Federal Aviation Agency

Washington, D.C.

Civil Aeronautics Manual 13

Aircraft Engine Airworthiness

Supplement No. 2, CAM 13 dated October 1, 1959 **Feb. 15, 1963**

SUBJECT: 30-Minute Power Rating for Helicopter Turbine Engines

This supplement is issued to incorporate into CAM 13 Civil Air Regulations Amendment 13–5.

Amendment 13–5 established a new 30-minute power rating for certain helicopter engines and a new endurance test schedule for substantiating the rating. The amendment was issued January 7, 1963, and became effective February 12, 1963.

New or revised material is enclosed in black brackets on the pages submitted with this supplement, except the pages in the addendum containing the preambles to amendments.

Remove the following pages:	*Insert the following new pages:*
1 and 2	1 through 2–1
15 through 17	15 through 18
P–5 and P–6	P–5 through P–7

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ATTACHMENTS.

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Aircraft Engine Airworthiness

Subpart A—General

Applicability and Definitions

13.0 *Applicability of this part.* This part establishes standards with which compliance shall be demonstrated for the issuance of and changes to type certificates for engines used on aircraft. This part, until superseded or rescinded, shall apply to all engines for which applications for type certification are made after the effective date of this part (August 20, 1938).

13.1 *Definitions.* As used in this part terms are defined as follows:

(a) *Administration.*

(1) *Administrator.* The Administrator is the Administrator of the Federal Aviation Agency.

(2) *Applicant.* An applicant is a person or persons applying for approval of an engine or any part thereof.

(3) *Approved.* Approved, when used alone or as modifying terms such as means, devices, specifications, etc., shall mean approved by the Administrator. (See sec. 13.18.)

(b) *General design.*

(1) *Standard atmosphere.* The standard atmosphere is an atmosphere (see NACA Technical Note 3182) defined as follows:

(i) The air is a dry, perfect gas.

(ii) The temperature at sea level is 59° F.,

(iii) The pressure at sea level is 29.92 inches Hg,

(iv) The temperature gradient from sea level to the altitude at which the temperature equals −69.7° F. is −0.003566° F./ft. and zero thereabove.

(v) The density ρ_0 at sea level under the above conditions is 0.002377 lbs. sec.^{2}/ft.^{4}

(2) *Brake horsepower.* Brake horsepower is the power delivered at the propeller shaft of the engine.

(3) *Take-off power or thrust.*

(i) Take-off power for reciprocating engines is the brake horsepower developed under standard sea level conditions and under the maximum conditions of crankshaft rotational speed and engine manifold pressure approved for the normal take-off, and limited in use to a maximum continuous period as indicated in the approved engine specification.

(ii) Take-off power for turbine engines is the brake horsepower developed under static conditions at specified altitudes and atmospheric temperatures and under the maximum conditions of rotor shaft rotational speed and gas temperature approved for the normal take-off, and limited in use to a maximum continuous period as indicated in the approved engine specification.

(iii) Take-off thrust for turbine engines is the jet thrust developed under static conditions at specified altitudes and atmospheric temperatures and under the maximum conditions of rotor shaft rotational speed and gas temperature approved for the normal take-off, and limited in use to a maximum continuous period as indicated in the approved engine specification.

[(4) *30-minute power for helicopter turbine engines.* 30-minute power for helicopter turbine engines is the maximum brake horsepower, developed under static conditions at specified altitudes and atmospheric temperatures, under the maximum conditions of rotor shaft rotational speed and gas temperature, and limited in use to periods of not over 30 minutes as shown on the engine data sheet.]

[(5)] *Maximum continuous power or thrust.*

(i) Maximum continuous power for reciprocating engines is the brake horsepower developed in standard atmosphere at a specified altitude and under the maximum conditions of crankshaft rotational speed and engine manifold pressure, and approved for use during periods of unrestricted duration.

(ii) Maximum continuous power for turbine engines is the brake horsepower developed at specified altitudes, atmospheric temperatures, and flight speeds and under the maximum conditions of rotor shaft rotational speed and gas temperature, and approved for use during periods of unrestricted duration.

(iii) Maximum continuous thrust for turbine engines is the jet thrust developed at specified altitudes, atmospheric temperatures, and flight speeds and under the maximum conditions of rotor shaft rotational speed and gas temperature, and approved for use during periods of unrestricted duration.

