DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

14 CFR Parts 1 and 33

[Docket No. 26019; Amendment Nos. 1–46, 33–18]

RIN 2120–AD21

Airworthiness Standards: Aircraft Engines New One-Engine-Inoperative (OEI) Ratings, Definitions and Type Certification Standards

AGENCY: Federal Aviation Administration (FAA), DOT.

ACTION: Final rule.

SUMMARY: This amendment establishes definitions for new one-engine inoperative (OEI) ratings, and type certification standards for those ratings. This amendment is the result of a petition for rulemaking from Aerospace Industries Association of America, Inc. (AIA), and a recognition by both the FAA, along with other civil airworthiness authorities, and the aviation industry for a need for additional OEI power rating standards. The maximum engine power rating for rotorcraft available under current certification standards contained in the Federal Aviation Regulations (FAR's) is the 2½-minute OEI rating. This amendment establishes definitions and type certification standards for the 30-second OEI and 2-minute OEI rating at higher power levels than currently available. These new ratings will enhance rotorcraft safety after an engine failure or precautionary shutdown by providing the availability for higher OEI power. The benefits from this amendment are enhanced safety through improved rotorcraft takeoff and landing performances, and shorter field operations or higher payload with the same degree of safety.

EFFECTIVE DATE: August 19, 1996.

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SUPPLEMENTARY INFORMATION:

Background

The FAA issued a Notice of Proposed Rulemaking (NPRM) No. 89–27 that was published in the Federal Register on September 22, 1989 (54 FR 39080), and also issued Supplemental Notice of Proposed Rulemaking (SNPRM) No. 89–27A that was published in the Federal Register on February 7, 1995 (60 FR 7380). These notices proposed to define new one-engine inoperative (OEI) ratings for rotorcraft engines and establish type certification standards for these new OEI ratings. The new OEI ratings will be applicable to turbine engines installed on multiengine powered rotorcraft.

The payload for multiengine rotorcraft is limited by the power available from the remaining operating engine(s) in the event one engine fails during takeoff or landing. Currently, the maximum engine power rating available for rotorcraft under part 33 is the 2½ OEI rating. This amendment establishes 30-second OEI and 2-minute OEI ratings at higher power level than currently available. The new rating will allow rotorcraft to carry higher payloads from existing fields or to takeoff from smaller fields with current payloads, without decreasing the level of safety for these operations. Engine type certification using these new ratings, however, as with other OEI ratings, remains optional.

The Aerospace Industries Association of America, Inc., (AIA) submitted a petition for rulemaking to the FAA on September 20, 1984, requesting an amendment of the FAR's to permit type certification of engines and rotorcraft with new OEI ratings. The FAA acknowledged receipt of the AIA petition, by letter on November 26, 1984, and issued a notice of that petition that was published in the Federal Register on December 10, 1984 (49 FR 48759). The FAA subsequently held the petition in abeyance pending AIA's submission of a revised petition for rulemaking on April 1, 1987.

The AIA then sponsored a meeting with the Association European des Constructeurs de Materiel d′Aerospatial (AECMA), the European Helicopter Association (EHA), and the European Joint Airworthiness Authorities (JAA) on April 9, 1987, and invited the FAA to attend. The purpose of this meeting was to familiarize the European community with the AIA petition. Thereafter, the FAA and the JAA convened their annual harmonization meeting on May 19–21, 1987, to discuss, in part, the status of programs of mutual interest. One result of the FAA/JAA meeting was a recommendation that the FAA and the JAA should strive to promulgate more harmonious rules and guidance material. Accordingly, the FAA coordinated their reviews of the AIA petition directly with the JAA. A meeting was held in late August 1987 between representatives of the FAA and the JAA to discuss the JAA's concerns with the AIA petition. The JAA provided many comments, most of which contained significant deviations from specifies of the petition being considered.

On November 19, 1987, AIA, AECMA, and EHA jointly sponsored a meeting at AIA Headquarters in Washington, DC, and invited the FAA and the JAA to attend. The purpose of this meeting was for industry, AIA, AECMA, and EHA, to jointly address and respond to the comments and concerns previously expressed by the JAA. In follow-up to this meeting, on June 8, 1988, the AIA submitted additional revisions to their petition for rulemaking.

