

	European Aviation Safety Agency	Turboshaft Engines Approval of 30-minute Take-off Power Rating	Issue: 1 Page 1/3 Date: 09.02.2011
Special Condition			

Subject: Approval of Turboshaft 30-minute Take-off Power Rating
Requirement Reference: Following CS-E¹ requirements: CS-E 20, CS-E 25, CS-E 40, CS-E 60, CS-E 515 and CS-E 740

¹ CS-E – Certification Specifications for Engines, Amendment 3, dated 23 December 2010

This Special Condition needs to be raised for the approval of an additional rating for turboshaft engines. This rating allows helicopter hovering at increased power for a limited time and is not currently defined in CS-E 40.

Statement of Issue:

This Special Condition defines the requirements for certification of a rating “30-minute Take-off Power” rating for a turboshaft engine, which covers prolonged helicopter hovering out of ground effect. This rating is intended to be used for periods of up to 30 minutes at any time between the take-off and landing phases in any flight without requiring additional post-flight maintenance.

In accordance with Part 21A.16B, as there are no CS-E requirements covering such rating, a Special Condition is necessary. The following requirements are affected: CS-E 20, CS-E 25, CS-E 40, CS-E 60 and CS-E 740.

Discussion:

The first request to the Agency for the certification of such a rating was in 1997. Since then, there have been several more requests, and each has been the subject of a Special Condition under a Certification Review Item (CRI) written specifically for the particular programme. The Agency anticipates further requests in the future and has therefore developed this Special Condition to ensure consistency in the requirements for certification of the rating.

In the past this rating has been called:

- AEO (All Engine Operative), generally in the case of multi-engine rotorcraft and/or
- HIP-SARM (Hovering at Increased Power for Search and Rescue Missions), generally in the case of single-engine rotorcraft

With regard to power requirements, the rating is equivalent to the Take-off rating.

CS-E provides requirements for a number of engine ratings. “Take-off” and “Maximum Continuous” ratings (referred to as “Standard ratings”) are listed in CS-E 40(a); “Other ratings” are listed in CS-E 40(b). In particular, CS-E 40(b)(3) lists One Engine Inoperative (OEI) ratings, applicable to Turbine Engines for Multi-Engine Rotorcraft. The requirements and associated usage limitations and conditions for these OEI ratings are clearly described in CS-Definitions and CS-E 20, CS-E 25, CS-E 40, CS-E 60 and CS-E 740.

Endurance Tests

As background information, the following table is a reminder of the test times required by CS-E 740 at the Take-off rating, as well as at the 30-minute OEI and Continuous-OEI ratings if those ratings are requested by the Applicant. It also shows the time required at continuous periods of minimum 30 minutes:



Special Condition

Time at ratings for Endurance Test (hours) Ref: CS-E 740 (c)(1)&(2)	Take-off	<i>of which time for continuous 30 min periods</i>	30-min OEI	<i>of which time for continuous 30 min periods</i>	Continuous OEI	<i>of which time for continuous 30 min periods</i>
"Standard ratings" only	18,75	5				
- with 30-min OEI only	18,75	5	12,5	12,5		
- with Cont-OEI only	18,75	5			25	25

Notes:

- 30-Second and 2-Minute OEI ratings are not quoted in the table as they are usually at higher power levels and are associated with mandatory inspections and/or maintenance actions
- With regard to the 2½-Minute OEI rating, CS-E 740 requires replacing 2 hours and 5 minutes at Take-off rating by 2 hours and 5 minutes at the 2½-Minute OEI rating

In order to cover the Endurance Test safety objectives for the "30-minute Take-off Power" rating, the Applicant shall propose and justify additional running time at or above this additional rating, including continuous 30 minute periods.

Pilot alert

Provision for means must be available to alert the pilot when the 30 minutes continuous time spent at the "30-minute Take-off Power" rating has expired, would it be required at aircraft level.