[(6)] *Gas temperature.* Gas temperature for turbine engines is the temperature of the gas stream obtained as indicated in the approved engine specification.

[(7)] *Manifold pressure.* Manifold pressure is the absolute pressure measured at the appropriate point in the induction system, usually in inches of mercury.

[(8)] *Critical altitude.*[1] The critical altitude is the maximum altitude at which in standard atmosphere it is possible to maintain without ram, at a specified rotational speed, a specified power or a specified manifold pressure. Unless otherwise stated, the critical altitude is the maximum altitude at which it is possible to maintain, at the maximum continuous rotational speed, one of the following:

(i) The maximum continuous power, in the case of engines for which this power rating is the same at sea level and at the rated altitude,

(ii) The maximum continuous rated manifold pressure, in the case of engines the maximum continuous power of which is governed by a constant manifold pressure.

[(Amendment 13-5, 28 F.R. 304, Jan. 11, 1963, effective Feb. 12, 1963.)]

[1] These definitions may not apply in the case of less conventional engines such as compound, variable discharge turbines, etc.

Certification

13.10 *Eligibility for type certificates.* An engine shall be eligible for type certification under the provisions of this part if it complies with the airworthiness provisions hereinafter established or if the Administrator finds that the provision or provisions not complied with are compensated for by factors which provide an equivalent level of safety: *Provided,* That the Administrator finds no feature or characteristic of the engine which renders it unsafe for use on aircraft.

13.11 *Designation of applicable regulations.* The provisions of this section shall apply to all engine types certificated under this part irrespective of the date of application for type certificate.

(a) Unless otherwise established by the Administrator, the engine shall comply with the provisions of this part together with all amendments thereto effective on the date of application for type certificate, except that compliance with later effective amendments may be elected or required pursuant to paragraphs (c), (d), and (e) of this section.

(b) If the interval between the date of application for type certificate and the issuance of the corresponding type certificate exceeds three years, a new application for type certificate shall be required, except that for applications pending on May 1, 1954, such three-year period shall commence on that date. At the option of the applicant, a new application may be filed prior to the expiration of the three-year period. In either instance the applicable regulations shall be those effective on the date of the new application in accordance with paragraph (a) of this section.

(c) During the interval between filing the application and the issuance of a type certificate, the applicant may elect to show compliance with any amendment of this part which becomes effective during that interval, in which case all other amendments found by the Administrator to be directly related shall be complied with.

(d) Except as otherwise provided by the Administrator, pursuant to section 1.24 of this subchapter, a change to the type certificate (see sec. 13.13(b)) may be accomplished, at the option of the holder of the type certificate, either in accordance with the regulations incorporated by reference in the type

operational range of rotational speed and engine power. If critical vibration is found to be present in the operating range of the engine, changes in design of the engine shall be made for its elimination prior to the conduct of the endurance test specified in section 13.254, or the endurance test shall include operation under the most adverse vibration condition for a period sufficient to establish the ability of the engine to operate without fatigue failure.

13.252 *Calibration tests.*

(a) The engine shall be subjected to such calibration tests as are necessary to establish its power characteristics and the conditions for the endurance test specified in section 13.254. The results of the power characteristics calibration tests shall constitute the basis for establishing the characteristics of the engine over its entire operating range of speeds, pressures, temperatures, and altitudes. Power ratings shall be based upon standard atmospheric conditions. (See also sec. 13.16(d).)

(b) Prior to the endurance test the power control(s) shall be adjusted to produce the maximum allowable gas temperatures and rotor speeds at take-off operating conditions. Such adjustment shall not be changed during the relevant calibration tests and the relevant runs of the endurance test.