The FAA then issued a final rule from a previous proposal amending parts 1 and 33 of the FAR's. Amendments 1–34 and 33–12 were issued and published in the Federal Register on September 2, 1988 (53 FR 34196, effective October 3, 1988), which redefined OEI ratings in part 1 and added the Continuous OEI rating in both part 1 and part 33.

After reviewing the revised AIA petition, and coordinating with the JAA, the FAA issued NPRM No. 89–27 (54 FR 39080), to address the part 33 engine certification aspects of 39-second and 2-minute OEI ratings, and NPRM No. 89–26 (54 FR 39086), to address the part 27 and part 29 rotorcraft certification aspects of the OEI ratings. Both NPRM's were published in the Federal Register on September 22, 1989. During the comment period, the FAA held a joint public meeting to discuss the proposals of both NPRM's in Fort Worth, Texas, on November 16, 1989 (see Notice of public meeting published on October 13, 1989, 54 FR 41986). The Final rules to part 27 and part 29 were published in the Federal Register on September 16, 1994 (59 FR 47764).

Based on the comments received, the FAA determined that the proposals contained in NPRM 89–27 warranted further consideration. Substantive changes were made to the proposed rule, and SNPRM 89–27A was published in the Federal Register on February 7, 1995 (60 FR 7380). The SNPRM gave all interested parties an opportunity to comment on the modified proposed rule.

All interested persons have been given an opportunity to participate in this rulemaking, and due consideration has been given to all matters presented. Some minor editorial changes have been made to clarify the proposals as indicated herein. The changes are based on comments received and further FAA review of the proposals. The FAA has determined that certain technical issues associated with proposed revisions to § 33.27 have not been resolved. These

technical issues will be discussed in an Aviation Rulemaking Advisory Committee (ARAC) working group (see Notice of establishment of Propulsion Harmonization Working Group at 57 FR 58840, December 11, 1992). Except for the proposed revisions to § 33.27 and other changes as indicated herein, the proposals contained in SNPRM 89–27A have been adopted without change.

Discussion of Comments

The commenters represent domestic and foreign engine manufacturers, and foreign civil airworthiness authorities. Four commenters provided the FAA with comments to NPRM 89–27, addressing numerous issues. The FAA also received comments to SNPRM 89–27A from three commenters. This discussion addresses all the comments made to SNPRM 89–27A, plus those comments made to NPRM 89–27 that were not already addressed in the discussion section of SNPRM 89–27A. Some comments presented orally at the November 16, 1989, public meeting have not been addressed here, since they have been withdrawn; other oral comments were submitted in writing to the rules docket. The transcript of the public meeting is in the Rules Docket. The comments are grouped according to the applicable sections of the proposed amendment, with general comments discussed first.

General Comments

One commenter recommends that the FAA should publish the proposals as worded in the SNPRM as a final rule for all applicable 14 CFR part 1 and 33 sections, with the exception of the proposed revisions to § 33.27.

One commenter states that the new structure of helicopter engine ratings as proposed creates a new certification scheme for helicopters and, accordingly, all the pertinent regulatory and advisory matter must be considered at the same time. The commenter points out that guidance material for the proposed ratings, including the maintenance inspection requirements under § 33.90 and on the issue of power assurance, is not available. Therefore, the commenter states that an acceptable level of safety cannot be achieved until all advisory and regulatory material can be reviewed at the same time.

The FAA disagrees. Even though specific advisory material that addresses the new OEI ratings is not yet available, the FAA will not delay issuing this Final rule. The existing guidance material on the issue of power assurance, which is a certification requirement of the helicopter under §§ 27.45(f) and 29.45(f), may be of assistance to applicants for type certification. A joint effort between the FAA's Engine & Propeller Directorate and the Rotorcraft Directorate, and both the engine and the helicopter industry, has resulted in a report published by the Society of Automotive Engineers (SAE), Aerospace Information Report AIR4083, ''Helicopter Power Assurance,'' dated July 13, 1989. Also, guidance material addressing the existing § 33.90 is provided in FAA Advisory Circular (AC) AC 33–2B, ''Aircraft Engine Type Certification Handbook''. This AC will be revised to include guidance material on power assurance and mandatory maintenance requirements for the new OEI ratings following the adoption of this Final rule. The FAA plans to issue advisory material for these new OEI ratings as soon as practical.

