

determined under the conditions specified in this paragraph, so that when the critical engine is suddenly made inoperative at that speed it shall be possible to recover control of the airplane, with the engine still inoperative, and maintain it in straight flight at that speed, either with zero yaw or, at the option of the applicant, with an angle of bank not in excess of 5°. Such speed shall not exceed $1.2 V_{s1}$ with:

- (1) Take-off or maximum available power on all engines,
 - (2) Rearmost center of gravity,
 - (3) Flaps in take-off position,
 - (4) Landing gear retracted,
 - (5) Cowl flaps in the position normally used during take-off,
 - (6) Maximum sea level take-off weight, or such lesser weight as may be necessary to demonstrate V_{MC} ,
 - (7) The airplane trimmed for take-off,
 - (8) The propeller of the inoperative engine windmilling, except that a different position of the propeller shall be acceptable if the specific design of the propeller control makes it more logical to assume the different position,
 - (9) The airplane airborne and the ground effect negligible.
- (b) In demonstrating the minimum speed of paragraph (a) of this section, the rudder force required to maintain control shall not exceed 180 pounds, and it shall not be necessary to throttle the remaining engines.

(c) During recovery of the maneuver of paragraph (a) of this section the airplane shall not assume any dangerous attitude, nor shall it require exceptional skill, strength, or alertness on the part of the pilot to prevent a change of heading in excess of 20° before recovery is complete.

Note: Interpretation No. 1 (17 F. R. 2112, Mar. 12, 1952), adopted by the Civil Aeronautics Board, Mar. 7, 1952, provides as follows:

(1) The Board interprets and construes subparagraph (8) of § 4b.133 (a) as requiring the Administrator to accept for the purposes of § 4b.133 a value for the one-engine-inoperative minimum control speed which has been established in accordance with the provisions of that section with the propeller of the inoperative engine feathered: Provided, That the airplane involved is equipped with an automatic feathering device acceptable to the Administrator under § 4b.10 for demonstrating compliance with the take-off path and climb requirement of §§ 4b.116 and 4b.120 (a) and (b).

TRIM

§ 4b.140 *General.* 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 shall comply with the trim requirements of §§ 4b.141 through 4b.144.

§ 4b.141 *Lateral and directional trim.* The airplane shall maintain lateral and directional trim under the most adverse lateral displacement of the center of gravity within the relevant operating limitations, under all normally expected conditions of operation, including operation at any speed from $1.4 V_{s1}$ to 90 per-

cent of the maximum speed in level flight obtained with maximum continuous power.

§ 4b.142 *Longitudinal trim.* The airplane shall maintain longitudinal trim under the following conditions:

(a) During a climb with maximum continuous power at a speed not in excess of $1.4 V_{s1}$ with the landing gear retracted and the wing flaps both retracted and in the take-off position,

(b) During a glide with power off at a speed not in excess of $1.4 V_{s1}$ with the landing gear extended and the wing flaps both retracted and extended, with the forward center of gravity position approved for landing with the maximum landing weight, and with the most forward center of gravity position approved for landing regardless of weight,

(c) During level flight at any speed from $1.4 V_{s1}$ to 90 percent of the maximum speed in level flight obtained with maximum continuous power with the landing gear and wing flaps retracted, and from $1.4 V_{s1}$ to V_{LS} with the landing gear extended.

§ 4b.143 *Longitudinal, directional, and lateral trim.* (a) The airplane shall maintain longitudinal, directional, and lateral trim at a speed equal to $1.4 V_{s1}$ during climbing flight with the critical engine inoperative, with

- (1) The remaining engine(s) operating at maximum continuous power,
- (2) Landing gear retracted,
- (3) Wing flaps retracted.

(b) In demonstrating compliance with the lateral trim requirement of paragraph (a) of this section, the angle of bank of the airplane shall not be in excess of 5 degrees.

§ 4b.144 *Trim for airplanes with four or more engines.* The airplane shall maintain trim in rectilinear flight at the climb speed, configuration, and power used in establishing the rates of climb in § 4b.121, with the most unfavorable center of gravity position, and at the weight at which the two-engine-inoperative climb is equal to at least $0.01 V_{s0}$ at an altitude of 5,000 feet.

STABILITY

§ 4b.150 *General.* The airplane shall be longitudinally, directionally, and laterally stable in accordance with §§ 4b.151 through 4b.157. Suitable stability and control "feel" (static stability) shall be required in other conditions normally encountered in service if flight tests show such stability to be necessary for safe operation.

§ 4b.151 *Static longitudinal stability.* In the conditions outlined in §§ 4b.152 through 4b.155, the characteristics of the elevator control forces and friction shall comply with the following:

(a) A pull shall be required to obtain and maintain speeds below the specified trim speed, and a push shall be required to obtain and maintain speeds above the specified trim speed. This criterion shall apply at any speed which can be obtained without excessive control force, except that such speeds need not be greater than the appropriate operating limit speed or

need not be less than the minimum speed in steady unstalled flight.

