European Union Aviation Safety Agency

Explanatory Note to ED Decision 2025/003/R

issued in accordance with Article 4(2) of MB Decision No 01-2022

Turbine-engine endurance and initial maintenance programme testing

Substantiation of piston-engine time between overhauls or replacements

‘CS-E Amendment 8’

RMT.0180

EXECUTIVE SUMMARY	
This Decision amends the Certification Specifications and Acceptable Means of Compliance for Engines (CS-E) to (1), for turbine engines, create provisions for an alternate endurance test that may be used for turbofan engines, and for a new test requirement for substantiation of an initial maintenance programme (IMP); and (2), for piston engines, create acceptable means of compliance to support the substantiation of a time between overhauls or a time between replacements if requested by the applicant. The objective is to modernise engine certification test requirements in order to: — take into account modern turbofan-engine design characteristics; — improve the level of confidence in the robustness of turbine-engine designs prior to entry into service by requiring a test to demonstrate the engine’s IMP; — ensure that EASA approves the IMP test compliance findings and benefits from the corresponding knowledge gained, including understanding the potential required corrective actions for when turbine-engine continuing airworthiness issues are discovered; — ensure a robust and harmonised substantiation of piston-engine time between overhauls (TBO) / time between replacements (TBR) intervals and the related maintenance programme; — increase harmonisation with the corresponding FAA regulations and certification policies. The regulatory material is expected to improve safety and have a positive economic impact.	
	ED DECISION AMENDED ED Decision 2003/009/RM – CS-E
AFFECTED STAKEHOLDERS Engine (turbine and piston engines) design organisations	
WORKING METHODS	

Development	**Impact assessment(s)**	**Consultation**
By EASA	Detailed	NPA – Public

RELATED DOCUMENTS / INFORMATION

- ToR RMT.0180, issued on 7 May 2021
- NPA 2023-06, issued on 21 June 2023
- CRD 2023-06, issued on 8 April 2025

PLANNING MILESTONES

Refer to the latest edition of Volume II of the *European Plan for Aviation Safety*[1].

[1] https://www.easa.europa.eu/en/document-library/general-publications/european-plan-aviation-safety-epas-2025

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1. About this Decision

1.1. How this regulatory material was developed

The European Union Aviation Safety Agency (EASA) identified the need to modernise the engine certification test requirements, and, after having assessed the impacts of the possible intervention actions and having consulted on those with the EASA Advisory Bodies, identified rulemaking as the appropriate intervention action.

This rulemaking activity is included in Volume II of the *European Plan for Aviation Safety* (EPAS) for 2025[2] under Rulemaking Task (RMT) 0180.

The draft regulatory material was consulted in accordance with the terms of reference (ToR) for this RMT with a public consultation through Notice of Proposed Amendment (NPA) 2023-06.

EASA reviewed the comments received and duly considered them for the preparation of the regulatory material presented here.

2 https://www.easa.europa.eu/en/document-library/general-publications/european-plan-aviation-safety-epas-2025

2. In summary – why and what

2.1. Why we need to act

EASA and industry have identified the need to modernise the turbine- and piston-engine certification test requirements in order to address the three issues described in Section 2.2 of NPA 2023-06: turbofan-engine endurance test, turbine-engine initial maintenance programme (IMP) test, and substantiation of piston-engine time between overhauls (TBO) / time between replacements (TBR).

2.2. What we want to achieve – objectives

The overall objectives of the EASA system are defined in Article 1 of the Basic Regulation. The regulatory material presented here is expected to contribute to achieving these overall objectives by addressing the issues mentioned in Section 2.1.