The commenter also states that this rulemaking is based on an assumption that the new OEI ratings will be used only during the takeoff and landing phases of flight. The commenter speculates that it would be possible that these new ratings be utilized under the ''External Load Operations'' provisions of § 133.45(e)(1). The commenter suggests that the Regulatory Evaluation section needs to address whether this assumption will be invalidated if the enhanced OEI performance is taken into account for other than takeoff and landing purposes.

The FAA disagrees. While the proposed new OEI ratings are intended to be used only after the failure of one engine on a multiengine rotorcraft during takeoff, climb, or landing, it is entirely possible that these new ratings might be utilized to meet the provisions of current § 133.45(e)(1), if the rotorcraft and the operator fulfill those criteria. Therefore, the Regulatory Evaluation does not depend on how the higher power levels associated with the new OEI ratings may be used in showing compliance with an existing regulation. In addition the commenter does not suggest any changes to the regulatory language of the proposed amendment to part 1 or part 33 to address that concern. These new ratings are intended to supplement the existing OEI rating structure for the type certification of engines and rotorcraft. Existing rotorcraft operating rules with respect to OEI conditions should not be impacted by the addition of the 30-second and the 2-minute OEI ratings.

Section 1.1 Definitions

One commenter recommends that the existing § 1.1 definition of rated 30-minute OEI power should be amended to clarify that the period of use must not exceed a total of 30 minutes during any flight. The commenter further states that many authorities are aware of instances of misinterpretations, not precluded by Flight Manuals, whereby more than 30 minutes of 30-minute OEI power could have been accumulated during one flight. This commenter also recommends that the common aspects of all existing and proposed definitions of rated power/thrust be expressed in identical language to eliminate differences as much as possible.

The FAA disagrees. The existing § 1.1 definition of rated 30-minute OEI power states that the engine power at this rating is limited in use to a period of not more than 30 minutes after the failure of one engine of a multiengine rotorcraft. The language used to define the new 30-second OEI and 2-minute OEI ratings is consistent with this and other OEI definitions. The recommendations on the existing definitions of rated power and thrust are beyond the scope of this rulemaking. Such a change may be considered, however, as part of the Engine & Propeller Directorate's ongoing study on engine ratings.

Section 33.14 Start-Stop Cyclic Stress

One commenter states that the proposal should also include a change to existing § 33.14 that would exclude OEI ratings from the meaning of the term ''maximum rated power'' as it appears in § 33.14. The commenter bases the need for this change on an interpretation of the existing § 33.14 using the preambles to two previous amendments to the FAR's, both pre-dating the most recent changes to parts 1 and 33 relating to OEI ratings. The commenter concludes that the suggested changes would make § 33.14 more rational and provide clarity to promote consistent application. The commenter also states that § 33.14 should address rotational speed operating limits and rotor temperatures in addition to rated powers/thrusts.

The FAA disagrees. No changes to § 33.14 were proposed in either NPRM No. 89–27 or SNPRM 89–27A. The FAA finds that the existing § 33.14 is adequate to address the new 30-second OEI and 2-minute OEI ratings.

Section 33.27 Turbine, Compressor, Fan and Turbosupercharger Rotors

Several commenters state that proposed revisions to § 33.27, rotor integrity, are not consistent with the status of the discussions on rotor integrity requirements currently ongoing in an ARAC working group.

The FAA agrees that proposed § 33.27 is not harmonized with JAR–E. The proposed revision to § 33.27 has been

removed from the Final rule as the proposal has not been completely harmonized by the FAA (part 33) and the JAA (JAR–E). However, the FAA will consider additional amendments to § 33.27, and ARAC harmonization is anticipated. In the interim the FAA will address each application for type certification that requests 30-second OEI and 2-minute OEI ratings on a case by case basis.

Section 33.29 Instrument Connection

One commenter states that § 29.1305(a)(24) requires an indication to the pilot when the use of OEI rating begins and when the allowed time of this rating has expired, and the proposed 33.29(c)(1) should have consistent requirements.

The FAA agrees. New § 33.29(c)(1) is changed accordingly. In addition, new § 33.29(c)(3) is changed to clarify the FAA's intent to require that each usage of a power level at one of the new OEI ratings is limited in duration. Therefore, for example, as the definition of the rating provides, 30-second OEI power is limited to three periods of use in any one flight following an engine failure, and each period of use is limited to no more than 30 seconds. Unused time from one period of use may not be accumulated for use during a subsequent period. Accordingly, new § 33.29(c)(3) is changed to provide for a means to record each use and the duration of each use of power at each rating.

