UNITED STATES OF AMERICA
CIVIL AERONAUTICS BOARD
WASHINGTON, D. C.

Civil Air Regulations Amendment 13-1
Effective: May 16, 1953
Adopted: April 9, 1953

AIRCRAFT ENGINE AIRWORTHINESS

Persently effective section 13.154 of Part 13 of the Civil Air Regulations prescribes the endurance tests to be conducted for the certification of aircraft engines. This section, however, does not differentiate between single and two-speed reciprocating engines nor does it relate to the purpose for which they are to be used.

As a result of discussions of these test provisions at the annual airworthiness review, it appears that the present provisions are not sufficiently detailed and of the necessary severity to disclose possible engine defects which past service difficulties have found to prevail. This amendment provides separate test runs for single-speed engines, two-speed engines, and engines designed for use in helicopters. In addition, the amendment specifies in greater detail and, in certain respects greater severity, the tests required.

In addition, there are a few changes of an editorial nature to clarify the intent of the provisions of this part.

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.

In consideration of the foregoing the Civil Aeronautics Board hereby amends Part 13 of the Civil Air Regulations (14 CFR, Part 13) effective May 16, 1953:

1. By amending § 13.1 (a) (3) by adding the following reference: "(See § 13.18.)".

2. By amending § 13.15 (c) to read as follows:

13.15 Inspections and tests. * * *

(c) All manufacturing processes, construction, and assembly are as specified in the type design.

3. By amending § 13.152 by deleting from the second sentence the words "such tests" and substituting in lieu thereof the words "the power characteristics calibration tests".

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4. By amending § 13.154 to read as follows:

13.154 Endurance test. The endurance test of an engine with a representative propeller shall include a total of 150 hours of operation and, depending upon the type and contemplated use of the engine, shall consist of one of the series of runs specified in paragraphs (a) through (c) of this section, whichever series is applicable. The runs shall be performed in such periods and order as are found appropriate by the Administrator for the specific engine. During the endurance test the engine power and the crankshaft rotational speed shall be controlled within ± 3 percent of the specified values.

(a) Single-speed engines. For engines not incorporating a supercharger and for those incorporating a single-speed supercharger, the following series of runs shall apply:

(1) A 30-hour run shall be conducted consisting of alternate periods of 5 minutes at take-off power and speed, and 5 minutes at maximum best economy cruising power or at maximum recommended cruising power.

(2) A 20-hour run shall be conducted consisting of alternate periods of 1½ hours at maximum continuous power and speed, and ½ hour at 75 percent maximum continuous power and 91 percent maximum continuous speed.

(3) A 20-hour run shall be conducted consisting of alternate periods of 1½ hours at maximum continuous power and speed, and ½ hour at 70 percent maximum continuous power and 89 percent maximum continuous speed.

(4) A 20-hour run shall be conducted consisting of alternate periods of 1½ hours at maximum continuous power and speed, and ½ hour at 65 percent maximum continuous power and 87 percent maximum continuous speed.

(5) A 20-hour run shall be conducted consisting of alternate periods of 1½ hours at maximum continuous power and speed, and ½ hour at 60 percent maximum continuous power and 84.5 percent maximum continuous speed.

(6) A 20-hour run shall be conducted consisting of alternate periods of 1½ hours at maximum continuous power and speed, and ½ hour at 50 percent maximum continuous power and 79.5 percent maximum continuous speed.

(7) A 20-hour run shall be conducted consisting of alternate periods of 2½ hours at maximum continuous power and speed, and 2½ hours at maximum best economy cruising power or at maximum recommended cruising power.

(b) Two-Speed engines. For engines incorporating a two-speed supercharger, the following series of runs shall apply:

(1) A 30-hour run shall be conducted consisting of alternate periods in the lower gear ratio of 5 minutes at take-off power and speed, and 5 minutes at maximum best economy cruising power or at maximum recommended cruising power. If a take-off rating is desired in the higher gear ratio, 15 hours of the 30-hour run shall be conducted in the higher gear ratio in alternate periods of 5 minutes at the observed horsepower obtainable with the take-off critical altitude manifold pressure and take-off speed, and 5 minutes at 70 percent high ratio maximum continuous power and 89 percent high ratio maximum continuous speed.