Engine deterioration

It must be ensured that the engine deterioration in service will not exceed its acceptable limits, which are either those assumed for declaring the engine Time Between Overhaul (TBO), or any other "on-condition" limits defined in the engine Instructions for Continued Airworthiness (ICA). For this, means must be provided, which may consist of a manual increment log, or automatic counting through the Engine Control Unit (ECU) of the time spent at the "30-minute Take-off Power" rating.

EASA Position:

The Certification Basis for the [engine model] in addition to the applicable airworthiness code is amended by this Special Condition as follows:

CS-E 20 Engine Configuration and Interfaces &
CS-E 25 Instructions for Continued Airworthiness

Operating limitations and cumulated time limitation (if any) associated with use of the "30-minute Take-off Power" rating must be specified in the Instructions for Continued Airworthiness (ICA) and will be included in the Type Certificate Data Sheet (TCDS).

It must be demonstrated that the use of the "30-minute Take-off Power" rating in service will not result in engine deterioration in excess of that assumed for the engine TBO (if one is declared) or in exceeding any other "on-condition" limit defined in the engine ICA.

If monitoring is to be performed by the pilot this must be specified in the instructions for installing and operating the engine.

CS-E 40 Ratings

In addition to the ratings already listed in CS-E 40, a new "30-minute Take-off Power" rating is created and defined as follows:

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“Rated 30-minute Take-off power” means the brake horsepower, developed in standard atmosphere at sea level or specified altitude, limited in use for periods of no more than 30 minutes each at rotor shaft rotation speed and gas temperature established for this rating.

The 30-minute Take-off rating is equivalent in power to the Take-off rating. It is intended for usage for periods of up to 30 minutes at any time between the take-off and landing phases in any flight.

CS-E 60 Provision for Instruments

The engine must have provision for means to alert the pilot when the 30 minutes allowable continuous time spent at the “30-minute Take-off Power” rating has expired, would it be required at aircraft level.

If monitoring is to be performed by the pilot this must be specified in the instructions for installing and operating the engine.

CS-E 515 Engine Critical Parts

A representative usage of the “30-minute Take-off Power” rating must be included in the Engine Flight Cycle used for the establishment of the Approved Life of the Engine Critical Parts.

CS-E 740 Endurance Tests

The following modifications of the test schedules required by CS-E 740(c) have been established as an acceptable means to demonstrate the capability of the engine in regard to this additional rating. The requirements are based on those associated with the Continuous OEI rating. Although the “30-minute Take-off Power” rating might be considered equivalent in principle to the 30-minute OEI rating, the Agency believes that in practice the “30-minute Take-off Power” rating may be used more frequently, and therefore that the test time associated with the Continuous OEI rating is a more appropriate precedent.

- In addition to the time at Take-off power required by CS-E 740, a further 25 hours consisting of continuous periods greater than or equal to 30 minutes must be run at the power level and associated operating limitations of the “30-minute Take-off Power” rating. The modified/additional test periods must be uniformly distributed throughout the endurance testing. In any case the modification of the CS-E 740 test sequences (order and schedules) must be proposed by the Applicant and accepted by the Agency.
- If, for compliance with the above requirement, credit is sought for time accrued during other parts of the test (e.g. for time at OEI ratings), it must be shown that these sequences were run with operating limitations equal to or higher than the “30-minute Take-off Power” rating operating limitations.
- It may be possible that the intended engine usage and performance characteristics are such that its power will be limited by mechanical limitations for a certain portion of its missions. In that case it may be acceptable to run a representative percentage of the runs to these mechanical limits, but not to exceed 50% of the required further 25 hours, i.e. 12.5 hours. The remaining percentage must be run to the higher thermal limits. The proposal must be substantiated and proposed to the Agency for acceptance.

No specific maintenance action is expected following the use of the “30-minute Take-off Power” rating. This will be justified by compliance with CS-E 740(h).

Any other method proposed by the Applicant shall be justified and will be subject to the acceptance of the Agency.