Regulations
Serial Number 84

THE UNITED STATES OF AMERICA
CIVIL AERONAUTICS AUTHORITY
WASHINGTON, D. C.

At a session of the Civil Aeronautics Authority
held at its office in Washington, D. C.
on the 28th day of May, 1940.

Acting pursuant to the authority vested in it by the Civil Aeronautics Act of 1938, particularly sections 205 (a), 601, 603, 604, and 605 of said Act, and finding that its action is desirable in the public interest and is necessary to carry out the provisions of and to exercise and perform its powers and duties under said Act, the Civil Aeronautics Authority adopts the following amendment to the Civil Air Regulations:

AMENTMENT NO. 56 OF THE CIVIL AIR REGULATIONS	PROVIDING: ALTERNATIVE REQUIREMENTS FOR TYPE AND AIRWORTHINESS CERTIFICATION OF AIRPLANES IN THE TRANSPORT CATEGORY; OPERATING LIMITATIONS FOR SUCH AIRPLANES; AMENDMENT OF THE GENERAL MINIMUM REQUIREMENT FOR A SHOWING OF AIRCRAFT BY AN APPLICANT FOR AN AIR CARRIER OPERATING CERTIFICATE UNDER PART 40

Effective July 1, 1940, Parts 04 and 40 of the Civil Air Regulations are amended as follows:

1. By amending section 04.430 to read as follows:

"04.430 Installation. All control systems and operating devices shall be so designed and installed as to provide reasonable ease of operation by the crew and so as to preclude the probability of inadvertent operation, jamming, chafing, interference by cargo, passengers or loose objects, and the slapping of cables against parts of the airplane. All pulleys shall be provided with satisfactory guards."

2. By amending section 04.701 to read as follows:

"04.701 Take-off. Take-off at sea level:

(a) Within 1,000 feet for land planes;

(b) Within 60 seconds in calm air for seaplanes."

3. By amending section 04.702 to read as follows:

"04.702 Climb. The average rate of climb for the first minute after the airplane leaves the take-off surface in accordance with section 04.701, and the rate of steady climb at sea level with not more than maximum except take-off power, shall not be less in feet per minute then:

(a) Land planes:

Eight times the measured power-off stalling speed in miles per hour with the flaps and landing gear retracted, or 300 feet per minute, whichever is greater;

(b) Sea planes:

Six times the measured power-off stalling speed in miles per hour with the flaps retracted, or 250 feet per minute, whichever is greater.

4. By amending section 04.71 (not including sections 04.710 to 04.714, inclusive) to read as follows:

"04.71 Modified performance requirements for air carrier airplanes. Prior to January 1, 1941, but not thereafter, the weight of any multi-engine air carrier aircraft operating in accordance with the requirements of Part 61 may be increased beyond the values corresponding to the landing speed specified in section 04.700 and take-off requirements of section 04.701, subject to the following conditions:"

5. By amending section 04.723 to read as follows:

"04.723 One engine inoperative performance. Multi-engine airplanes shall be flight tested at such altitudes and weights as are necessary, in the opinion of the Authority, to prepare accurate data to show climbing performance within the range of weight for which certification is sought, with the critical engine inoperative and each other engine operating at not more than maximum except take-off power. Such data when approved by the Authortiy shall be kept in the airplane at all times during flight in a place conveniently accessible to the pilot."

6. By adding a new section as follows:

"04.75 Alternative requirement for certification of airplanes in the 'Transport Category'. In lieu of any of the requirements of sections 04.700, 04.701, 04.703, 04.704, 04.705, and 04.707 an airplane may be certificated upon the basis of the following requirements: Provided, That in standard air at the maximum take-off weight for which certification is sought (but not in excess of design weight) with Vs representing stalling speed determined in section 04.7502(a) at that weight:

(a) The rate of climb determined in section 04.7502(c) at sea level is not less than its value in the equation:

$$C = 0.04\ V2s^*$$

(b) The rate of climb determined in section 04.7502(b) at sea level is not less than its value in the equation:

$$C = 0.07\ V2s^*$$

(c) The rate of climb determined in section 04.7501 at 5,000 feet above sea level is not less than its value in the equation:

$$C = 0.02\ V2s^*$$

Provided Further, That the applicant may meet the requirement of (a) and (b) at the maximum landing weight sought and select tires and wheels on the basis of such weight:

* See footnote to sections 04.760(e) and (f) for tabulation of values.