Section 33.85 Calibration Tests

One commenter states that the reference in proposed § 33.85(d) to §§ 33.87(f) (1) through (8) should read § 33.87, because paragraphs (1) through (8) of proposed § 33.87(f) relate only to the new 30-second OEI and 2-minute OEI ratings where proposed § 33.85(d) is also applicable to the 2½-minute OEI rating.

The FAA disagrees. New § 33.85(d) is intended for 30-second OEI and 2-minute OEI ratings only, and reference to the 2½-minute OEI rating was accidentally included in the SNPRM. Therefore, the reference to the 2½-minute OEI rating is removed from new § 33.85(d).

Section 33.87 Endurance Test

One commenter questions whether, during the additional endurance testing introduced by proposed § 33.87 (f)(1) through (f)(8), at least 100 percent of 30-second OEI and 2-minute OEI rated powers must be produced during all such operations. The commenter states that it appears to be the intent because § 33.87(a)(3) remains applicable to the proposed § 33.87(f), yet the commenter states that 100 percent power may only be required for the first sequence of proposed § 33.87(f), and not for all the sequences.

The FAA disagrees. The 100 percent rule of § 33.87(a)(3) applies to new § 33.87(f) for all sequences; no exceptions are intended or implied.

One commenter suggests the following for proposed § 33.87 (f)(1) through (f)(8):

1. The test sequence described by § 33.87 (f)(1) through (f)(8) would be required to be repeated eight times for a total time of not less than 180 minutes and would be required to be conducted in a prescribed sequence and without stopping during the 180 minutes total test period.

2. The sequence during which the length of the particular test condition defined by § 33.87(f)(4) is increased to sixty-five minutes would need to be re-defined as: ''except that during the fourth or fifth test sequence this period shall be sixty-five minutes.''

The FAA disagrees. The two hour supplementary test is to simulate a flight scenario using 30-second and 2-minute OEI ratings. After the initial 30-second and 2-minute applications to complete the takeoff or effect a rejected takeoff and the climb out to a safe altitude and airspeed, the engine is run at the 30-minute or continuous OEI rating power to maintain a safe altitude enroute and to complete a landing of the aircraft. The two hour cyclic test defined in this section demonstrates the ability of the engine to complete a safe flight with up to three applications of the 30-second and 2-minute OEI ratings during one flight. The proposed changes from the commenter are not supported by reasonable technical justification.

Section 33.88 Engine Overtemperature Test

One commenter suggests that the words ''steady state'' be inserted before the words ''power-on r.p.m.'' in proposed § 33.88(c). The commenter states that the words are necessary since the test is conducted at maximum steady state rpm limit rather than maximum transient rpm limit. In addition, the proposed change to ''steady state'' rpm limit and to the post test acceptance criteria is also applicable to engines not having automatic temperature limiting which are tested at 75 °F above the maximum temperature limit.

The FAA disagrees. The overtemperature condition associated with usage of the 30-second OEI rating is normally expected from over-fueling and consequently is accompanied by an excess rpm, not a steady state level associated with a non-overtemperature or a non-overboost condition.

One commenter states that use of the words ''provides an exception from the existing requirements'' in the preamble for Proposal No. 10 of NPRM 89–27, published September 22, 1989, concerning proposed § 33.88, could be misconstrued, and that it would have been better to state ''* * * provides for an alleviation from the rotational speed and the gas temperature prescribed by the existing requirements* * *.''

The FAA disagrees. The commenter does not suggest any changes to proposed § 33.88 and the editorial comment addresses the wording preference in the preamble only.

One commenter states that the last sentence of proposed § 33.88(c) should read as follows: ''Following this run, the turbine assembly may exceed serviceable limits, provided there is no evidence of imminent failure. The applicant may be required to show there is no evidence of imminent failure by analysis or test''. Another commenter states that current JAR–E has no direct equivalent to the 5 minute tests of either the existing § 33.88 or proposed § 33.88(a). Proposed § 33.88 (b) and (c), which make provision for 5 minute or 4 minute over-temperature test for 30-second OEI ratings, will be considered by the JAA as a possible basis for a revision to JAR–E. However, this will be in addition to complying with the existing turbine rotor overtemperature requirement of JAR–E, C4–6, paragraph 22. The commenter also suggests that proposed § 33.88 (b) and (c) should include a requirement that the worst case intended flight profile must be assumed to include at least a further two applications of 30-second OEI power, each followed by an application of 2 minute OEI power for consistency of interpretation and compatibility with usage rational for these particular OEI ratings, as stated in the ''Background'' of NPRM 89–27.