(b) The air speed shall return to within 10 percent of the original trim speed when the control force is slowly released from any speed within the limits defined in paragraph (a) of this section.

(c) The stable slope of stick force curve versus speed shall be such that any substantial change in speed is clearly perceptible to the pilot through a resulting change in stick force.

§ 4b.152 *Stability during landing.* The stick force curve shall have a stable slope, and the stick force shall not exceed 80 pounds at any speed between $1.1 V_{s1}$ and $1.8 V_{s1}$ with:

- (a) Wing flaps in the landing position,
- (b) The landing gear extended,
- (c) Maximum landing weight,
- (d) Throttles closed on all engines,
- (e) The airplane trimmed at $1.4 V_{s1}$ with throttles closed.

§ 4b.153 *Stability during approach.* The stick force curve shall have a stable slope at all speeds between $1.1 V_{s1}$ and $1.8 V_{s1}$ with:

- (a) Wing flaps in sea level approach position,
- (b) Landing gear retracted,
- (c) Maximum landing weight,
- (d) The airplane trimmed at $1.4 V_{s1}$ and with power sufficient to maintain level flight at this speed.

§ 4b.154 *Stability during climb.* The stick force curve shall have a stable slope at all speeds between 85 and 115 percent of the speed at which the airplane is trimmed with:

- (a) Wing flaps retracted,
- (b) Landing gear retracted,
- (c) Maximum take-off weight,
- (d) 75 percent of maximum continuous power,
- (e) The airplane trimmed at the best rate-of-climb speed, except that the speed need not be less than $1.4 V_{s1}$.

§ 4b.155 *Stability during cruising—*
(a) *Landing gear retracted.* Between $1.3 V_{s1}$ and V_{NR} the stick force curve shall have a stable slope at all speeds obtainable with a stick force not in excess of 50 pounds with:

- (1) Wing flaps retracted,
- (2) Maximum take-off weight,
- (3) 75 percent of maximum continuous power,
- (4) The airplane trimmed for level flight with 75 percent of the maximum continuous power.

(b) *Landing gear extended.* The stick force curve shall have a stable slope at all speeds between $1.3 V_{s1}$ and the speed at which the airplane is trimmed, except that the range of speeds need not exceed that obtainable with a stick force of 50 pounds with:

- (1) Wing flaps retracted,
- (2) Maximum take-off weight,
- (3) 75 percent maximum continuous power, or the power for level flight at the landing gear extended speed, V_{LS} , whichever is the lesser,
- (4) The airplane trimmed for level flight with the power specified in subparagraph (3) of this paragraph.

4. By amending § 4b.119 (b) by adding a new subparagraph (7) to read as follows:

4b.119 Climb; all engines operating. * * *

(b) Landing configuration. * * *

(7) A climb speed not in excess of $1.4V_{S0}$.

5. By amending § 4b.120 (d) by adding a new subparagraph (8) to read as follows:

4b.120 One-engine-inoperative climb. * * *

(d) Flaps in approach position. * * *

(8) A climb speed not in excess of $1.5V_{S1}$.

6. By amending § 4b.141 to read as follows:

4b.141 Lateral and directional trim. The airplane shall maintain lateral and directional trim under the most adverse lateral displacement of the center of gravity within the relevant operating limitations, under all normally expected conditions of operation, including operation at any speed from $1.4V_{S1}$ to V_{NO} or to M_{NO} , whichever is the lesser.

7. By amending § 4b.142 (c) to read as follows:

4b.142 Longitudinal trim. * * *

(c) During level flight at any speed from $1.4V_{S1}$ to V_{NO} or to M_{NO} , whichever is the lesser, with the landing gear and wing flaps retracted, and from $1.4V_{S1}$ to V_{LE} with the landing gear extended.

8. By amending § 4b.154 (d) to read as follows:

4b.154 Stability during climb. * * *

(d) 75 percent of maximum continuous power for reciprocating-engine-powered airplanes; and maximum power thrust selected by the applicant as an operating limitation for use during climb (see § 4b.718) for turbine-engine-powered airplanes,

9. By amending § 4b.155 (a) (3) and (4) to read as follows:

4b.155 Stability during cruising.

(a) Landing gear retracted. * * *

(3) 75 percent of maximum continuous power, or the maximum cruising power selected by the applicant as an operating limitation (see § 4b.718), whichever is the greater, except that the power need not exceed that required at V_{NO} ,

(4) The airplane trimmed for level flight with the power specified in subparagraph (3) of this paragraph.

10. By amending § 4b.155 (b) (3) to read as follows:

4b.155 Stability during cruising. * * *

(b) Landing gear extended. * * *

(3) 75 percent of maximum continuous power, or the maximum cruising power selected by the applicant as an operating limitation, whichever is the greater, except that the power need not exceed that required for level flight at V_{LE} ,

11. By amending § 4b.210 (b) (4) by deleting the last sentence and inserting in lieu thereof the following: "At altitudes where V_D is limited by Mach number, it shall be acceptable to limit V_C to a Mach number selected by the applicant."