More specifically, with the regulatory material presented here, EASA intends to modernise the applicable engine certification test requirements in order to:

— update the turbine-engine endurance test specifications, taking into account modern turbofan-engine design characteristics;

— improve the level of confidence in the robustness of turbine-engine designs prior to entry into service by requiring a test to demonstrate the engine's IMP;

— ensure that EASA itself approves the compliance finding provided by the applicant for the IMP test and benefits from the corresponding knowledge gained, including understanding the potential corrective actions required when turbine-engine continuing airworthiness issues are discovered;

— ensure robust and harmonised substantiation of piston-engine TBO/TBR intervals and the related maintenance programme;

— increase harmonisation with the corresponding Federal Aviation Administration (USA) (FAA) regulations and certification policies.

2.3. How we want to achieve it – overview of the amendments

Issue 1: turbofan-engine endurance test

CS-E 740 (Endurance Tests) is amended. The amendment takes into account the recommendations contained in the report issued by the Engine Harmonization Working Group, entitled *Alternate Test to 14CFR33.87 Endurance Test*, Revision A, dated 31 March 2021. An alternate test for turbofan engines is made available to the applicant as an optional alternative to the current endurance test, as provided for in a new subparagraph (4) of CS-E 740(c). The alternate test demonstration is achieved by evaluating (via a critical point analysis of the product's design and intended use (operating envelope)) and defining a hybrid prescriptive/performance-based severity test for the engine. This will test the engine type design to its limiting speeds and temperatures (redlines) for type certificate limits. Furthermore, the test will evaluate the engine's capability to successfully run in close proximity to minimum speed and temperature margins (close to operating limits) as expected while in service, still operating at a severity level consistent with the intent of the classic endurance test prescribed by CS-E 740(c)(1) (or FAA 14 CFR section (FAR) 33.87).

The test will run more hours and cycles than the classic endurance test schedule, utilising a simulated flight cycle. Therefore, it will provide results that are more representative of responses to threats characteristic of revenue service, while also providing a test of the engine's capability at least as severe as intended by the classic test.

A new AMC E 740(c)(4) supports the demonstration of compliance with CS-E 740(c)(4). The acceptable means of compliance (AMC) provides a description of the alternate endurance test concept and of the critical point analysis that is expected to be conducted. It also deals with the methods to be used to demonstrate the severity equivalence between the alternate and classic endurance tests. Some alternate endurance test examples are provided to illustrate the comparative severity methodology.

In addition, the following amendments are made to ensure consistency of CS-E parts with the new specifications and AMC for alternate endurance testing.

— CS-E 690 (Engine Bleed) is amended to mention the alternate endurance test and account for the fact that this test does not prescribe testing stages.

— AMC E 650 (Vibration Surveys), AMC E 690 (Engine Bleed), AMC E 740(c)(2)(i) (Endurance Tests – 30-Minute Power Rating), AMC E 740(c)(3) (Endurance Tests), AMC E 740(h)(2) (Endurance Tests – Inspection Checks) and CS-E 890 (Thrust Reverser Tests) are amended to update a reference to a CS-E 740 subparagraph that has been renumbered.

— CS-E 730 (Engine Calibration Test) is amended to add a statement clarifying the purpose of the calibration test.

— In CS-E 740, several paragraphs are amended to refer to the alternate endurance test option. CS-E 740(b)(6) is created to address a Significant Standards Difference (SSD) between EASA and FAA airworthiness codes, related to FAR 33.87(a)(3) (note that this topic was initially addressed in NPA 2023-06 inside CS-E 740(h), but the text has nevertheless been modified and moved). CS-E 740(h) is amended so that it now addresses the engine performance target after test completion; as a consequence, the content of the former CS-E 740(h) is moved to the new CS-E 740(i).

— CS-E 740(f)(4)(ii) is created to specify how the Type Certificate Data Sheet (TCDS)-declared Exhaust Gas Temperature (EGT) operating limit temperatures are determined when using the alternate endurance test.

— CS-E 740(f)(4)(iv) is amended to include the possibility to obtain an approval for a transient exhaust gas temperature operating limit up to 30 seconds, in addition to the '2 minutes' option. This reflects the approvals granted on some certification projects using special conditions and also harmonises with the related content of FAA AC 33.87-1.

