



**Subject:** Approval of Turboshaft 30-minute Take-off Power Rating  
**Requirement Reference:** CS-Definitions<sup>1</sup>  
Following CS-E<sup>2</sup>, in particular the following requirements: CS-E 20, CS-E 25, CS-E 40, CS-E 60, CS-E 515 and CS-E 740

This Special Condition needs to be raised for the approval of an additional rating for turboshaft engines. This rating allows helicopter hovering at increased higher power than Maximum Continuous power for a limited time and is not currently defined included 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 multiple periods of up to 30 minutes each, at any time between the take-off and landing phases in any flight, without requiring additional post-flight maintenance.

This rating is not defined in CS-Definitions. In accordance with Part 21A.16B, as and there are no CS-E requirements covering such rating. Therefore in accordance with Part 21A.16B a Special Condition is necessary. The following requirements are affected: CS-E 20, CS-E 25, CS-E 40, CS-E 60, CS-E 515 and CS-E 740.

### **Discussion:**

The first request to the Agency for the certification of such a rating was made in 1997 to the Joint Aviation Authorities (JAA). 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 their rating.

In the past this rating has been called:

- AEO (All Engine Operative) 30 minutes, generally in the case of multi-engine rotorcraft, and/or
- HIP-SARM (Hovering at Increased Power for Search and Rescue Missions), generally either in the case of single-engine rotorcraft or for multi-engine rotorcraft, or
- 30-minute Take-off

With regard to power requirements, the this rating was generally equivalent to the Take-off rating. However for the purpose of this Special Condition it may be set at any level between the Maximum Continuous up to and including the Take-off rating.

CS-E provides requirements for a number of engine ratings, as defined in CS-Definitions. "Take-off" and "Maximum Continuous" ratings (referred to as "Standard ratings") are listed in

<sup>1</sup> CS-Definitions Amendment 2, dated 23 December 2010

<sup>2</sup> CS-E – Certification Specifications for Engines, Amendment 3, dated 23 December 2010



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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, where applicable, 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 for the Take-off and Maximum Continuous ratings, as well as at for 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:



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Time at ratings for Endurance Test (hours) Ref: CS-E 740 (c)(1)&(2)	Take-off		30-min OEI		Continuous OEI		Maximum Continuous	
	Total Take-off	of which time for continuous periods of minimum 30 minutes	Total 30-min OEI	of which time for continuous periods of minimum 30 minutes	Total	of which time for continuous periods of minimum 30 minutes	Total	of which time for continuous periods of minimum 30 minutes
"Standard ratings" only	18,75	5					45	45
---with 30-min OEI only	18,75	5	12,5	12,5			32,5	32,5
---with Cont-OEI only	18,75	5			25	25	20	20
-with 30-min OEI and Cont-OEI	18,75	5	12,5	12,5	12,5	12,5	20	20

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 (c)(2)(i) requires replacing substituting 2 hours and 5 minutes part of the time run at Take-off rating by 2 hours and 5 minutes at the with run at 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 be excessive and is adequately covered the by the engine Instructions for Continued Airworthiness (ICA) of the engine. 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 applicable Certification Specification, CS-E, used to establish 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

E 20(d): The Operating limitations associated with use of the "30-minute Power" rating are to be specified in the instructions for installing and operating the engine. If monitoring is to be performed by the pilot this must also be specified in the instructions for installing and operating the engine. &

#### CS-E 25 Instructions for Continued Airworthiness

The usage of the "30-minute Power" rating is to be considered in the establishment of the Instructions for Continued Airworthiness (ICA).

~~Operating Usage~~ limitations (if any) and such as 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.

#### CS-E 40 Ratings

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

"Rated 30-minute Take-off power" means, with respect to rotorcraft turbine engines, the approved brake horsepower, developed in standard atmosphere at sea level or under static conditions at specified altitudes and temperatures within the operating limitations established for the engine, 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 Power" rating may be set at any level between the Maximum Continuous up to and including the Take-off rating, and is equivalent in power to the Take-off rating. It is intended may be used for usage for multiple periods of up to 30 minutes each, 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.~~

#### 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 and/or the life cycle counting method used for the establishment of the Approved Life of the Engine Critical Parts, as appropriate.

#### 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 for the "30-minute Power" rating are based on those associated with the Continuous OEI rating.



NOTE: –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 additional test time requirements associated with this new rating have been developed using the approach previously adopted for the Continuous OEI rating is a more appropriate precedent.

- In addition to the time at Take-off power requirements of required by CS-E 740, a further 25 hours consisting of continuous periods greater than or equal to of 30 minutes must be run at the power level and associated operating limitations of the “30-minute Take-off Power” rating. These periods must be alternated with periods at Maximum Continuous power or less.
- Time spent at “standard” Take-off power may not be counted towards the required additional 25 hours of testing.
- The Applicant may propose to either include the required additional 25 hours within the overall test normally required by CS-E 740, or perform a complementary test, or a combination thereof.
- In the case where the additional 25 hours are included within the overall test normally required by CS-E 740, the modified test periods must be uniformly distributed throughout the endurance testing.
- For compliance with the above requirement, credit may be sought for time accrued during other parts of the test normally required by CS-E 740. This allowance excludes the time spent at “standard” Take-off power, but may include for instance time spent at OEI ratings. It must then be shown that these sequences were run with operating limitations equal to or higher than the “30-minute Power” rating operating limitations.
- In any all cases the modification of the CS-E 740 test sequences and/or the complementary test sequences (order and schedules) must be proposed by the Applicant and accepted by the Agency.
- It may be possible that the intended engine usage and performance characteristics of the engine are such that its power will be limited by subject to mechanical limitations for a certain portion of its missions. In that case it may be acceptable to run a representative percentage of the runs time required at the “30-minute Power” rating to these mechanical limits, but not to exceed 50% of the required further additional 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. These assumptions will be recorded in the instructions for installing and operating the engine, in accordance with CS-E 30(a).

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)(1).

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