

(4) *Airplane demonstration test.* For each airplane and engine combination to be certificated, the applicant must conduct flight-testing with one or more airplanes to demonstrate that the aircraft, its components and equipment are capable of and function properly during ETOPS and ETOPS diversions. This flight-testing may be coordinated with, but is not in place of flight-testing required for compliance to § 21.35(b)(2).

(i) The flight test program must include:

(A) Flights simulating actual ETOPS operation including normal cruise altitude, step climbs, and APU operations if compliance to paragraph I (b)(2) of this appendix is necessary.

(B) Demonstration of maximum normal flight duration with maximum diversion time for which eligibility is sought.

(C) Engine inoperative maximum time diversions to demonstrate the airplane and propulsion system's capability to safely conduct an ETOPS diversion, including a repeat of a maximum continuous thrust (MCT) diversion on the same engine.

(D) Non-normal conditions to demonstrate the airplane's capability to safely conduct an ETOPS diversion under worst case system failure conditions expected to occur in service.

(E) Diversions into representative operational diversionary airports.

(F) Repeated exposure to humid and inclement weather on the ground followed by long-range operations at normal cruise altitude.

(ii) The flight testing must validate the adequacy of the airplane's flying qualities, performance and flight crew's ability to deal with the conditions of paragraphs (b)(4)(i)(C), (b)(4)(i)(D), and (b)(4)(i)(E) of Section III of this appendix.

(iii) The engine-inoperative diversions must be evenly distributed among the number of engines in the applicant's flight test program except as required by paragraph (b)(4)(i)(C) of Section III of this appendix.

(iv) The test airplane or airplanes must be operated and maintained using the recommended operations and maintenance manual procedures during the airplane demonstration test.

(v) At the completion of the airplane or airplanes demonstration testing, the ETOPS Significant Systems must undergo an airplane visual inspection per the Instructions for Continued Airworthiness of § 25.1529. The engines must also undergo a gas path inspection. These inspections are intended to identify any abnormal conditions that could result in an in-flight shutdown or diversion. The applicant must identify, track and resolve any abnormal conditions in accordance with paragraph (b)(5) of Section III of this appendix.

(5) *Problem tracking and resolution system.* The applicant must establish a problem tracking and resolution system to address problems, as identified in § 21.4(a)(5), encountered on the ETOPS Significant Systems during airplane and engine testing that could affect the safety of ETOPS operations. If the airplane or engine type certificated is a derivative of a previously certificated airplane or engine the criteria of § 21.4(a)(4) may apply.

(i) The system must contain a means for prompt identification of problems that could impact the safety of ETOPS operations.

(ii) The system must contain the process for the timely notification to the responsible FAA office of all relevant problems encountered, and corrective actions deemed necessary, in a manner that allows for appropriate FAA review of all planned corrective actions.

(iii) The system must be in effect during the phases of airplane and engine development that will be used to assess early ETOPS eligibility.

(iv) Upon type certification, the problem tracking and resolution system will revert to the requirements of § 21.4.

(6) *Reliability demonstration acceptance criteria.* For ETOPS significant systems, the type and frequency of failures that occur during the airplane flight test program and the airplane demonstration test required by paragraph (b)(4) of this section must be consistent with the type and frequency of failures or malfunctions that would be expected to occur on presently certified ETOPS airplanes, or any non-ETOPS derivative models of those aircraft or engines.

(c) *Combined service experience and early ETOPS method.*

(1) The in-service experience requirements of paragraph (a)(1) of Section III of this appendix may be reduced to 15,000 engine hours provided compliance to paragraphs (a)(3), (b)(1), (b)(2), (b)(3), (b)(5), and (b)(6) of Section III of this appendix have been met.

(2) Additionally, as allowed by § 21.21(b)(1), the in-service experience requirements of paragraph (a)(1) of Section III of this appendix may be reduced to some level other than 15,000 engine hours provided compensating factors that provide an equivalent level of safety are provided.

## PART 33—ENGINE CERTIFICATION

9. The authority citation for part 33 continues to read as follows:

**Authority:** 49 U.S.C. 106(g), 40113, 44701–44702–44704.

10. Amend § 33.71 by revising paragraph (c)(4) to read as follows:

### § 33.71 Lubrication system.

\* \* \* \* \*

(c) \* \* \*

(4) Each oil tank cap must provide an oil-tight seal. For applicants seeking type design eligibility for engines to be installed in an Extended Operations (ETOPS) airplane in accordance with § 25.1535, the oil tank must be designed to prevent a hazardous quantity of oil loss due to oil tank cap installation errors.

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11. Revise § 33.90 to read as follows:

### § 33.90 Initial maintenance inspection test.

Each engine, except engines being type certificated through amendment of an existing type certificate or through supplemental type certification

procedures, must complete one of the following tests on an engine that substantially conforms to the final type design to establish when the initial maintenance inspection is required:

(a) An approved engine test that simulates the conditions in which the engine is expected to operate in service, including typical start-stop cycles.

(b) An approved engine test in accordance with §§ 33.200(c) and 33.200(f) of this part.

12. Add subpart G of part 33 to read as follows:

## Subpart G—Special Requirements: Turbine Aircraft Engines

### § 33.200 Early extended operations (ETOPS) eligibility and test requirements.

Each applicant seeking engine type design eligibility for an engine to be installed in a twin-engine ETOPS airplane that does not have the service experience required by 14 CFR part 25, Appendix L, section II, paragraph (a) must comply with the following:

(a) The engine must be designed using a design quality process acceptable to the Administrator, which assures that design features of the engine minimize the occurrence of failures, malfunctions, or maintenance errors that could result in loss of thrust control, in-flight shutdown, or other power loss.

(b) The design features of the engine must address problems that have been shown to result in loss of thrust control, in-flight shutdown, or other power loss, when compared to the applicant's other relevant type design approvals received within the past ten years, providing that adequate service data is available within that ten year period. Applicants without applicable engine service experience may show equivalent experience and equivalent knowledge of problem mitigating design practices to that gained from actual service experience in a manner acceptable to the Administrator.

(c) The following test must be conducted on an engine that substantially conforms to the type design and in accordance with an approved test plan that consists of:

(1) *Simulated ETOPS Mission Cyclic Endurance.* The test must include a minimum of 3,000 representative service start-stop mission cycles (take-off, climb, cruise, descent, approach, landing and thrust reverse), plus three simulated diversion cycles at maximum continuous thrust for the maximum diversion time for which ETOPS eligibility is sought. The diversions are to be approximately evenly distributed over the cyclic duration of the test, with the last diversion to be conducted