— CS-E 920 (Over-temperature Test) is amended to harmonise its content with FAA FAR 33.88, taking into a comment from the FAA.

Issue 2: turbine-engine initial maintenance programme (IMP) test

New CS-E specifications (i.e. CS-E 930) are created, considering the requirements under FAA FAR 33.90, but adapted to allow the applicant to demonstrate an IMP (instructions for continued airworthiness (ICA) submitted under CS-E 25). The initial maintenance inspection (IMI) approach is one method that the applicant may use. Other methods are allowed, in particular on-condition based maintenance programming. The applicant has to complete a test with an engine that adequately conforms to the type design to substantiate the IMP. The test must simulate the conditions in which the engine is expected to operate in service, including typical start–stop cycles.

A new corresponding AMC E 930 is created to support applicants when demonstrating compliance with the new CS-E 930 specifications. This AMC has been developed based on the FAA AC 33.90-1A (Initial Maintenance Inspection (IMI), FAA FAR 33.90, Test for Turbine Engines). It provides the possibility of combining the IMP test with the early ETOPS test (currently addressed in AMC 20-6B).

AMC E 930(c) has been added to provide information related to the applicability of CS-E 930 to changes to type certificate.

In addition, AMC E 25 (Instructions for continued airworthiness) paragraph 1 is amended to add a reference to the IMP test.

Issue 3: substantiation of piston-engine time between overhauls / time between replacements

A new paragraph (6) is created in AMC E 25 (Instructions for continued airworthiness) to indicate how applicants may substantiate a TBO/TBR and the associated ICA. Limited credit can be taken from the CS-E 440 endurance test alone. In order to go beyond this limitation, the substantiation requires running an engine cyclic durability test on an engine representative of the type design using a cycle profile that is based on estimated aircraft flight profiles. The number of cycles should be representative of the TBO/TBR intended to be declared and should represent a level of engine deterioration at least equivalent to that of an engine at the end of the intended TBO/TBR.

Editorial corrections

— Correct two references to CS-E 50(f) that are wrong and replace them by correct references to CS-E 50(j): in AMC E 20(f) Power assurance data for engines with one or more OEI power ratings and in AMC E 740(c)(3) Endurance Tests.

— Correct a wrong reference to CS-E 130(c) and replace it with a reference to CS-E 130(e): in AMC E 130 Fire Protection.

— In AMC E 320 Performance Correction, replace the obsolete reference to International Organization for Standardization (ISO) 1585:1992 by the current version of the standard, which is ISO 1585:2020.

Targeted applicability of the regulatory material (CS-E amendment)

The Decision will enter into force and apply on the day following that of its publication in the Official Publication of EASA.

2.4. What the stakeholders' views are

During the consultation of the ToR with the EASA Advisory Bodies (AB), some comments were provided by the technical committee representing the design and manufacturing industry. The comments were supportive of the proposed rulemaking. In particular, the introduction of an alternate endurance test in CS-E has been requested by engine manufacturers for years, and this was confirmed by their contribution to the work done in the Aviation Rulemaking Advisory Committee Engine Harmonization Working Group. The harmonisation with FAA FAR 33.90 IMI has also been welcomed. Some detailed technical recommendations were made, which EASA took into account during the drafting of the NPA.

During the NPA public consultation on the draft CS-E amendment, EASA received 147 comments from industry, EU national competent authorities, FAA and Transport Canada Civil Aviation (TCCA).

CRD 2023-06 provides a summary of the most substantial comments received and the corresponding EASA positions, as well as all detailed responses to all individual comments.

In addition, below are some highlights of stakeholders' views and EASA's corresponding responses.

Issue 1: alternate endurance test for turbofan engines

FAA underlined its support for introducing this test option and suggested improvements to the proposal.