13.254 *Endurance test.* The endurance test of an engine with a representative propeller (if applicable) shall include a total of 150 hours of operation consisting of 25 periods of 6 hours each as specified in [either paragraph (a) or (b) of this section.] The runs shall be performed in, whichever is applicable, such order as is found appropriate by the Administrator for the specific engine. During the endurance test, the engine power and/or thrust and the engine rotational speed shall not be less than 100 percent of the specified values except that substantiating evidence shall be submitted if the engine parameters are not controlled within this limitation. Each period of the 150-hour endurance test shall be conducted as follows:

[(a) *All engines except helicopter engines for which a 30-minute rating is desired.*]

[(1)] *Take-off and idling.* One hour of alternate 5-minute periods shall be conducted at take-off power and/or thrust and at idling power and/or thrust. The developed powers and/or thrusts at take-off and idling conditions and their corresponding rotor speed and gas temperature conditions shall be as established by the power control(s) in accordance with the schedule established by the manufacturer. It shall be permissible to control manually during any one period the rotor speed and power and/or thrust while taking data to check performance. For engines with augmented take-off ratings which involve increases in turbine inlet temperature, rotor speed, or shaft power, this period of running at take-off shall be at the augmented rating. For engines with augmented take-off ratings which do not materially increase operating severity, the amount of running conducted at the augmented rating shall be established by the Administrator. In changing the power setting after each period, the power-control lever shall be moved in the manner prescribed in paragraph (e) of this section.

[(2)] *Maximum continuous and take-off.* Fifteen periods each of 30 minutes' duration shall be conducted at maximum continuous power and/or thrust, and 10 periods each of 30 minutes' duration shall be conducted at take-off power and/or thrust.

[(3)] *Maximum continuous power and/or thrust.* One hour and 30 minutes shall be conducted at the maximum continuous power and/or thrust.

[(4)] *Incremental cruise power and/or thrust.* Two hours and 30 minutes shall be conducted at the successive power lever positions corresponding to at least 15 approximately equal speed and time increments between maximum continuous engine rotational speed and ground or minimum idle rotational speed. For engines operating at constant speed, the thrust and/or power may be varied in lieu of speed. In the event significant peak vibrations exist anywhere between ground idle and maximum continuous conditions, the number of increments chosen may be altered to increase the amount of

running conducted while being subjected to the peak vibrations up to an amount not to exceed 50 percent of the total time spent in incremental running. (See also sec. 13.251.)

[(5)] *Acceleration and deceleration runs.* Thirty minutes shall be conducted of accelerations and decelerations consisting of 6 cycles from idling power and or thrust to take-off power and/or thrust and maintained at the take-off power lever position for 30 seconds and at the idling power lever position for approximately 4½ minutes. In complying with the provisions of this paragraph, the power-control lever shall be moved from one extreme position to the other in not more than one second, except where different regimes of control operations are incorporated necessitating scheduling of the power-control lever motion in going from one extreme position to the other, a longer period of time shall be acceptable but in no case shall this time exceed 2 seconds.

[(6)] *Starts.* One hundred starts shall be made, of which 25 starts shall be preceded by at least a 2-hour engine shutdown. Ten starts shall be false engine starts pausing for the applicant's specified minimum fuel drainage time before attempting a normal start. Ten starts shall be normal restarts with not longer than 15 minutes since engine shutdown. It shall be acceptable to make the remaining starts after completion of the 150 hours of endurance testing.

[(7)] *Maximum temperatures.* The limiting maximum hot gas and, when practicable, oil inlet temperatures shall be substantiated by operation at these limits during all the takeoff and maximum continuous running of the endurance test except where the test periods are of 5 minutes or shorter duration and do not always permit stabilization.

[(b) *Helicopter engines for which a 30-minute rating is desired.*

[(1) *Takeoff and idling.* One hour of alternate 5-minute periods shall be conducted at takeoff power and thrust and at idling power and thrust. The developed powers and thrusts at takeoff and idling conditions and their corresponding rotor speed and gas temperature conditions shall be as established by the power control(s) in accordance with the schedule established by the manufacturer. It shall be permissible to control manually during any one period the rotor speed and power and thrust while taking data to check performance. For engines with augmented takeoff ratings which involve increases in turbine inlet temperature, rotor speed, or shaft power, this period of running at rated takeoff power shall be at the augmented rating. In changing the power setting after each period, the power-control lever shall be moved in the manner prescribed in subparagraph (5) of this paragraph.

[(2) *30-minute power.* Thirty minutes shall be conducted at 30-minute power and/or thrust.

[(3) *Maximum continuous power and thrust.* Two hours shall be conducted at the maximum continuous power and thrust.