(1) If such landing weight is not less than 87 percent of design weight,

(2) If adequate provision is made for the rapid and safe discharge during flight of a quantity of fuel sufficient to reduce the weight of the airplane from the maximum take-off weight to such landing weight, and

(3) If the airplane is capable of withstanding those ground shock loads exerted during take-off at maximum take-off weight.

"04.750 Performance. The applicant shall furnish such information concerning each of the following items of performance as is necessary, in the opinion of the Authority, to determine such performance in standard air at any weight and altitude within the range for which certification is sought:

"04.7500 Take-off. The greater of the following distances:

(a) The sum of the distance required to accelerate from a standing start on a level take-off surface at not more than take-off power to a point at which the true indicated airspeed is not less that that required to maintain full control with the critical engine inoperative, and the distance required to bring the airplane to a full stop thereafter;

(b) The sum of the distance required to accelerate from a standing start on a level take-off surface at not more than take-off power to a point at which the true indicated airspeed is not less than that required to maintain full control with the critical engine inoperative, and, with the critical engine made inoperative at such point, the distance required to attain:

(1) An altitude not less than 50 feet above the take-off surface.

(2) A speed not less than 110 percent of power-off stalling speed, and

(3) A steady climb with the primary flap control in the "take-off setting", and the landing gear fully extended or in the position it would reach 10 seconds after retraction is started from the fully extended position, at a rate not less than that prescribed in section 04.75(a).

"04.7501 En route operation. The best rate of steady climb in feet per minute with the critical engine inoperative, its propeller stopped, each other engine operating at not more than maximum except take-off power, the landing gear fully retracted, and the primary flap control in the most favorable setting.

"04.7502 Approach.

(a) The true indicated stalling speed in miles per hour with power off, the landing gear fully extended, the primary flap control in the "landing setting", and the flaps in such position that the stalling speed does not exceed 80 miles per hour.

(b) The best rate of steady climb in feet per minute with all engines operating at not more than take-off power, the landing gear fully extended, and the flaps in the same position used in (a) for the particular weight and altitude involved;

(c) The best rate of steady climb in feet per minute with the critical engine inoperative, its propeller stopped, each other engine operating at not more than take-off power, the landing gear fully extended or in the position it would reach 10 seconds after retraction is started from the fully extended position, the primary flap control in the "approach setting", and the flaps in such position that the true indicated stalling speed with power off does not exceed 85 miles per hour.

"04.7503 Landing. The horizontal distance required to land and come to a complete stop from a point at a height 50 feet above the landing surface, subject to the following conditions:

(a) That prior to reaching such point a steady gliding approach shall be maintained with a true indicated flight path airspeed not less than 130 percent of stalling speed determined in section 04.7502(a) for the particular weight and altitude involved, a rate of descent not in excess of 500 feet per minute and the flaps extended not beyond the position used in section 04.7502(a) for the particular weight and altitude involved.

(b) That after reaching such point the nose of the airplane shall not be depressed nor power or flap extension increased: Provided, That after the airplane is on the landing surface and the true indicated airspeed has been reduced to not more than nine-tenths of the stalling spped determined in section 04.7502(a) at the same weight and altitude, the flaps may be extended beyond the position specified in (a) or other aerodynamic braking device may be used;

(c) That operating pressures on the braking system shall not be in excess of those approved by the manufacturer of the brakes;

(d) That the brakes shall not be used in such manner as to produce excessive wear of brakes or tires;

(e) The landing shall be made in such manner that there is no excessive vertical acceleration, no tendency to bounce, nose over, or ground loop, and in such manner that its reproduction shall not require any exceptional degree of skill on the part of the pilot, or exceptionally favorable conditions. If this last condition (with respect to exceptional skill or favorable conditions) is not met, the distance to be determined shall be that considered to correspond to a piloting technique normally usable.