Industry commentators made various suggestions to clarify or improve the proposed amendments. When considering these comments, EASA sought to reflect as much as possible the consensus reached by the Aviation Rulemaking Advisory Committee group report recommendations, which have been the basis used to draft the proposed amendment (refer to NPA 2023-06).

The proposed amendment to CS-E 870(b)(1) (Exhaust Gas Over-temperature Test) (possibility of performing a five-minute test as part of an alternate endurance test) has been considered by several industry commentators impractical or unclear in terms of test conditions. EASA accepted these positions, and the draft amendment has therefore been withdrawn. Furthermore, EASA decided to harmonise CS-E 920 (Over-temperature Test) with FAR 33.88.

Issue 2: turbine-engine IMP test

FAA welcomed the harmonisation with FAR 33.90.

Industry commentators made various suggestions to clarify or improve the proposed amendments. The specificities of helicopter engines have been considered and reflected.

Issue 3: substantiation of piston-engine time between overhauls / time between replacements

TCCA considers the TBR concept not compatible with the engine ICA concept. EASA, however, considers that it is consistent with CS-E 25(c)(5). AMC E 25 is now amended to include a section (6) supporting the demonstration of a TBR value.

TCCA also recommended requiring a TBO/TBR demonstration in CS-E 25, referring to a safety recommendation. EASA does not agree. The applicants should decide if they wish to establish such recommended maintenance actions, and if so decided they can use the corresponding AMC E 25 provisions.

3. Expected benefits and drawbacks of the regulatory material

The expected benefits and drawbacks of the CS-E amendment are summarised below. For the full impact assessment of the alternative options, please refer to Appendix 1 (Impact assessment) of NPA 2023-06.

It will have the following effects for turbine engines.

— It will improve the robustness and the representativeness of turbofan-engine endurance testing, thereby reducing the number of continuing airworthiness issues, including less potentially hazardous or catastrophic failure conditions at the aircraft level. It will also ease EASA's continued airworthiness oversight of turbine engines thanks to better involvement in the IMP testing activities. This should result in an improvement of safety with a reduction in the number of design-related issues, and more efficient management of the corrective actions when such issues appear.

— The overall economic impact for applicants and EASA, if they use the alternate endurance test when the classic test is not adapted, is positive. The impact of the new IMP specification is also positive (ease of validations). A negative economic impact could be induced for applicants who intend to get only EASA type certificates without voluntarily running an IMP test (which is considered improbable).

It will have the following effects for piston engines.

— It will implement in CS-E the content of the most recent means of compliance certification review items approved by EASA (equivalent to the corresponding FAA policy statement) to improve the robustness of the TBO/TBR substantiation. It is expected that this will improve safety by reducing the number of design-related failures occurring before the engine overhaul.

— The economic impact is neutral, as the amendment does not universally mandate additional tests. Applicants can base the TBO on the endurance test only, but with a limit applied to the TBO/TBR that they can substantiate. This is already what is done according to the last means of compliance certification review item.

No other impacts have been identified.

4. Monitoring and evaluation

EASA will assess the implementation of the amended CS-E through:

— the experience gathered during CS-E certification projects carried out after the issuing of the CS-E amendment;

— the monitoring ensured as part of the normal continuing airworthiness process that is followed by EASA and type certificate holders; and

— the investigation of occurrences (incidents and accidents) and the analysis of safety recommendations from designated safety investigation authorities.

5. Proposed actions to support implementation

No specific action.

6. References

— Engine Harmonization Working Group (EHWG) report, dated 31 January 2017.[3]

— Engine Harmonization Working Group (EHWG) report Revision A, dated 31 March 2021.[4]

[3] Advisory and Rulemaking Committees – Engine Harmonization Working Group - Engine Endurance Testing Requirements

[4] Advisory and Rulemaking Committees – Engine Harmonization Working Group – Revised Final Recommendation Report; 150 Hour