Title 14—AERONAUTICS AND SPACE

Chapter I—Federal Aviation Agency

[Docket No. 7264; Amdt. 91-33]

PART 91—GENERAL OPERATING AND FLIGHT RULES

Authorization for Ferry Flight With One Engine Inoperative

The purpose of these amendments to § 91.45 of the Federal Aviation Regulations is to provide rules for ferry flight of a turbine engine powered airplane equipped with either three or four engines, with one engine inoperative, to a base for repair of that engine. These amendments also change § 91.45 to require the use of temperature accountability for the takeoff field length in flight tests of four-engine reciprocating engine powered airplanes under that section; to require the addition of certain data to the Airplane Flight Manual, and certain limitations to the operator's manual; and to make the rules of the section applicable to the same kind of ferry flights by commercial operators of large aircraft, in addition to air carriers.

These amendments (except as now changed) were proposed in Notice No. 66-10 and published in the FEDERAL REGISTER on April 5, 1966 (31 F.R. 5381). Public comment was received from five sources. One comment expressed opposition to all ferry flights with one engine inoperative. However, the safety record of these flights supports the extension of the rules accomplished by the amendments. The other comments did not oppose the objectives of the proposals as such, but offered a number of suggestions some of which have been adopted, others not.

Several comments dealt with the proposed or existing general criteria of § 91.45(a). Thus, some concern was expressed as to the inclusion, in the operator's manual, of limitations that the operating weight on any ferry flight must be the minimum necessary therefor, and takeoffs must be made from dry runways. Responsive to these comments, these amendments provide in § 91.45(a)(3)(i) and (ii) that the weight may include the necessary reserve fuel load, and that takeoffs may be made from wet runways after approval of an operator's showing of actual takeoff techniques with full controllability from wet runways. One comment was adverse to the provision of § 91.45(a)(4)(ii), already contained in the regulations, that no person may take off an airplane if weather conditions at the takeoff or destination airport are less than those required for VFR flight, and it suggested "circling minimums" of 500 feet and 1 or 2 miles visibility. However, the Agency believes that VFR conditions are essential for safe ferry operations, especially in the event of an additional engine failure at takeoff and destination landing areas, in order to allow the crewmembers to concentrate on the emergency and to minimize the necessity of holding or making an instrument approach.

Several comments dealt with the criteria for flight tests. One comment felt that the speed of not less than 1.3Vs₁, already contained in § 91.45(b)(1), is too high. However, the experience with this speed indicates it is satisfactory for the purpose and its use should be continued. Several comments objected to the proposed requirement, for both reciprocating and turbine engine powered airplanes, of attainment of a speed not less than the two-engine inoperative minimum control speed before the airplane reaches 400 feet above the surface after takeoff. This requirement has been dropped from the amendments, since upon reconsideration the Agency agrees with the observations made by these comments that the new requirement is not necessary in view of past satisfactory operations without it, and that the minimum cleanup altitude is 400 feet under the airworthiness standards for takeoff path in § 25.111(c)(2) and (4) of Part 25 of the Federal Aviation Regulations.

The preamble of Notice 66-10 referred to the use of "full" temperature accountability for the takeoff field length in flight tests for reciprocating engine powered airplanes, but the word "full" was not used in the proposed regulations themselves (§ 91.45(b)(5)). The operating factors for the weight and takeoff distance may be as little as one-half of the full accountability values, under § 25.61, the provision under which temperature accountability is to be computed. Accordingly, the rule as written governs in this respect, and not the language employed in the preamble of the Notice.

Two comments suggested that the minimum final climb gradient in the test flight for a three-engine turbine engine powered airplane with two engines inoperative should be 1 percent at the end of the takeoff rather than 1.2 percent as proposed for § 91.45(c)(4)(i). The Agency does not concur with this suggestion. Section 25.121(c), the provision to which reference is made for maximum weight for the performance, requires a 1.2 percent gradient for a two-engine airplane for one engine inoperative, and it is proper to require the same gradient for the similar situation of a three-engine airplane with two engines inoperative.

