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MISCELLANEOUS AMENDMENTS RESULTING FROM FIRST AIRWORTHINESS REVIEW

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PART 4b—AIRPLANE AIRWORTHINESS; TRANSPORT CATEGORIES

Miscellaneous Amendments Resulting From First Airworthiness Review

As a result of the First Federal Aviation Agency Airworthiness Review, the Agency published a notice of proposed rule making affecting several parts of the Civil Air Regulations. This notice was published in the FEDERAL REGISTER (26 F.R. 5130) and circulated as Civil Air Regulations Draft Release No. 61-12 dated June 8, 1961. There are contained herein amendments to Part 4b of the Civil Air Regulations which stem from this First FAA Airworthiness Review.

Interested persons have been afforded an opportunity to express their comments in regard to the proposal. In some cases the proposal has been modified in accordance with such comments. The more significant amendments being adopted by the Agency are discussed herein.

Several revisions to the flight requirements are being made. A change is made to § 4b.160(c)(1) for consistency with the trim condition applicable to the stall speed in present § 4b.112(c)(1). The proposed amendment to § 4b.112, to redefine the stalling speed as the 1g level flight stall speed, is being deferred pending further evaluation of the effect of such a change.

To supplement existing controllability requirements, § 4b.130 is being expanded to provide pilot control force criteria during phases of unsteady flight and during transition from one flight condition to another. The proposal provided, among other things, that both temporary and prolonged forces be considered with the airplane trimmed in the prior steady flight condition. Two significant changes have been made to this proposal. The first change permits compliance to be shown in an untrimmed condition when the airplane cannot be trimmed so as not to encroach upon the requirements of §§ 4b.140 through 4b.144. The second change permits retrim during the investigation of the prolonged forces. In conjunction with these changes, the proposed note has been deleted because it does not illustrate the prescribed forces. In addition, § 4b.131 is being amended to prescribe the maximum longitudinal control force applicable to operation with one hand.

A number of changes are being made to the stability requirements. Because static longitudinal stability may become dependent upon the stick-fixed characteristics as well as the stick-free characteristics when artificial stick forces are used, the stability requirements of § 4b.150 through § 4b.155 are being revised. If the elevator control forces are not the result of the elevator control surface hinge moments, it must be shown that an upward displacement of the elevator trailing edge is necessary to obtain and maintain speeds below the specified trim speed and a downward displacement of the elevator trailing edge is necessary to obtain and maintain speeds above the specified trim speed. Proposed § 4b.151(a), has been changed merely to reflect the new speed nomenclature prescribed by the addition of § 4b.191. Section 4b.151(c), which now requires any speed change to be perceptible to the pilot by a change in stick force, is also being amended. Because of difficulties in ascertaining a "perceptible" change in stick force, the minimum stick force versus speed gradient is being defined as not less than one pound per 6 knots. Present § 4b.155 provides that the airplane be stable over the entire operating speed range under the most adverse trim condition. In many cases this involves very large speed ranges over which it is no longer considered necessary to demonstrate stability without retrimming. While it was originally proposed to permit retrimming at V_A it has been determined that such a provision would be unnecessarily restrictive and the proposal has been changed to permit retrim at a speed midway in the cruising speed range. However, this change necessitates the addition of a provision to insure stability over an adequate speed range in those cases where the operating speed range is relatively small.

In conjunction with these proposed changes, §§ 4b.150-1 and 4b.151-1 are being deleted, together with the discussion of policies relating thereto, as well as §§ 4b.152-1, 4b.153-1, 4b.154-1, and 4b.155-1 because this material does not reflect the changes being made to the corresponding sections of the regulations and the information contained in these sections is already covered elsewhere. In addition §§ 4b.157-1(e)(3), (e)(4), and (f)(2) are being deleted because they are in conflict with the provisions of § 4b.157.

Amendments to the strength requirements include changes to the provisions on flap design speeds, pressure cabins, unsymmetrical loads due to engine failure, ground handling conditions, landing gear fatigue evaluation, and casting factors.

The present requirements on design flap speed V_F in § 4b.210(b)(1) were based on the concept of a single speed at which the pilot could place the flaps in any position from fully retracted to fully extended without reducing or increasing speed and without exceeding limit loads or without approaching a stalling condition. For this reason the requirements specify that V_F shall not be less than the greater of 1.4 V_{s_1} (flaps retracted) or 1.8 V_{s_0} (flaps in landing position). However, the development of more efficient flaps has resulted in the establishment of different operating speeds and flap positions for various stages of flight; e.g., initial approach, final approach, landing, and takeoff. The requirements are being amended to permit supplementary values of the flaps extended operating limit speed (§ 4b.714(c)), and to cover en route flap conditions (§ 4b.212(b)). Nevertheless, the single flap design speed concept has been retained in §§ 4b.210(b), 4b.212(a), 4b.221(a), and 4b.714(a).