The FAA disagrees. The intent of the post-test requirements is to assure that after the overtemperature test, the engine is suitable for continued service use to complete the worst case intended flight profile associated with the application of the 30-second OEI power rating. Although the worst case scenario may include at lease two additional applications of both 30-second OEI power and 2-minute OEI power, the last sentence of revised § 33.88(b) and revised § 33.88(c) will permit the FAA, on a case by case assessment, to apply the best engineering judgment for each given engine type design tested.

Two commenters state that the FAA is proposing a certification standard for rotorcraft engines with a temperature limiter that differs from the standard for all other type engines. The commenters conclude that if a temperature limiter principle is acceptable for rotorcraft engines, it should also be acceptable for other gas turbine engines and for other engine ratings. Therefore, the proposal should be changed to apply generally and not just to 30-second and 2-minute OEI ratings.

The FAA disagrees. The FAA considers that this comment is beyond the scope of this rulemaking, which addresses only certification standards for rotorcraft engines. The FAA may consider further rulemaking to revise § 33.88 for other gas turbine engine certifications.

One commenter states that the overtemperature subject has been incorporated into the harmonization effort and requests that the FAA clearly indicate the intent to harmonize certification standards related to overtemperature.

The FAA agrees. The FAA will continue to support the ongoing harmonization effort toward the overtemperature test rule with the JAA through the ARAC. However, the proposed overtemperature test requirements in the SNPRM for 30-second and 2-minute OEI ratings are published as an addition to the existing rule based on the comments received. It is anticipated that the ARAC will recommend the adoption of the overtemperature test for these new ratings in their draft proposals.

Section 33.90 Initial Maintenance Inspection

One commenter suggests that the interpretation of the current § 33.90 needs to clearly define the requirements in that section for engines that incorporate the new OEI rated power levels, and that an advisory circular must be published together with this Final rule.

The FAA disagrees. The FAA should not delay publication of this Final rule pending the development of new advisory material. The FAA plans to issue to the advisory material as soon as practical.

Section 33.93 Teardown Inspection

One commenter states that in proposed § 33.93, there is an ''and'' which they believe should be an ''or'' in the first sentence of proposed § 33.93(c), so that the fifth and sixth lines would read: ''the endurance testing of § 33.87 (b) or (c) or (d) or (e) or this part and followed * * *''. This change is needed because proposed 33.87(a) states: ''for engines tested under paragraphs (b), (c), (d) or (e) of this section * * *'' and the new § 33.87(f) reads: ''and following completion of the tests under paragraphs (b), (c), (d) or (e) of this section * * *''.

The FAA agrees. The changes to revised § 33.93 are made.

Regulatory Evaluation Summary

Changes to the federal regulations must undergo several economic analyses. First, Executive Order 12866 directs Federal agencies to promulgate new regulations or modify existing regulations only if the potential benefits to society outweigh the potential costs. Second, the Regulatory Flexibility Act of 1980 requires agencies to analyze the economic impact of regulatory changes on small entities. Finally, the Office of Management and Budget directs agencies to assess the effects of regulatory changes on international trade. In conducting these assessments, the FAA has determined that this rule: (1) Will generate benefits exceeding its costs and is not ''significant'' as defined in Executive Order 12866; (2) is not ''significant'' as defined in DOT's Policies and Procedures; (3) will not have a significant impact on a substantial number of small entities; and (4) will not restrain international trade. These analyses are available in the docket.

The new OEI power ratings will afford rotorcraft manufacturers the opportunity to install higher rated engines in their products. The principal operational benefits will be the ability to carry higher payloads from existing fields or to takeoff from smaller fields with current payloads, which should enable more Category B operators to use their rotorcraft for Category A operations, and also increase the potential for all operators to use more efficient and profitable routes.