"04.751 Flight characteristics. There shall be no flight characteristic which, in the opinion of the Authority, makes the airplane unairworthy. The airplane shall also meet the following requirements under all critical loading conditions within the range of center of gravity, and, except as provided in section 04.7511(e), at the maximum weight for which certification is sought:

"04.7510 Controllability and maneuverability. The airplane shall be controllable and maneuverable during take-off, climb, level flight, glide, or landing, including landing with the flaps and landing gear fully extended and the propellers in low pitch, under all conditions of operation consistent with its intended use, including those conditions normally encountered in the event of sudden failure of any engine. It shall be possible with the air-

plane trimmed in a glide with power off and its speed not in excess of 140 percent of the measured stalling speed, to control the airplane with one hand without exertion of unusual control force and without change in the trim control setting, upon the full extension or retraction of wing flaps or the sudden application of take-off power on all engines.

"04.7511 Trim. The means used for trimming the airplane shall be such that after being trimmed and without further pressure upon or movement of either the primary control or its corresponding trim control by the pilot or the automatic pilot, the airplane will maintain:

(a) Rectilinear level flight at cruising speed (90 percent of the indicated high speed with maximum except take-off power);

(b) Lateral trim under all conditions of operation consistent with the intended use of the airplane, including operation at any speed from best rate of climb speed to high speed and operation in which there is greatest lateral variation in the distribution of the useful load;

(c) Longitudinal trim, under the following conditions:

(1) During climb at the best rate of climb speed with maximum except take-off power,

(2) During a glide with power off at a speed not in excess of 140 percent of the measured power off stalling speed, and

(3) During level flight at any speed from 90 percent of high speed to the sum of stalling speed and 20 percent of the difference between high speed and stalling speed;

(d) Rectilinear climbing flight with the critical engine inoperative, each other engine operating at maximum except take-off power and the best rate of climb speed under such conditions;

(e) Rectilinear flight with any two engines inopertive and each other engine operating at maximum except take-off power under the following conditions:

(1) With the weight of the airplane not more than that at which there is a speed range in level flight of not less than 10 miles per hour;

(2) With the speed of the airplane not more than the high speed obtained under the conditions specified in (1) less 10 miles per hour.

"04.7512 Stability. The requirement of stability shall be as follows:

"04.75120 Static stability. The static stability of the airplane under all conditions of speed, power, and trim appropriate to the intended use of the airplane during take-off climb, level flight, glide, and landing, shall be such that:

(a) The pitching, yawing, or rolling moment caused by change of angle of attack, skidding, or side-slipping, respectively, shall be restorative;

(b) The stick force required to maintain steady flight after the airplane is trimmed shall, without further adjustment of the trim control, increase continuously with progressive change of flight path speed from the speed at which the airplane is trimmed under the following conditions:

(1) With all engines operating at maximum except take-off power, and

(2) During a glide with power off.

(c) The slope of the curves of stick force versus speed determined under (b) shall lie between such limits that:

(1) Any substantial change in speed is clearly evident to the pilot through a resultant change in stick force;

(2) The stick forces required to produce necessary changes in speed do not reach excessive values.

"04.75121 Dynamic stability. With 75 percent of maximum except take-off power and with the controls free, the airplane shall be dynamically stable longitudinally during level flight and during a climb at 75 percent of the speed obtained during such flights. The amplitude of any short period oscillation occurring between stalling speed and 110 percent of "never exceed" speed shall be heavily damped with the primary controls in a fixed position.

"04.7513 Stalling. With power off and with 75 percent of maximum except take-off power, it shall be possible to prevent rolling or yawing by normal use of the aileron or rudder controls when the airplane is gradually stalled with the flaps and landing gear in any position. The airplane shall not pitch excessively during such operations. The airplane shall be recoverable without difficulty or the use of power from the inoperative engine when it is stalled with the critical engine inoperative and the remaining engines operating at 75 percent of maximum except take-off power.

"04.7514 Flutter and vibration. All parts of the airplane shall be free from flutter or excessive vibration under all speed and power conditions appropriate to the operation of the airplane during take-off, climb, level flight, and landing, and during glide at speeds up to the maximum indicated airspeed attained during official flight tests (see section 04.722). There shall be no appreciable buffeting for any flap position at any speed in excess of 10 miles per hour above stalling speed for such position nor shall buffeting at lower speeds be so violent as to interfere with the pilot's control of the airplane or cause discomfort to its occupants.

