) with a specific meaning, but should not be confused with its use in other CS's, it is introduced into CS-E 15(d). The definition uses identical wording to the previous definition of JAR-1 Change 5.