The testing costs associated with obtaining these ratings should be viewed as the price of an additional capability and would be evaluated by the manufacturer based on market potential. It is not possible to quantify the extent of the net operational benefits that will be realized by the operators because the number of products that will be certificated to this standard cannot be predicted. The FAA is able to conclude, however, that the rule will not have a negative economic impact on manufacturers or operators. Because these are optional ratings, manufacturers will provide this capability only if the additional costs can be recovered in the marketplace.

Safety after an engine failure under the provisions of this rule will be as test equivalent to operational safety under the previous regulations. This assessment is based on the requirement for an engine inspection following one mission cycle of either the 30-second or 2-minute OEI power levels. All engine parts that may not be suitable for further use must be discarded and replaced in order to maintain the continued airworthiness of the engine. The existing minimum level of engine airworthiness will be maintained under this rule by virtue of new and existing design, analysis, and test certification requirements. In summary, the FAA finds that the benefits of this rule will exceed the costs.

International Trade Impact Analysis

These rule changes will have little or no impact on trade for both U.S. firms doing business in foreign countries and foreign firms doing business in the United States. In the U.S. market, foreign manufacturers will have the option of designing engines and helicopters capable of satisfying the new OEI ratings and therefore will not be at a competitive disadvantage with U.S. manufacturers. Because of the large U.S. market, foreign manufacturers are likely to certify their rotorcraft to U.S. rules, which will limit any competitive advantage U.S. manufacturers might gain in foreign markets.

Regulatory Flexibility Determination

The Regulatory Flexibility Act of 1980 (RFA) was enacted by Congress to ensure that small entities are not unnecessarily or disproportionately burdened by Government regulations. The RFA requires a Regulatory Flexibility Analysis if a rule would have a significant economic impact, either detrimental or beneficial, on a substantial number of small entities. FAA order 2100.14A, Regulatory Flexibility Criteria and Guidance, establishes threshold cost values and small entity size standards for complying with RFA review requirements in FAA rulemaking actions. A review of domestic engine manufacturers indicates that none meets the minimum size threshold. As such, the FAA has determined that this rule will not have significant economic impact on a substantial number of small entities.

Federalism Implications

The regulations adopted herein will not have substantial direct effects on the States, on the relationship between the national government and the States, or on the distribution of power and

responsibilities among the various levels of government. Therefore, in accordance with Executive Order 12612, it is determined that this regulation does not have sufficient federalism implications to warrant the preparation of a Federalism Assessment.

Conclusion

For the reasons discussed in the preamble, and based on the findings in the Regulatory Flexibility Determination and the International Trade Impact Analysis, the FAA has determined that this regulation is not a significant regulatory action under Executive Order 12866. In addition, the FAA certifies that these amendments do not have a significant economic impact, positive or negative, on a substantial number of small entities under the criteria of the Regulatory Flexibility Act. These amendments are considered nonsignificant under DOT Regulatory Policies and Procedures (44 FR 11034, February 26, 1979). A regulatory evaluation of the amendments, including a Regulatory Flexibility Determination and Trade Impact Analysis, has been placed in the docket. A copy may be obtained by contacting the person identified under **FOR FURTHER INFORMATION CONTACT**.

List of Subjects

14 CFR Part 1

Airmen, Flights, Balloons, Parachutes, Aircraft Pilots, Pilots Transportation, Agreements, Kites, Air Safety, Safety, Aviation Safety, Air Transportation, Air Carriers, Aircraft, Airports, Airplanes, Helicopters, Rotorcraft, Heliports, Engines, Ratings.

14 CFR Part 33

Engines, Rotorcraft, Air Transportation, Aircraft, Aviation safety, Safety.

Adoption of the Amendments

Accordingly, The Federal Aviation Administration (FAA) amends 14 CFR part 1 and part 33 as follows:

PART 1—DEFINITIONS AND ABBREVIATIONS

1. The authority citation for part 1 continues to read as follows:

Authority: 49 U.S.C 106(g), 40113, 44701.

2. Section 1.1 is amended by adding the definitions in alphabetical order of ''Rated 30-Second OEI Power'' and ''Rated 2-Minute OEI Power'' to read as follows:

§ 1.1 General Definitions.