Two other suggestions made by comments with respect to criteria for flight tests have been adopted. Thus, § 91.45(c)(2) has been clarified as to its inclusion of V_2 speed with respect to takeoff field length; and the word "original" has been dropped from the reference to type certification in § 91.45(c)(1) and (2)(iii) as issued, with respect to the power selection, since use of the word might be confusing when applied to airplanes recertified for engine thrust increases.

Some concern was expressed that the proposals made in Notice 66-10 would require additional flight tests for aircraft for which approved Airplane Flight Manual data for one engine-out ferry flights already had been obtained. Pending these amendments of the rules to provide for the distinction between reciprocating and turbine engine powered airplanes, the Agency has approved the use of jet ferry data contained in Airplane Flight Manuals based upon flight tests determined to meet the existing requirements of §91.45(a)(1) for three- or four-engine turbine engine powered airplanes. Therefore, it was also determined that this data might be used for compliance with § 91.45(a)(2). Also, the criterion (temperature accountability) added to the regulatory requirements for flight tests in the case of reciprocating engine powered airplanes, and to the criteria used for approval in the case of turbine engine powered airplanes, is a comparatively minor change. In view of these circumstances, these amendments include a provision in § 91.45(a)(1) that each operator who before the effective date of the amendments has shown that a model of airplane with one engine inoperative is satisfactory for safe flight by a test flight conducted in accordance with performance data contained in the applicable Airplane Flight Manual under § 91.45(a)(2) need not repeat that test flight.

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

In consideration of the foregoing, and for the reasons stated in Notice No. 66-10, § 91.45 of Part 91 of the Federal Aviation Regulations is amended effective November 19, 1966, to read as follows:

§ 91.45 Authorization for ferry flight with one engine inoperative by air carriers and commercial operators of large aircraft.

(a) *General.* An air carrier or commercial operator of large aircraft may conduct a ferry flight of a four-engine airplane or a turbine engine powered airplane equipped with three engines, with one engine inoperative, to a base for the purpose of repairing that engine subject to the following:

(1) The airplane model has been test flown and found satisfactory for safe flight in accordance with paragraph (b) or (c) of this section, as appropriate. However, each operator who before November 19, 1966, has shown that a model of airplane with an engine inoperative is satisfactory for safe flight by a test flight conducted in accordance with performance data contained in the applicable Airplane Flight Manual under

(As published in the Federal Register /31 F.R. 13525/ on October 20, 1966)

subparagraph (2) of this paragraph need not repeat the test flight for that model.

(2) The approved Airplane Flight Manual contains the following performance data and the flight is conducted in accordance with that data:

(i) Maximum weight.

(ii) Center of gravity limits.

(iii) Configuration of the inoperative propeller (if applicable).

(iv) Runway length for takeoff (including temperature accountability).

(v) Altitude range.

(vi) Certificate limitations.

(vii) Ranges of operational limits.

(viii) Performance information.

(ix) Operating procedures.

(3) The operator's manual contains operating procedures for the safe operation of the airplane, including specific requirements for—

(i) A limitation that the operating weight on any ferry flight must be the minimum necessary therefor with the necessary reserve fuel load;

(ii) A limitation that takeoffs must be made from dry runways unless, based on a showing of actual operating takeoff techniques on wet runways with one engine inoperative, takeoffs with full controllability from wet runways have been approved for the specific model aircraft and included in the Airplane Flight Manual;

(iii) Operations from airports where the runways may require a takeoff or approach over populated areas; and

(iv) Inspection procedures for determining the operating condition of the operative engines.

(4) No person may take off an airplane under this section if—

(i) The initial climb is over thickly populated areas; or

(ii) Weather conditions at the takeoff or destination airport are less than those required for VFR flight.

