

## **Supplementary requirements to CS-E for approval of Engine Operation with Selectable OEI Ratings Structures**

### **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 02/04 dated 30 March 2004, 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**

The ability to operate a rotorcraft engine with a single AEO ratings structure and two selectable OEI ratings structures within a given engine model is considered unconventional, for which the applicable airworthiness code does not contain adequate or appropriate safety standards. Whilst the individual ratings may already be considered in existing Certification Specifications, the ability to operate on a flight by flights Selectable OEI ratings structures is not addressed.

The selectable OEI ratings structures will provide optimised OEI power levels appropriate for the intended mission. Once an OEI ratings structure has been employed, the engine must not operate in the other OEI ratings structure unless mandatory maintenance activity has been performed.

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 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, CS-E 740, CS-E 750 and CS-E 920. Following review of the Certification Specification for engines, the EASA team have concluded that relevant requirements are in place for each of the individual ratings required, however the current Certification Specifications do not address the availability of selectable alternate OEI ratings. It is this novelty that is addressed by this Special Condition.

### **EASA Position**

For certification of Selectable OEI ratings structure on a turbo-shaft engine, the following requirements shall be applied, in addition to those of CS-E:-

#### **CS-E 40 (b) (3)**

Selectable OEI Ratings Structures is defined as an engine with a single AEO ratings structure and capable of two different OEI ratings structures (an OEI ratings structure consists of a specific set of 30-Second, 2-Minute and Continuous OEI ratings), selected by the rotorcraft and verified by the

engine. Once an OEI ratings structure has been used, adequate means are required to ensure that the engine will not operate in the other OEI ratings structure unless mandatory maintenance actions have been performed.

#### CS-E 20 Engine Configuration and Interfaces

Operating limitations (if any) associated with use of the “Selectable OEI ratings structures” ratings are to be specified in the instructions for installing and operating the engine. If monitoring is to be performed at aircraft level, this must also be specified in the instructions for installing and operating the engine.

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

In addition to CS-E 25(b)(1), the airworthiness limitations section must also prescribe the mandatory post flight inspection and maintenance actions associated with each of the different Selectable OEI ratings structures function usage. This includes the mandatory actions necessary to permit to the engine to operate in the other OEI ratings structure and restore the availability of both OEI ratings structures. The adequacy of these maintenance actions must be validated.

#### CS-E 50 Engine Control Systems

Within the System Safety Assessment of CS-E 50 (d) specific consideration to the “Selectable OEI ratings structure” should be made including any required engine to engine communication.

Aircraft supplied data in relation to the “Selectable OEI ratings structure” should be specifically addressed in compliance with CS-E 50 (g).

In accordance with CS-E 50 (j), the engine must incorporate means or provision for means for automatic availability and automatic control of the 30-Second OEI Power within its operating limitations, once selection and verification of the appropriate OEI ratings structure by the pilot has been made. Automatic availability of power and control thereof must be demonstrated for the selected OEI ratings structure on any given flight.

#### CS-E 60 Provision for instrument

The engine should have means, or provision for means, to indicate positively to the rotorcraft:

- a) The OEI ratings structures that are available ,
- b) Engine confirmation of rotorcraft selected OEI ratings structure, and
- c) Engine current OEI ratings structure

#### CS-E 740 Endurance Tests / CS-E 750 Starting Tests

CS-E 740 provides endurance test requirements for the certification of engines. These specifications also include requirements for the demonstration of various engine ratings including OEI ratings. Furthermore CS-E 750 provides Starting Test requirements to be demonstrated during the course of the endurance test. Following review of these requirements, it is considered that they provide suitable demonstration for each of the OEI engine ratings, but do not adequately address the situation where alternate OEI ratings structures exist. In order to demonstrate the capability of the

engine in regard to multiple alternate OEI ratings, for each Selectable OEI ratings structure proposed by the applicant, an endurance test conducted in accordance with the requirements of CS-E 740 encompassing all relevant ratings and including the starting tests of CS-E 750 must be performed. The applicant may however elect to demonstrate the engines capability by performing a single endurance test encompassing the most severe combination of ratings. Where multiple endurance tests are required they need not be performed on the same engine.