* * * * *

Rated 30-second OEI power, with respect to rotorcraft turbine engines, means the approved brake horsepower developed under static conditions at specified altitudes and temperatures within the operating limitations established for the engine under part 33 of this chapter, for continued one-flight operation after the failure of one engine in multiengine rotorcraft, limited to three periods of use no longer than 30 seconds each in any one flight, and followed by mandatory inspection and prescribed maintenance action.

Rated 2-minute OEI power, with respect to rotorcraft turbine engines, means the approved brake horsepower developed under static conditions at specified altitudes and temperatures within the operating limitations established for the engine under part 33 of this chapter, for continued one-flight operation after the failure of one engine in multiengine rotorcraft, limited to three periods of use no longer than 2 minutes each in any one flight, and followed by mandatory inspection and prescribed maintenance action.

* * * * *

PART 33—AIRWORTHINESS STANDARDS: AIRCRAFT ENGINES

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

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

4. Section 33.7 is amended by redesignating paragraph (c)(1)(viii) as (c)(1)(x); by revising newly redesignated (c)(1)(x); and by adding new paragraphs (c)(1)(viii) and (c)(1)(ix) to read as follows:

§ 33.7 Engine ratings and operating limitations.

* * * * *

(c) * * *

(1) * * *

(viii) Rated 2-minute OEI power;

(ix) Rated 30-second OEI power; and

(x) Auxiliary power unit (APU) mode of operation.

* * * * *

5. Section 33.29 is amended by adding new paragraph (c) as follows:

§ 33.29 Instrument connection.

* * * * *

(c) Each rotorcraft turbine engine having a 30-second OEI rating and a 2-minute OEI rating must have a provision for a means to:

(1) Alert the pilot when the engine is at the 30-second OEI and the 2-minute OEI power levels, when the event begins, and when the time interval expires;

(2) Determine, in a positive manner, that the engine has been operated at each rating; and

(3) Automatically record each usage and duration of power at each rating.

6. Section 33.67 is amended by adding new paragraph (d) as follows:

§ 33.67 Fuel system.

* * * * *

(d) Engines having a 30-second OEI rating must incorporate means for automatic availability and automatic control of a 30-second OEI power.

7. Section 33.85 is amended by adding new paragraphs (c) and (d) as follows:

§ 33.85 Calibration tests.

* * * * *

(c) In showing compliance with this section, each condition must stabilize before measurements are taken, except as permitted by paragraph (d) of this section.

(d) In the case of engines having 30-second OEI, and 2-minute OEI ratings, measurements taken during the applicable endurance test prescribed in § 33.87(f) (1) through (8) may be used in showing compliance with the requirements of this section for these OEI ratings.

8. Section 33.87 is amended by revising the introductory text of paragraph (a) and paragraph (a)(8); by redesignating paragraph (f) as paragraph (g); by revising the reference ''(e)(2) (ii) through (iv)'' to read ''(g)(2) (ii) through (iv)'' in newly designated paragraph (g)(2)(i), by revising the reference ''(e)(2)(i)'' to read ''(g)(2)(i)'' in newly designated paragraph ''(g)(2)(ii)''; by revising the reference ''(e)(2)(i)'' to read ''(g)(2)(i)'' in newly designated paragraph ''(g)(2)(iii)''; by revising the reference ''(e)(2) (i) and (ii)'' to read ''(g)(2) (i) and (ii)'' in newly designated paragraph (g)(2)(iv); and by adding a new paragraph (f) to read as follows:

§ 33.87 Endurance test.

(a) *General.* Each engine must be subjected to an endurance test that includes a total of at least 150 hours of operation and, depending upon the type and contemplated use of the engine, consists of one of the series of runs specified in paragraphs (b) through (g) of this section, as applicable. For engines tested under paragraphs (b), (c), (d), (e) or (g) of this section, the prescribed 6-hour test sequence must be conducted 25 times to complete the required 150 hours of operation. Engines for which the 30-second OEI and 2-minute OEI ratings are desired must be further tested under paragraph

(f) of this section. The following test requirements apply:

* * * * *

(8) If the number of occurrences of either transient rotor shaft overspeed or transient gas overtemperature is limited, that number of the accelerations required by paragraphs (b) through (g) of this section must be made at the limiting overspeed or overtemperature. If the number of occurrences is not limited, half the required accelerations must be made at the limiting overspeed or overtemperature.