(5) No air carrier or commercial operator of large aircraft may carry any persons other than required flight crewmembers on board the airplane during the flight.

(6) No air carrier or commercial operator of large aircraft may use a flight crewmember unless he is thoroughly familiar with the operating procedures for one-engine inoperative ferry flights listed in its manual and the limitations and performance information listed in the Airplane Flight Manual.

(b) *Flight tests: Reciprocating engine powered airplanes.* The airplane performance of a reciprocating engine powered airplane with one engine inoperative must be determined by flight test as follows:

(1) A speed not less than $1.3V_{S1}$ must be chosen at which the airplane may be controlled satisfactorily in a climb with the critical engine inoperative (with its propeller removed or in a configuration desired by the operator) and with all other engines operating at the maximum power determined in subparagraph (3) of this paragraph.

(2) The distance required to accelerate to the speed listed in subparagraph (1) of this paragraph and to climb to 50 feet must be determined with—

(i) The landing gear extended;

(ii) The critical engine inoperative and its propeller removed or in a configuration desired by the operator; and

(iii) The other engines operating at not more than the maximum power established under subparagraph (3) of this paragraph.

(3) The takeoff, flight, and landing procedures such as the approximate trim settings, method of power application, maximum power, and speed must be established.

(4) The performance must be determined at a maximum weight not greater than the weight that allows a rate of climb of at least 400 feet a minute in the en route configuration set forth in § 25.67(d) of this chapter at an altitude of 5,000 feet.

(5) The performance must be determined using temperature accountability for the takeoff field length, computed in accordance with § 25.61 of this chapter.

(c) *Flight tests: Turbine engine powered airplanes.* The airplane performance of a turbine engine powered airplane with one engine inoperative must be determined in accordance with the following, by flight tests including at least three takeoff tests:

(1) Takeoff speeds V_R and V_2, not less than the corresponding speeds under which the airplane was type certificated under § 25.107 of this chapter, must be chosen at which the airplane may be controlled satisfactorily with the critical engine inoperative (with its propeller removed or in a configuration desired by the operator, if applicable) and with all other engines operating at not more than the power selected for type certification, as set forth in § 25.101 of this chapter.

(2) The minimum takeoff field length must be the horizontal distance required to accelerate, and climb to the 35-foot height at V_2 speed (including any additional speed increment obtained in the tests), multiplied by 115 percent, and determined with—

(i) The landing gear extended;

(ii) The critical engine inoperative and its propeller removed or in a configuration desired by the operator (if applicable); and

(iii) The other engines operating at not more than the power selected for type certification, as set forth in § 25.101 of this chapter.

(3) The takeoff, flight, and landing procedures such as the approximate trim settings, method of power application, maximum power, and speed, must be established. The airplane must be satisfactorily controllable during the entire takeoff run when operated according to these procedures.

(4) The performance must be determined at a maximum weight not greater than the weight determined under § 25.121(c) of this chapter, but with—

(i) The actual steady gradient of the final takeoff climb requirement not less than 1.2 percent at the end of the takeoff path with two critical engines inoperative; and

(ii) The climb speed not less than the two-engine inoperative trim speed for the actual steady gradient of the final takeoff climb prescribed by subdivision (i) of this subparagraph.

(5) The airplane must be satisfactorily controllable in a climb with two critical engines inoperative. Climb performance may be shown by calculations based on, and equal in accuracy to, the results of testing.

(6) The performance must be determined using temperature accountability for takeoff distance and final takeoff climb, computed in accordance with § 25.101 of this chapter.

For the purposes of subparagraphs (4) and (5), "two critical engines" means two adjacent engines on one side of an airplane with four engines, and the center engine and one outboard engine on an airplane with three engines.

(Secs. 307, 313(a), 603, and 607 of the Federal Aviation Act of 1958; 49 U.S.C. 1348, 1354, 1424, 1427)

Issued in Washington, D.C., on October 14, 1966.

WILLIAM F. MCKEE,
Administrator.