

## **Special Condition**

### **Piston Engines intended for Use in Rotorcraft**

This Special Condition is raised to support the certification of piston engines intended for use in rotorcraft.

CS-E 10 (c) states that »The specifications of subparts A, B and C apply to Piston Engines. Any necessary variations of the specifications of subparts B and C for Piston Engines intended for use in rotorcraft will be decided in accordance with 21A.16.«

#### **Introductory note:**

The hereby proposed Special Condition was 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.”*

No comment was received during the public consultation period.

#### **Statement of Issue:**

This Special Condition defines the necessary variations of the specifications of CS-E subparts B and C for Piston Engines intended for use in rotorcraft.

Commission Regulation (EU) No 748/2012 paragraph 21.A.16B Special Conditions has to be addressed as the related airworthiness code does not contain adequate or appropriate safety standards for the product.

#### **Discussion:**

EASA has been informed about potential future applications for type certification of piston engines intended for use in rotorcraft.

CS-E Amendment 4 has been reviewed and compared with 14 CFR Part 33 in order to identify necessary variations for rotorcraft piston engines. 14 CFR Part 33 contains requirements specific to rotorcraft engines. It results that the following CS-E requirements need to be adapted:

- 1) CS-E 340 Vibration Tests
- 2) CS-E 440 Endurance Tests

FAA AC 33-2 (as well as later revisions 2A and 2B) explains the background of the special endurance test cycle for rotorcraft:

»Helicopter engines are currently required to meet the specific test requirements of FAR, Section 33.49(d) or Section 29.923. Before this special endurance test was made effective on May 15, 1953, in Civil Air Regulations, Part 13, it became evident from

service experience that some engines operated in helicopters were hazardous and unreliable because of the characteristically high steady engine speeds and powers with the overspeeds often encountered in helicopters.«

**EASA Position:**

1) The purpose of this Special Condition is an amendment of CS-E based on the 14 CFR Part 33 requirements for rotorcraft piston engines. It does not introduce additional new requirements not previously available to industry.

2) A propeller may not properly represent the loads on rotorcraft piston engines. Therefore, the first sentence of CS-E 340 (b) shall be amended as follows:

»Engine output shaft loading: A representative flight Propeller or a device simulating the actual engine output shaft loading must be used during this test.«

For harmonisation with 14 CFR Part 33, the following sentence shall be added at the end of CS-E 340 (b):

»Each accessory drive and mounting attachment must be loaded, with the loads imposed by each accessory used only for an aircraft service being the limit load specified by the applicant for the drive or attachment point.«

3) The first sentence of CS-E 440 (a)(5) shall be amended as follow:

»Engine output shaft loading: A representative flight Propeller or a device simulating the actual engine output shaft loading must be used during this test.«

4) In CS-E 440 (b), the following schedules shall be added:

»(4) *Schedule for Engines Intended for Use in Rotorcraft:*

To be eligible for use on a rotorcraft each engine must either comply with paragraphs (a) through (j) of CS 29.923, or must undergo the following series of runs:

Part 1 A 35-hour run consisting of alternate periods of 30 minutes each at rated takeoff power with takeoff speed, and at rated maximum continuous power with maximum continuous speed.

Part 2 A 25-hour run consisting of alternate periods of 2½ hours each at rated maximum continuous power with maximum continuous speed, and at 70 percent rated maximum continuous power with maximum continuous speed.

Part 3 A 25-hour run consisting of alternate periods of 2½ hours each at rated maximum continuous power with maximum continuous speed, and at 70 percent rated maximum continuous power with 80 to 90 percent maximum continuous speed.

- Part 4 A 25-hour run consisting of alternate periods of 2½ hours each at 80 percent rated maximum continuous power with takeoff speed, and at 80 percent rated maximum continuous power with 80 to 90 percent maximum continuous speed.
- Part 5 A 25-hour run consisting of alternate periods of 2½ hours each at 80 percent rated maximum continuous power with takeoff speed, and at either rated maximum continuous power with 110 percent maximum continuous speed or at rated takeoff power with 103 percent takeoff speed, whichever results in the greater speed.
- Part 6 A 15-hour run at 105 percent rated maximum continuous power with 105 percent maximum continuous speed or at full throttle and corresponding speed at standard sea level inlet pressure, if 105 percent of the rated maximum continuous power is not exceeded.

*(5) Schedule for Rotorcraft Engine Incorporating a Turbocharger.*

For Rotorcraft Engines incorporating a turbocharger, the schedule of CS-E 440 (b)(4) will apply, except that:

- (i) Entire run specified in Part 1 must be made at critical altitude pressure;
- (ii) The portions of the runs specified in Part 2 and 3 at rated maximum continuous power must be made at Critical Altitude pressure and the portions of the runs at other power must be made at 2500 m altitude pressure;
- (iii) The entire run specified in Part 4 must be made at 2500 m altitude pressure;
- (iv) The portion of the runs specified in Part 5 at 80 percent of rated maximum continuous power must be made at 2500 m altitude pressure and the portions of the runs at other power must be made at Critical Altitude pressure;
- (v) The entire run specified in Part 6 of this section must be made at Critical Altitude pressure; and
- (vi) The turbocharger used during the 150-hour endurance test must be run on the bench for an additional 50 hours at a representative inlet pressure and at the limiting turbine wheel inlet gas temperature and rotational speed for Maximum Continuous Power operation unless the limiting temperature and speed are maintained during 50 hours of the rated Maximum Continuous Power operation.«

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