

Testing supplementary to the requirements of CS-E for approval of Engine Operation in Auxiliary Power Unit (APU) Mode

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 helicopter engine in Auxiliary Power Unit (APU) mode on the ground with the helicopter rotor stopped is considered unconventional usage, for which the applicable airworthiness code does not contain adequate or appropriate safety standards.

CS-E contains requirements for testing the effects of locking and unlocking the free power turbine (CS-E 900 Propeller Parking Brake), and the effects of a short period of operation with the rotor locked on starting (CS-E 750 Starting Tests) but clarification are required to define their applicability for this specific usage of an engine. Regarding engine operating in the APU mode it is considered necessary to extend the requirements of CS-E 750 to address the much longer periods of ground locked rotor operation which are likely to be encountered when operating in APU mode.

EASA Position

For certification of an APU mode on a turbo-shaft engine with a rotor lock, the following requirements shall be applied, in addition to those of CS-E:-

- a) Ground locking: a total of 45 hours of engine operation with the output shaft locked to simulate rotor brake engaged in a manner which demonstrates the engine's ability to function without adverse effects while operating in the APU mode under the maximum conditions of engine speed, torque, temperature, air bleed and power extraction as specified by the applicant.
- b) Starting test: 100 engine starts and stops with the output shaft locked in a manner simulating rotor brake engagement during APU mode operation.
- c) Dynamic braking: A total of 400 application-release cycles of simulated brake engagements must be made in a manner which clearly demonstrates the complete engine's ability to function without adverse effect while operating in the APU mode under the maximum conditions of engine acceleration and deceleration rate, rotor speed, torque and

temperature as specified by the applicant. The engine output shaft must be stopped prior to brake-release.

- d) The tests required by paragraphs (a) and (b) must be performed on the same engine, but this engine need not be the same engine used for the tests required by CS-E740.
- e) The tests required by paragraphs (a), (b) and (c) above shall be followed by engine disassembly to the extent necessary to show that the condition of the engine is satisfactory for continued safe operation in accordance with the instructions for continued airworthiness.