* * * * *

(f) *Rotorcraft engines for which 30-second OEI and 2-minute OEI ratings are desired.* For each rotorcraft engine for which 30-second OEI and 2-minute OEI power ratings are desired, and following completion of the tests under paragraphs (b), (c), (d), or (e) of this section, the applicant may disassemble the tested engine to the extent necessary to show compliance with the requirements of § 33.93(a). The tested engine must then be reassembled using the same parts used during the test runs of paragraphs (b), (c), (d), or (e) of this section, except those parts described as consumables in the Instructions for Continued Airworthiness. The applicant must then conduct the following test sequence four times, for a total time of not less than 120 minutes:

(1) *Takeoff power.* Three minutes at rated takeoff power.

(2)*30-second OEI power.* Thirty seconds at rated 30-second OEI power.

(3) *2-minute OEI power.* Two minutes at rated 2-minute OEI power.

(4) *30-minute OEI power, continuous OEI power, or maximum continuous power.* Five minutes at rated 30-minute OEI power, rated continuous OEI power, or rated maximum continuous power, whichever is greatest, except that, during the first test sequence, this period shall be 65 minutes.

(5) *50 percent takeoff power.* One minute at 50 percent takeoff power.

(6) *30-second OEI power.* Thirty seconds at rated 30-second OEI power.

(7) *2-minute OEI power.* Two minutes at rated 2-minute OEI power.

(8) *Idle.* One minute at idle.

* * * * *

9. Section 33.88 is revised to read as follows:

§ 33.88 Engine overtemperature test.

(a) Each engine must run for 5 minutes at maximum permissible rpm with the gas temperature at least 75 °F (42 °C) higher than the maximum rating's steady-state operating limit, excluding maximum values of rpm and gas temperature associated with the 30-second OEI and 2-minute OEI ratings. Following this run, the turbine assembly must be within serviceable limits.

(b) Each engine for which 30-second OEI and 2-minute OEI ratings are desired, that does not incorporate a means to limit temperature, must be run for a period of 5 minutes at the maximum power-on rpm with the gas temperature at least 75 °F (42 °C) higher than the 30-second OEI rating operating limit. Following this run, the turbine assembly may exhibit distress beyond the limits for an overtemperature condition provided the engine is shown by analysis or test, as found necessary by the Administrator, to maintain the integrity of the turbine assembly.

(c) Each engine for which 30-second OEI and 2-minute OEI ratings are desired, that incorporates a means to limit temperature, must be run for a period of 4 minutes at the maximum power-on rpm with the gas temperature at least 35 °F (20 °C) higher than the maximum operating limit. Following this run, the turbine assembly may exhibit distress beyond the limits for an overtemperature condition provided the engine is shown by analysis or test, as found necessary by the Administrator, to maintain the integrity of the turbine assembly.

(d) A separate test vehicle may be used for each test condition.

10. Section 33.93 is revised to read as follows:

§ 33.93 Teardown inspection.

(a) After completing the endurance testing of § 33.87 (b), (c), (d), (e), or (g) of this part, each engine must be completely disassembled, and

(1) Each component having an adjustment setting and a functioning characteristic that can be established independent of installation on the engine must retain each setting and functioning characteristic within the limits that were established and recorded at the beginning of the test; and

(2) Each engine part must conform to the type design and be eligible for incorporation into an engine for continued operation, in accordance with information submitted in compliance with § 33.4.

(b) After completing the endurance testing of § 33.87(f), each engine must be completely disassembled, and

(1) Each component having an adjustment setting and a functioning characteristic that can be established independent of installation on the engine must retain each setting and functioning characteristic within the limits that were established and recorded at the beginning of the test; and

(2) Each engine may exhibit deterioration in excess of that permitted in paragraph (a)(2) of this section including some engine parts or components that may be unsuitable for further use. The applicant must show by analysis and/or test, as found necessary by the Administrator, that structural integrity of the engine including mounts, cases, bearing supports, shafts, and rotors, is maintained; or

(c) In lieu of compliance with paragraph (b) of this section, each engine for which the 30-second OEI and 2-minute OEI ratings are desired, may be subjected to the endurance testing of §§ 33.87 (b), (c), (d), or (e) of this part, and followed by the testing of § 33.87(f) without intervening disassembly and inspection. However, the engine must comply with paragraph (a) of this section after completing the endurance testing of § 33.87(f).

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David R. Hinson,

Administrator.

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