[(4) *Incremental cruise power and thrust.* Two hours shall be conducted at the successive power lever positions corresponding with not less than 12 approximately equal speed and time increments between maximum continuous engine rotational speed and ground or minimum idle rotational speed. For engines operating at constant speed, it shall be permissible to vary the thrust and power in lieu of speed. In the event significant peak vibrations exist anywhere between ground idle and maximum continuous conditions, the number of increments chosen shall be altered to increase the amount of running conducted while being subjected to the peak vibrations up to an amount not exceeding 50 percent of the total time spent in incremental running. (See also sec. 13.251.)

[(5) *Acceleration and deceleration runs.* Thirty minutes shall be conducted of accelerations and decelerations consisting of 6 cycles from idling power and thrust to takeoff power and thrust and maintained at the takeoff power lever position for 30 seconds and at the idling power lever position for approximately 4½ minutes. In complying with the provisions of this subparagraph, the

power-control lever shall be moved from one extreme position to the other in not more than one second except that, where different regimes of control operations are incorporated necessitating scheduling of the power-control lever motion in going from one extreme position to the other, a longer period of time shall be acceptable but in no case shall this time exceed 2 seconds.

[(6) *Starts.* One hundred starts shall be made, of which 25 starts shall be preceded by at least a 2-hour engine shutdown. Ten starts shall be false engine starts pausing for the applicant's specified minimum fuel drainage time before attempting a normal start. Ten starts shall be normal restarts, each performed not more than 15 minutes after engine shutdown. It shall be acceptable to make the remaining starts after completion of the 150 hours of endurance testing.

[(7) *Maximum temperatures.* The limiting maximum hot gas and oil inlet temperatures shall be substantiated by operation at these limits during all the takeoff, 30-minute power, and maximum continuous running of the endurance test except where the test periods are not longer than 5 minutes and do not permit stabilization.]

[(Amendment 13-5, 28 F.R. 304, Jan. 11, 1963, effective Feb. 12, 1963.)]

13.255 *Operation test.* The operation test shall include all testing found by the Administrator to be necessary to demonstrate starting, idling, acceleration, overspeeding, functioning of propeller (if applicable) and ignition, and any other operational characteristic of the engine.

13.256 *Engine component tests.*

(a) For those systems which cannot be adequately substantiated by endurance testing in accordance with the provisions of section 13.254, additional tests shall be conducted to establish that components are capable of functioning reliably in all normally anticipated flight and atmospheric conditions.

(b) Temperature limits shall be established for those components which require temperature controlling provisions in the aircraft installation to assure satisfactory functioning, reliability, and durability.

13.257 *Teardown inspection.* After completion of the endurance test the engine shall be completely disassembled and a detailed inspection shall be made of the engine parts to check for fatigue and wear.

13.258 *Engine adjustments and parts replacements.* During the block tests servicing and minor repairs of the engine shall be permissible. If major repairs or replacement of parts are found necessary during the tests or in the teardown inspection, the parts in question shall be subjected to such additional tests as are found by the Administrator to be necessary.

13.259 *Engine-propeller systems tests.*

The following tests shall be conducted, where applicable, with a propeller installed which will be representative of the type used on a typical aircraft installation. They may be included in the endurance run or otherwise performed in a manner acceptable to the Administrator.

(a) Feathering operation: 25 cycles.

(b) Negative torque and/or thrust system operation: 25 cycles from maximum continuous power.

(c) Automatic decoupler operation: 25 cycles from maximum continuous power (if repeated decoupling and recoupling in service is the intended function of the device).

(d) Reverse thrust operation: 175 cycles from the flight-idle position to full reverse and 25 cycles at maximum continuous power from full forward to full reverse thrust. At the end of each cycle the propeller shall be operated in reverse pitch for a period of 30 seconds at the maximum rotational speed and power declared by the applicant for reverse pitch operation.

13.260 *Thrust reversers.*

If the engine incorporates a reverser, the endurance, calibration, operation, and vibration tests prescribed in this part shall be run with the reverser installed. In complying with the provisions of this section, the power control lever shall be moved from one extreme position to the other in not more than one second except, where regimes of control

operations are incorporated necessitating scheduling of the power control lever motion in going from one extreme position to the other, a longer period of time shall be acceptable but in no case shall this time exceed 3 seconds. In addition, the tests prescribed in paragraphs (a) and (b) of this section shall be applicable. These tests may be scheduled as part of the endurance run.