"04.752 Detail design. The airplane shall meet the following detail design requirements.

"04.7520 Trim controls. Trimming devices shall be capable of continued normal operation in spite of the failure of any one connecting or transmitting element in the primary control system. Trim controls shall operate in the plane and with the sense of the motion of the airplane which their operation is intended to produce.

"04.7521 Flap control. The flap control shall provide means for bringing the flaps from any position within the operating range to the fully retracted or fully extended position and to the take-off, approach, or landing position used in demonstrating compliance with the requirements of section 04.750 by placing the primary flap control in a single setting clearly marked as corresponding to each such flap position, the flaps thereupon moving directly to the desired position without requiring further attention. If any extension of the flaps beyond the "landing setting" is possible, the flap control shall be clearly marked to

identify such range of extension. If more than one position of the flaps is used for take-off, approach, or landing, respectively, a secondary control shall be provided. Such secondary control shall operate independently of the primary control and in such manner that when it has been adjusted (for the effect of weight or altitude), the necessary flap position can thereafter be obtained by placing the primary flap control in the desired setting. The secondary control shall be so designed and marked as to be readily intelligible to and operable by the crew. The rate of flap retraction during retraction from any flap position in steady flight at a speed less than 110 percent of the stalling speed for that flap position shall not produce so rapid a loss of lift as to require the use of exceptional piloting technique in order to continue a straight flight path.

"04.7522 Brakes. In the event of a single failure in any connecting or transmitting element in the brake system, or the loss of any single source of hydraulic or electrical energy, it shall be possible to make a landing in accordance with the conditions of section 04.7503 within a distance not exceeding that specified therein by more than 40 percent.

"04.753 There shall be furnished with each airplane a copy of a manual which shall contain such information regarding the operation of the airplane as the Authority may require, including, but not limited to, the following:

(a) All performance data required under section 04.750 together with any pertinent description of the conditions, airspeeds, etc., under which such data were determined;

(b) Adequate instructions for the use and adjustment of the flap controls under section 04.7521; and

(c) The minimum true indicated airspeed required to maintain full control with the critical engine inoperative."

7. By adding a new section to read as follows:

"04.76 Operating limitations upon airplanes certificated under section 04.75. The operation in air commerce of any airplane certificated in accordance with the provisions of section 04.75 shall be subject to the following restrictions unless otherwise specifically authorized by the Authority:

"04.760 No person shall operate any airplane certificated in accordance with the provisions of section 04.75 for the purpose of take-off:

(a) If the weight of the airplane exceeds its certificated maximum take-off weight;

(b) If the weight of the airplane exceeds the sum of its certificated maximum landing weight and the weight of fuel and oil required by Part 60;

(c) If the weight of the airplane is such that in standard air at the altitude of the take-off area, the distance* determined in section 04.7500 exceeds the distance measured along the centerline of the runway in the direction of take-off from the point at which acceleration is started to a point on a line at right angles to such centerline formed by the intersection of the runway surface with a plane inclining upward at an angle equal to the angle of the flight path that the airplane, with the critical engine inoperative and without change of weight by dumping fuel or ballast, can maintain, and clearing any obstacle located within 250 feet on either side of the centerline of the runway and within 1,000 feet of the intersection of the inclined plane with the runway surface.

(d) If the weight of the airplane in standard air at the particular altitude involved is such that in the event the critical engine fails at the critical airspeed during the take-off (the true indicated airspeed at which such engine was made inoperaivve in determining the distance required in section 04.7500) it would not be possible to continue the take-off and:

(1) Clear any obstacle by a horizontal distance not less than 300 feet without banking the airplane prior to crossing the boundary of the landing area upon which take-off was made or without banking more than 15 degrees thereafter, and

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* Note: For the purpose of determining the relation of the distance specified in section 4.760(c) to the distance required under section 04.7500 the latter distance may be reduced for the effect of not more than 50 percent of any wind velocity component along the runway of intended take-off.

(2) Attain an altitude and position from which the airplane could be landed safely on the same or other landing area.

