CIVIL AERONAUTICS BOARD

WASHINGTON, D. C.

CIVIL AIR REGULATIONS

PART 13.—AIRCRAFT ENGINE AIRWORTHINESS

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CIVIL AIR REGULATIONS

PART 13.—AIRCRAFT ENGINE AIRWORTHINESS [1]

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13.1 GENERAL

13.10 Scope. The airworthiness requirements set forth in this Part shall be used as a basis for determining the original eligibility of aircraft engines for use in certificated aircraft or for the issuance of type certificates therefor. Aircraft engines, when manufactured in accordance with, and conforming to, the aircraft engine specifications approved and in effect prior to the effective date of these regulations, of types having satisfactory safety records, will be eligible for use in certificated aircraft if such engines are in condition for safe operation.

13.11 Deviation. Deviation from these requirements may be permitted if it is clearly demonstrated that such deviation meets standards equivalent to or in excess of the requirements of this Part in insuring safe operation.

13.12 Acceptance of Army or Navy requirements. Equivalent requirements of the United States Army or Navy, with respect to airworthiness, may be accepted in lieu of the requirements provided in this Part.

13.13 Inspection. An authorized representative of the Administrator shall be permitted at any time and place to make such inspections and tests as are necessary to determine compliance with the requirements of this Part.

[1] Civil Aeronautics Manual 13, which may be secured from the Correspondence Section, Civil Aeronautics Administration, Washington, D. C., sets forth, in detail, the Administrator's interpretations and explanations of the requirements of this Part.

13.2 AIRWORTHINESS REQUIREMENTS

13.20 Design and construction. The engine shall be designed and constructed to function reliably under all flight and atmospheric conditions when properly installed, operated, and maintained in an aircraft.

13.200 Materials. The engine shall be made of materials proved by experience or conclusive tests to be uniformly adequate in quality and strength, and otherwise suitable for the parts in which they are used.

13.201 Fire prevention. The engine shall be so designed and constructed, and materials of such quality shall be used, that the probability of the occurrence and spread of fire, because of structural failure, over-heating, or other causes, shall be reduced to a minimum.

13.202 Detail design. The engine shall incorporate only details of design proved by experience or conclusive tests to be reliable and otherwise satisfactory for safe operation.

13 2020 Durability. The wearing surfaces, lubrication system and parts subject to fatigue shall be so designed and constructed that no unsafe condition will develop between overhaul periods when the engine is properly installed, operated and maintained in an aircraft.

13.2021 Vibration. The engine shall be designed and constructed to operate throughout its normal operating range of speeds and powers without excessive stress in the engine parts because of vibration, and without imparting excessive vibration forces to the engine support structure, when the engine is properly installed, operated and maintained in an aircraft with a suitable flight propeller.

13.2022 Fuel and induction system.

(*a*) The fuel system of the engine shall be designed and constructed to supply a satisfactory mixture under all flight and atmospheric conditions, during idling, acceleration, take-off, flight and landing, when the engine is properly installed, operated and maintained in an aircraft.

(*b*) The intake passages of the engine through which air, or fuel in combination with air passes. for combustion purposes. shall be designed and constructed, insofar as possible, to avoid formation of ice deposits in such passages. The engine shall be designed and constructed so as to permit the use of a satisfactory means of ice prevention.

13.2023 Ignition system. All spark ignition engines shall be equipped with (1) a dual ignition system having at least two spark plugs per cylinder and two separate electrical circuits having separate sources of electrical energy, or (2) an ignition system which will function with equal reliability in flight.

13.2024 Lubrication system. The lubrication system of the engine shall be so designed and constructed that the system will function properly in all flight attitudes and atmospheric conditions in which the engine is intended to be used. In wet sump engines, such requirement shall be met when only one-half the maximum oil supply is in the engine. The system shall be so designed and constructed that provision can readily be made for properly cooling the oil.

13.2025 Engine cooling. The engine shall be designed and constructed to provide satisfactory cooling when the engine is properly installed, operated and maintained in an aircraft.

13.2026 Engine and accessory mounting attachments.

(*a*) The mounting attachments and structure of the engine shall have sufficient strength when the engine is properly supported by a suitable engine mount structure, to meet the structural loading conditions of Part 04, and to withstand vibration forces likely to occur.

(*b*) Accessory mounting provisions and drives shall be designed and constructed to provide for the safe operation of the engine with the accessories attached. All essential engine accessories which may require inspection, adjustment, or removal between engine overhauls shall be mounted

in such manner that they may be readily inspected, adjusted or removed without disassembly of the engine.

13.21 Block testing. The engine, including at least essential accessories, shall satisfactorily complete block testing as hereinafter provided under power outputs and conditions simulating the most severe flight operations possible when the engine is properly installed, operated and maintained in an aircraft. Separate engines of identical design and construction may be used for the endurance, calibration, and operation tests.

13.210 Testing equipment and personnel. The applicant shall furnish suitable testing equipment and facilities, and competent personnel to conduct the required block tests.

13.211 Witnessing of tests. An authorized representative of the Administrator shall witness all block testing sufficiently to ascertain that the information presented in the applicant's test report is substantially correct and complete. Such representative shall witness, in their entirety, the operation test, the calibration test, the tear-down inspections, and at least the last 50 hours of the endurance tests.

13.212 Engine operating conditions and limitations. The engine operating conditions maintained within suitable tolerances or satisfactorily demonstrated during the testing shall determine the operating limitations to be assigned the engine by the Administrator. Such operating limitations shall include those necessary or advisable for safe operation of the engine, and may be placed on the following and any necessary additional items: Power output, crankshaft speed, manifold pressure, spark and mixture settings, fuel and oil grades, and cylinder head, barrel, intake air, and oil inlet temperatures.