(a) If the reverser is intended for use only as a braking means on the ground, 175 reversals shall be made from flight-idle forward thrust to maximum reverse thrust and 25 reversals shall be made from maximum forward to maximum reverse thrust. After each reversal, the reverser shall be operated at full reverse thrust for a period of 30 seconds.

(b) If the reverser is intended for use in flight, the provisions of paragraph (a) of this section shall apply, except that, after each reversal, the reverser shall be operated at full reverse thrust for a period of one minute.

Note: The provisions of section 4b.407 apply to the complete reverser system, including that portion which is an integral part of the engine.

(Amendment 13-4, 27 F.R. 3003, March 30, 1962, effective May 3, 1962.)

Section 13.211 is being amended to require for turbine engines that an electric ignition system (if used) shall have at least two igniters and two separate secondary electric circuits. This will afford reliability similar to that obtained with reciprocating engines employing dual electric ignition systems.

Section 13.217 is being added to provide that the power or thrust of turbine engines can be increased under static conditions from flight idle to 95 percent of the takeoff rating in not over 5 seconds.

Section 13.259 is being added to specify criteria which are intended to assure that engine-actuated propeller controls function without detrimental effect on either the engine or the propeller.

Section 13.260 is being added to establish the airworthiness standard for thrust reversers. Detailed test provisions are specified for reversing systems intended for ground use only. For inflight reversing systems, these basic provisions are intended to be applied together with such other tests as are found necessary by the Administrator to assure the airworthiness of the device. A note is appended to this requirement to clarify the applicability of section 4b.407 to portions of reverser systems which are also integral parts of the engine.

Amendments which were proposed to establish fail safe criteria for automatic engine control systems, to provide that compressor rotors be designed and constructed to provide sufficient strength to withstand damage-inducing factors associated with engine operation, and to provide additional design considerations to assure the structural integrity of turbine rotors, are deferred pending the results of further study of the problems which are involved in these issues. For the same reason, a proposal to add a requirement establishing criteria to prevent unsafe conditions in the event of a single probable failure or malfunction of any single element in the engine, is also deferred.

Interested persons have been afforded an opportunity to participate in the making of this amendment (24 F.R. 128), and due consideration has been given to all relevant matter presented.

Amendment made changes in sections 13.110, 13.112, 13.155, 13.211, 13.210, and added new sections 13.217, 13.259, and 13.260.

Amendment 13–4

Miscellaneous Amendments Resulting From the First Federal Aviation Agency Airworthiness Review

Adopted: Mar. 27, 1962
Effective: May 3, 1962
Published: Mar. 30, 1962 (27 F.R. 3003)

As a result of the First Federal Aviation Agency Airworthiness Review, the Agency published a notice of proposed rule making affecting several parts of the Civil Air Regulations. This notice was published in the FEDERAL REGISTER (26 F.R. 5130) and circulated as Civil Air Regulations Draft Release No. 61–12 dated June 8, 1961. There are contained herein amendments to Part 13 of the Civil Air Regulations which stem from this First FAA Airworthiness Review.

Presently effective section 13.260 requires, among other things, that thrust reversers be subjected to reversal tests and that, after each reversal, the reverser be operated at full reverse thrust for a period of one minute. A period of operation this long is unnecessary for reversers intended for use only as a braking means on the ground since the usual period of reverse thrust in operation has been shown to be between 20 and 30 seconds. Accordingly, the provision is revised by reducing the reverse thrust test time for such reversers from one minute per cycle to 30 seconds per cycle.

Concurrently, the provisions of section 13.260(b), dealing specifically with reversers intended for use in flight, are being amended to retain the requirement for a one-minute reversal operation. In addition, the proposed provision requiring such other tests to be conducted as are found necessary to insure safe and reliable operation of the reverser in flight is not being adopted. This provision unnecessarily repeats the requirement which appears elsewhere and could lead to an incorrect inference that flight tests of an engine might be required as a part of engine type certification.

Interested persons have been afforded an opportunity to participate in the making of this amendment, and due consideration has been given to all relevant matter presented.

Amendment changed "one minute" to "30 seconds" in section 13.260(a), and revised section 13.260(b).

Amendment 13-5

30-Minute Power Rating for Helicopter Turbine Engines

Adopted: Jan. 7, 1962
Effective: Feb. 12, 1963
Published: Jan. 11, 1963 (28 F.R. 304)

A notice of proposed rule making was published in the Federal Register April 10, 1962 (27 F.R. 3405), and circulated to the industry as Draft Release 62-15 dated April 4, 1962. This draft release proposed to amend Part 13 of the Civil Air Regulations by establishing a new 30-minute power rating for helicopter engines and a new endurance test schedule to be required for substantiating the rating.