(e) If the weight of the airplane is such that when reduced by the weight of fuel and oil that would be consumed in reaching any ground obstacle within 10 miles on either side of the intended or prescribed route to be flown, the best rate of steady climb determined in section 04.7501 at such reduced weight and in standard air at an altitude not less than 1,000 feet above such ostacle, would be less than the rate given by the equation:

$$C = 0.02\ V2s \quad \text{.....*}$$

with Vs representing the true indicated stalling speed at such weight and altitude determined as provided in section 04.7502(a) and with "C" representing the rate of climb in feet per minute: Provided, That for flights along a civil airway the requirement of rate of climb shall not apply to any obstacle extending into the airway less than half its width and less than 20miles along its length whose position can be readily identified by means of air navigation facilities and avoided thereafter.

*Note: The equations specified in section 04.760(e) and (f) require the following rates of climb:

Stalling speed	Rate of Climb		
	0.02V2s	0.04V2s	0.07V2s
50	50	100	175
55	61	121	212
60	72	144	252
65	85	169	296
70	98	196	343
75	113	225	394
80	128	256	448

(f) If the weight of the airplane is such that when reduced by the weight of fuel and oil that would be consumed in reaching the first point of intended landing, the best rate of steady climb determined in sections 04.7502(c) and 04. 7502(b) at such reduced weight and in standard air at the altitude of such landing area, would be less, respoctively, than the rates given by the equations:

$$C = 0.04\ V2s \quad \text{.....(1)*}$$

and

$$C = 0.07\ V2s \quad \text{.....(2)*}$$

where Vs represents the true indicated stalling speed in miles per hour at such weight and altitude determined as provided in section 04.7502(a) and "C" is the rate of climb in feet per minute.

(g) If the weight of the airplane is such that when reduced by the weight of fuel and oil that would be consumed in reaching the first point of intended landing, the landing distance determined under section 04.7503 for such reduced weight and in standard air at the altitude of such landing area, exceeds, in the case of scheduled air carrier operation for the carriage of passengers, six-tenths or, in the case of other operation, seven-tenths of the effective landing length of the runway upon which it is intended to land. The effective landing length of such runway shall be the distance measured from the farthest boundary toward which the landing may be completed, back along the centerline of the runway (in the direction opposite to that of landing), to a point on a line at right angles to such centerline formed by the intersection of the runway surface with a plane inclining upward at an angle of 1 to 20 clearing the top of any obstacle located 250 feet on either side of the centerline of the runway extended 1,000 feet beyond the boundary of the landing area.

"04.761 Availability of performance manual. A copy of the manual required in section 04.753 shall be kept in the airplane at all times during flight in a place conveniently accessible to the pilot."*

8. By amending section 40.12 of Part 40 to read as follows:

*Note: See footnote to section 04.760(e).

*Note: All of the provisions of this amendment with respect to operating limitations will be deleted in the near future from Part 04 and will be incorporated in a Part or Parts pertaining solely to operating procedures and limitations.

"40.12 Aircraft. Applicant shall show aircraft certificated as provided in Part 04 of a model and number deemed by the Authority to be necessary for safe operation as related to the service offered, the route traversed, and the operating and maintenance procedures and techniques proposed. No airplane certificated as a basic type in accordance with the requirement of section 04.75 shall be deemed adequate for use in scheduled air transportation unless, in the opinion of the Authority, it can meet the requirement of section 04.76 over each route to be flown. Airplanes proposed for use for the carriage of passengers under these regulations shall be subject to the following requirements:

(a) No airplane certificated as a basic type after December 31, 1940, shall be deemed adequate for use in scheduled air transportation unless it has been certificated in accordance with the requirement of section 04.75;

(b) On or after January 1, 1942, no individual airplane shall be deemed adequate for use in scheduled air transportation unless, in the opinion of the Authority, it can meet the requirement of section 04.76 over each route to be flown or unless such airplane has been used in scheduled air transportation with the aproval of the Authority prior to that date;

(c) No airplane shall be deemed adequate for use in scheduled air transportation after December 31, 1945, unless, in the opinion of the Authority, it can meet the requirement of section 04.76 over each route to be flown."

By the Authority:

/s/ Paul J. Frizzell

Paul J. Frizzell
Secretary.

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