(2) A 15-hour run shall be conducted consisting of alternate periods in the lower gear ratio of 1 hour at maximum continuous power and speed, and $\frac{1}{2}$ hour at 75 percent maximum continuous power and 91 percent maximum continuous speed.

(3) A 15-hour run shall be conducted consisting of alternate periods in the lower gear ratio of 1 hour at maximum continuous power and speed, and $\frac{1}{2}$ hour at 70 percent maximum continuous power and 89 percent maximum continuous speed.

(4) A 30-hour run shall be conducted in the higher gear ratio at maximum continuous power and speed.

(5) A 5-hour run shall be conducted consisting of alternate periods of 5 minutes in each of the supercharger gear ratios. The first 5 minutes of the test shall be conducted at normal rated speed in the higher gear ratio and the observed horsepower obtainable with 90 percent of the normal rated manifold pressure in the higher gear ratio under sea level conditions. The condition for operation for the alternate 5 minutes in the lower gear ratio shall be that obtained by shifting to the lower gear ratio at constant speed.

(6) A 10-hour run shall be conducted consisting of alternate periods in the lower gear ratio of 1 hour at maximum continuous power and speed, and 1 hour at 65 percent maximum continuous power and 87 percent maximum continuous speed.

(7) A 10-hour run shall be conducted consisting of alternate periods in the lower gear ratio of 1 hour at maximum continuous power and speed, and 1 hour at 60 percent maximum continuous power and 84.5 percent maximum continuous speed.

(8) A 10-hour run shall be conducted consisting of alternate periods in the lower gear ratio of 1 hour at maximum continuous power and speed, and 1 hour at 50 percent maximum continuous power and 79.5 percent maximum continuous speed.

(9) A 20-hour run shall be conducted consisting of alternate periods in the lower gear ratio of 2 hours at maximum continuous power and speed, and 2 hours at maximum best economy cruising power and speed or at maximum recommended cruising power.

(10) A 5-hour run shall be conducted in the lower gear ratio at maximum best economy cruising power and speed or at maximum recommended cruising power and speed.

NOTE: Where simulated altitude test equipment is not available and when operating in the higher gear ratio, the runs may be conducted at the observed horsepower obtained with the critical altitude manifold pressure or specified percentages thereof, and the fuel-air mixtures may be adjusted rich enough to suppress detonation.

(c) Helicopter engines. For engines to be eligible for use on helicopters, the following series of runs shall apply:

(1) A 35-hour run shall be conducted consisting of alternate periods of 30 minutes each at take-off power and speed, and at maximum continuous power and speed.

(2) A 25-hour run shall be conducted consisting of alternate periods of 2½ hours each at maximum continuous power and speed, and at 70 percent maximum continuous power at maximum continuous speed.

(3) A 25-hour run shall be conducted consisting of alternate periods of 2½ hours each at maximum continuous power and speed, and at 70 percent maximum continuous power at 80 to 90 percent maximum continuous speed.

(4) A 25-hour run shall be conducted consisting of alternate periods of 2½ hours each at 80 percent maximum continuous power at take-off speed, and at 80 percent maximum continuous power at 80 to 90 percent maximum continuous speed.

(5) A 25-hour run shall be conducted consisting of alternate periods of 2½ hours each at 80 percent maximum continuous power at take-off speed, and at either maximum continuous power at 110 percent maximum continuous speed or at take-off power at 103 percent take-off speed, whichever condition results in the greater speed.

(6) A 15-hour run shall be conducted at 105 percent maximum continuous power and 105 percent maximum continuous speed or at full throttle and corresponding speed at standard sea level carburetor entrance pressure, provided that 105 percent of the maximum continuous power is not exceeded.

5. By amending § 13.252 (a) by deleting from the second sentence the words "such tests" and substituting in lieu thereof the words "the power characteristics calibration tests".

(Sec. 205 (a), 52 Stat. 984; 49 U.S.C. 425 (a). Interpret or apply secs. 601, 603, 52 Stat. 1007, as amended, 1008; 49 U.S.C. 551, 553)

By the Civil Aeronautics Board:

/s/ M. C. Mulligan

M. C. Mulligan
Secretary

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