13.213 Calibration tests. The engine shall be subjected to such calibration tests as are necessary to establish its power characteristics and the conditions under which it is to be endurance tested. Such tests shall cover, but need not be limited to, the proposed cruising, maximum-except-take-off, and take-off operating conditions.

13.214 Operation tests. The engine shall be operated at various power outputs and speeds throughout the proposed operating range to demonstrate that the engine has satisfactory running and vibration characteristics, and freedom from detonation.

13.215 Endurance tests. The endurance tests shall consist of the following 150 hours of testing on the same engine, in the order stated: (1) 50 hours at maximum-except-take-off power, (2) 50 hours at the most critical cruising conditions, (3) 40 hours at 91 percent take-off power or at least maximum-except-take-off power, and (4) 10 hours at take-off power. Such endurance test shall be conducted in periods of not less than 30 minutes duration.

13.2150 Engine adjustments and parts replacements.

(*a*) External adjustments and replacements of minor parts such as spark plugs, which are normally made in servicing aircraft engines, may be performed at reasonably spaced servicing periods designated in advance by the applicant.

(*b*) Minor internal adjustments and replacements of minor parts, which are normally made during a top overhaul, may be performed during the optional 100-hour tear-down inspection.

(*c*) The tests shall not be considered satisfactory if excessive adjustments or excessive replacements of minor parts are made, unless it is demonstrated that the causes therefor have been remedied.

(*d*) Parts used to replace other parts, except as permitted by subsections (*a*) and (*b*) hereof, shall satisfactorily meet the 150-hour endurance tests; *provided*, that the Administrator may accept other substantially equivalent proof of such parts.

13.2151 Forced stops. A forced stop is any malfunctioning of the engine or its essential accessories which would cause or make advisable an engine stop, including, but not limited to,

structural failure, excessive increase in vibration, excessive leaking of fuel, oil, or coolant, or an appreciable decrease in performance not attributable to general wear or change in atmospheric conditions. When a forced stop occurs, appropriate corrective measures shall be taken to insure insofar as possible that similar malfunctioning will not reduce the reliability of the engine in service.

13.216 Optional tear-down inspection. The applicant may, but shall not be required to, conduct a tear-down inspection after the completion of the first 100 hours of endurance testing.

13.217 Final tear-down inspection.

(*a*) At the completion of the endurance tests, the engine shall be completely disassembled and a detailed inspection made of the engine parts. Highly stressed parts shall be examined by suitable methods to determine the presence of hidden fatigue cracks. Wear measurements shall be taken and a comparison made of the final condition of parts and their condition prior to the beginning of the endurance tests or their dimensions as shown on the drawings. A conformity check consisting of a comparison of the parts of the engine tested with the drawings may be required at this time.

(*b*) If any part shows evidence of fatigue or impending failure or is otherwise not in a condition for safe operation, the engine will not be considered satisfactory unless appropriate corrective measures are taken and proven satisfactory by suitable testing; *provided*, that the Administrator may accept other substantially equivalent proof.

13.218 Test report. The applicant shall prepare and submit a suitable report completely covering the required testing of the engine and the tear-down inspections. Such report shall be signed by an authorized representative of the applicant and the authorized representative of the Administrator who witnessed the testing and tear-down inspections.

13.22 Identification plate. A suitable identification plate shall be permanently attached to the engine in a location which will be readily accessible when the engine is installed in an aircraft. Such plate shall contain such pertinent information as may be prescribed by the Administrator.

13.23 Demonstration of compliance. Compliance with the airworthiness requirements of this Part shall be substantiated insofar as practicable by pertinent technical data and inspections. Analyses or additional tests satisfactory to the Administrator shall be made when warranted by unconventional design features or the results of block testing.

TYPE CERTIFICATE

13.3 Type certificate. In order to obtain an aircraft engine type certificate an applicant shall comply with the foregoing and following requirements: [2]

13.30 Data required. In addition to the data required to show compliance with the airworthiness requirements, the applicant for a type certificate shall submit descriptive data adequate for the reproduction of other engines of the same type

13.31 Changes. When any change in design, construction or operating limitations is made in an engine being manufactured under a type certificate, suitable data describing the change shall be submitted for the approval of the Administrator.

13.310 Major changes. A major change is any change in design, construction, or operating limitations which might have an adverse effect on the reliability or other airworthiness characteristics of an engine. Proof adequate to show that a major change does not have such adverse effect shall be submitted to the Administrator. Engines incorporating major changes shall not be released for service until such changes are approved by the Administrator.

[2] For regulations governing issuance of type certificates see Part 02.

13.311 Minor changes. A minor change is any change not within the definition of a major change. Adequate data describing each minor change shall be made conveniently available, in the manufacturing plant, to a representative of the Administrator at least by the time such change is released for production. The technical data file formally submitted to the Administrator shall be brought up to date insofar as such minor changes are concerned at least every six months.

13.32 Manufacturer's instructions. The holder of a type certificate shall within a reasonable time after receiving such certificate prepare and submit for approval by the Administrator suitable instructions for the installation, operation, servicing, maintenance, repair and overhaul of the type certificated engine model or models. The holder of a type certificate shall make the approved instructions available to persons engaged in the operation, maintenance, repair or overhaul of engines manufactured under such certificate and shall prepare, submit for approval, and make available such revisions to the instructions as are found advisable from service experience.

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