The rules being adopted establish a new 30-minute power rating for certain helicopter engines and a new endurance test schedule for substantiating the rating. These rules will provide for a higher power, to be used in complying with helicopter performance requirements. They will affect the manufacturer of the helicopter engine primarily since they involve changes to the type certification requirements for such engines.

The presently effective provisions of Part 7 of the Civil Air Regulations require that certain rotorcraft takeoff and en route climb performance determinations be made with one engine inoperative and remaining engines operating at maximum continuous power. Representations from the industry have been made that a higher power could be used in making these determinations without adversely affecting safety and that improved helicopter performance would result. It has been recommended that rated takeoff power, if used within practical limits, could be used in place of maximum continuous power.

In response to these representations, the Agency has recently authorized type certification of twin turbine-powered transport category helicopters using takeoff power, in lieu of maximum continuous power, in establishing climb performance. The use of such takeoff power is limited to periods not exceeding 30 minutes in duration.

At the same time the Agency indicated that this performance requirement as well as other more comprehensive requirements, presently under study, would be incorporated into

existing Part 7 as soon as operating experience is obtained on the twin turbine-powered helicopters.

While the use of rated takeoff power by the helicopter manufacturers for the establishment of certain performance data for their twin turbine-powered helicopters results in the substantiation of such power for turbine engines installed in their helicopters, the Agency believes that in the future such substantiation should be accomplished prior to type certification and subsequent installation of the engine. While engine manufacturers may now substantiate their turbine engies for takeoff power for 30 miutes duration, the present rules do not specifically provide for a 30-minute power rating. Therefore, it is considered appropriate to amend the provisions of Part 13 to provide for the substantiation of turbine engines used in helicopters for this higher power during type certification of such engines where a rating at this higher power is desired. Accordingly, Part 13 is being amended by defining and adding a new rating of "30-minute power," which will be limited to periods of use not exceeding 30 minutes duration. To insure reliable operation at this power, a new test schedule is being added to section 13.254 for substantiating such power for turbine engines used in helicopters.

Comments on the draft release were received from interested persons and consideration has been given to all relevant matter presented. Several comments were received to the effect that the new rating should be optional and, in any case, applicable only to engines usd in multiengine helicopters. The draft release provides that all helicopter turbine engines would be required to be type certificated in accordance with the new test schedule for the 30-minute power rating. The Agency concurs with these comments and the rating and test schedule are being made optional accordingly. Other comments calling attention to typographical or constructional errors in the draft release have also been accepted and appropriate changes have been made to the rules being amended.

A number of comments were made suggesting changes or additions which have not been incorporated in the rules being amended. One comment discussed the desirability of adopting, for commercial use, other special ratings used by the military services. Such ratings are not pertinent to the amendments as they were proposed and their inclusion is not warranted at this time. One comment requested deletion of the word "maximum" from the definition of 30-minute power. This deletion is not being made because it is intended that both takeoff power and 30-minute power would represent the maximum output at which the engine would be rated for type certification. There is presently in process a rule making action which would add the word "maximum" to takeoff power. This does not preclude the use of lower power in meeting helicopter performance certification requirements. In this connection, another comment considered the power level of the 30-minute rating indefinite, and that it could be declared higher than takeoff power by an engine manufacturer. It was also suggested that the rating be called a "contingency rating." The Agency considers that takeoff power and 30-minute power are properly defined for rating purposes. The question of whether the new rating should be termed "contingency power" was considered at length before publication of the draft release, and the Agency sees no purpose to be served by changing terminology at this time. Another comment considered the test schedule at 30-minute power to be inadequate, particularly in view of the relatively small amount of testing at maximum temperature. The comment recommended increasing the running time at takeoff power and at 30-minute power, and increasing the time at maximum temperature. The Agency believes that the periods of operation at various powers and temperatures represent reasonable minima for type certification and that consideration of increases in testing severity lie outside the scope of the problem at issue. Accordingly, no changes are being made to the test schedule as published in the draft release.

Amendment made changes in sections 13.1 and 13.254.

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