

within 100 cycles of the completion of the test.

(2) *Unbalance and Vibration Endurance.* (i) The simulated ETOPS mission cyclic endurance test required by § 33.200(c)(1) must be performed with the high speed and low speed main engine rotors independently unbalanced to obtain a minimum of 90 percent of the recommended field service maintenance vibration levels. In addition to the specified unbalance for the low and high-speed rotors, for engines with three main engine rotors, the intermediate speed rotor must also be independently unbalanced to obtain a minimum of 90 percent of the recommended production acceptance vibration level. The vibration level must be defined as the peak level seen during a slow acceleration and deceleration of the engine across the operating speed range.

(ii) Each 60 rpm incremental step of the typical high-speed rotor start-stop mission cycle speed range (take-off, climb, cruise, descent, approach, landing and thrust reverse) must be subjected to a minimum of three million vibration cycles during the cyclic endurance test. The test may be conducted using any rotor speed step increment up to 200 rpm provided that the typical service start-stop cycle speed range is covered. For a 200 rpm step the corresponding vibration cycle count is to be ten million cycles.

(iii) Each 60 rpm incremental step of the high-speed rotor approved operational speed range between minimum flight idle and cruise power, and not covered by § 33.200(c)(2)(ii), must be subjected to a minimum of 300,000 vibration cycles during the cyclic endurance test. The test may be conducted using any rotor speed step increment up to 200 rpm provided that the applicable speed range is covered. For a 200 rpm step the corresponding vibration cycle count is to be 1 million cycles.

(iv) Vibration surveys will be conducted at periodic intervals throughout the cyclic endurance test. The equivalent value of the peak vibration level observed during the surveys must meet the minimum vibration requirement of § 33.200(c)(2)(i).

(v) An alternate vibration test that provides an equivalent demonstration of the unbalance and vibration endurance test specified in paragraphs §§ 33.200(c)(2)(i) through 33.200(c)(2)(iv) may be approved by the Administrator.

(d) Prior to the testing required by § 33.200(c), the test engine must be subjected to a calibration run to

document power and thrust characteristics.

(e) At the conclusion of the testing required by § 33.200(c), the test engine must:

(1) Be subjected to a calibration test at sea-level conditions; and any change in thrust characteristics must be within certified limits.

(2) Be visually inspected in accordance with the on-wing inspection recommendations and limits contained in the Instructions for Continued Airworthiness submitted in support of § 33.4.

(3) Be completely disassembled and:

(i) The engine hardware must be inspected:

(A) In accordance with the applicable inspection recommendations and limits contained in the Instructions for Continued Airworthiness submitted in support of § 33.4;

(B) With consideration of the causes of loss of thrust control, in-flight shutdown or other power losses identified by § 33.200(b); and

(C) In a manner to identify wear or distress conditions which could result in loss of thrust control, in-flight shutdown, or other power loss, and which are not specifically identified by § 33.200(b) or addressed within the current Instructions for Continued Airworthiness.

(ii) The engine hardware must not show distress to the extent that could result in loss of thrust control, in-flight shutdown, or other power loss within a period of operation before the component, assembly or system would likely have been inspected or functionally tested for integrity while in service. Such hardware distress must have corrective action implemented by way of design changes, maintenance instructions or operational procedures before ETOPS eligibility is granted.

(iii) The type and frequency of hardware distress that occurs during the engine test must be consistent with the type and frequency of hardware distress that would be expected to occur on ETOPS eligible engines, or any non-ETOPS derivative engines of this type. Additional analysis and/or tests may be required to satisfy this requirement.

(f) The 3,000 cycle simulated ETOPS mission cyclic endurance test required by § 33.200(c) may be used to show compliance with §§ 33.90 and 33.90(b). After completing the full number of test cycles required for an initial maintenance inspection test conducted in accordance with § 33.90(a), the 3,000 cycle simulated ETOPS mission cyclic endurance test may be interrupted so that the engine may be inspected by an on-wing or other method and criteria

acceptable to the Administrator. Following the § 33.90(b) inspection, the ETOPS test must be resumed to complete the requirements of § 33.200.

13. Add paragraph A33.3(c) to Appendix A to read as follows:

Appendix A to Part 33—Instructions for Continued Airworthiness

* * * * *

A33.3 Content

* * * * *

(c) *Extended Operations (ETOPS) Requirements.* For engines to be installed in ETOPS airplanes, procedures for engine condition monitoring must be included within the Instructions for Continued Airworthiness. The engine condition monitoring procedures must be able to determine prior to flight, whether an engine is capable of providing, within certified engine operating limits, the maximum power or thrust, bleed air and power extraction required for the desired engine inoperative diversion. For engines to be installed on twin-engine ETOPS airplanes, the engine condition monitoring procedures must be validated before ETOPS eligibility is granted.

PART 121—AIR CARRIER OPERATIONS

14. The authority citation for part 121 continues to read as follows:

Authority: 49 U.S.C. 106(g), 40113, 40119, 41706, 44101, 44701–44702, 44705, 44709–44711, 44713, 44716–44717, 44722, 46105.

15. Add § 121.7 to read as follows:

§ 121.7 Definitions and designations.

The following definitions apply to those sections of part 121 that apply to ETOPS:

Adequate airport means an airport that:

(1) The Administrator determines satisfies safety requirements of part 139, subpart D, excluding aircraft rescue and fire fighting service, or

(2) Meets the landing performance requirements of § 121.197, or

(3) Is a military airport that is active and operational, and meets the landing performance requirements of § 121.197.

ETOPS alternate means an adequate airport listed in the certificate holder's operations specifications that meets the requirements of § 121.624 and the Rescue and Fire Fighting (RFF) requirements of § 121.106 designated in a dispatch/flight release. This definition applies to flight planning and does not in any way limit the discretion of the pilot in command during flight.

ETOPS area of operation. (1) ETOPS area of operation means for turbine engine powered airplanes with two engines, an area beyond 60 minutes from an adequate airport, or with more than two engines, an area beyond 180 minutes from an adequate airport, and