Recent improvements in high lift flap design have raised the question of whether it is any longer necessary for the design speed for flaps in the landing position to be based on the stalling speed with flaps retracted. In view of the current operating practice of progressively reducing airspeed as flaps are extended during approach and landing, and of retracting flaps as airspeed increases during takeoff or balked landing, it appears more rational to base the design speed for each flap position on the operating and stalling speeds corresponding with the particular flap position. Therefore, § 4b.210(b)(1) is being amended to permit the selection of a flap design speed for each flap position established for the various stages of flight, with minimum values of 1.8 V_{s_0} for flaps in the landing position, and 1.6 V_{s_1} for flaps in the takeoff position. Where an automatic flap positioning or load limiting device is employed, it is permissible to use the speeds and flap positions programmed by the device. Related changes are being made to §§ 4b.1(d)(10), 4b.212(a), (b), and (c), 4b.221, and 4b.714 to make these requirements consistent with the method adopted for establishing flap design speeds. In this connection, it was proposed to amend § 4b.323(c) to provide specific speed limits for flap load limiting devices in addition to the existing objective requirement in that section. However, the proposed specific limits are not being adopted because the minimum values required in operation depend upon other characteristics of the particular airplane design, and such characteristics can be evaluated under the provisions of the existing regulation.

The present strength requirements for pressurized cabins state that, where the cabin is separated into compartments by bulkheads or floors, the primary structure shall be designed for the effects of sudden release of pressure in any compartment having external doors or windows. Difficulties have arisen in applying these requirements because primary structure is not defined and the objectives are not stated clearly. Therefore, § 4b.216(c)(4) is being amended to state that, under conditions of sudden pressure release, the integrity of the structure supporting flight and ground loads and other structure the failure of which could interfere with the continued safe flight and landing of the aircraft, shall be maintained. Damage to other portions of the airplane is acceptable, provided reasonable design precautions are taken to minimize the probability of parts becoming detached which might in-

jure occupants while in their seats. Fail-safe design features may be taken into account, provided possible operational and maintenance errors are also considered.

Section 4b.216(d) presently contains a general requirement that the airplane be designed for the unsymmetrical loads resulting from failure of one engine; e.g., yaw loads due to windmilling drag of a turbopropeller engine. On the basis of experience gained in design evaluation, testing, and operation of turbopropeller airplanes, § 4b.216(d) is being amended to state the factors to be considered in determining these loads, including types of engine failure, corresponding airplane speeds, malfunctioning of propeller drag limiting systems, and pilot corrective action.

Section 4b.235 presently contains an inconsistency between the drag loads specified for the main landing gear in the braked roll condition (which may be based on the maximum obtainable brake torque), and the drag load specified for one main gear in the nose wheel yawing condition (which is based solely on a friction coefficient of 0.8). Changes to § 4b.235 are being made which apply the yawing loads resulting from the 0.8 coefficient to the nose gear and supporting structure only. A drag load corresponding with the basic braked roll condition is being applied to one main gear as an overall airplane design condition.

The fatigue evaluation requirements of § 4b.270 at present apply only to structure supporting flight loads. A number of cases of landing gear fatigue cracking or failure have been reported. Although these failures have not resulted in fatal accidents, the possibility of fire after landing gear failure is a potential hazard. Therefore, a new § 4b.271 is being adopted, requiring a fatigue evaluation of the landing gear structure, and, where such evaluation indicates a need, the establishment of inspection or other procedures to prevent catastrophic fatigue failure. Alternatively, it may be shown that catastrophic failure of the landing gear is not probable after fatigue failure or after obvious partial failure of a single structural element.

The present requirements on factors of safety and inspections for structural castings (§ 4b.307(a)) specify a special factor of 2.0 for visual inspection only, and a factor of 1.25 when radiographic inspection and strength tests of 3 sample castings are employed. Section 4b.307(a) is being amended to provide a series of casting factors and corresponding test and inspection requirements which reflect current methods and practices. In addition, a minor revision in the format of § 4b.307(a) as proposed is being made and, in the light of comment received, alternative methods of compliance with the proposed requirements of this section are being added.

A revision to § 4b.334(e) concerning landing gear position indicators and warning devices is being made to insure warning in the event a landing is made with one or more throttles advanced. A note is also being added setting forth an acceptable means of compliance which would replace § 4b.334–2. To insure that essential equipment in wheel wells is not damaged by loose tire treads or a bursting tire, a provision is being added which requires protection of such equipment. As a result of comments made on the proposal, alternatives are being added to the requirement, to permit a finding that a tire cannot burst from overheat or that a loose tire tread cannot cause damage. It is intended that such findings will be based on the use of a wheel which is fitted with a fusible plug and a tubeless tire or that an extended wheel is located so that a tire tread which has separated from the wheel cannot enter the wheel well and that the wheel is braked to a stop before retraction into the wheel well.

Current provisions of § 4b.352 do not require fail-safe windshields and windows on pressurized cabin airplanes; however, existing turbine transport airplanes incorporate this feature, which has prevented complete loss of cabin pressurization in a considerable number of partial windshield failure incidents. Therefore, § 4b.352(d) is being amended to require that windshields and window panels in pressurized cabins have strength to withstand the maximum differential pressure load, aerodynamic pressures, and temperature effects after failure of a single element. This amendment differs from that proposed in that it is less restrictive as to the type of window or windshield required.

Sections 4b.357 and 4b.371(d) require that, when louvres or other ventilating devices are provided between cabin partitions, it shall be possible for the crew to stop the flow of air through such ventilating devices. Because this requirement does not accomplish its apparent objective which is covered elsewhere, §§ 4b.357 and 4b.371(d) are being deleted.

Sections 4b.358(c)(2) and 4b.643 presently require an additional factor of safety of 1.33 on the loads for seat and safety belt attachments, and § 4b.307(c) requires a factor of 1.15 for structural fittings (attachments). Sections 4b.358(c)(2) and 4b.643 are being clarified by inserting a statement that the 1.33 factor may be applied in lieu of the 1.15 factor, not be added to it. This is consistent with the general principle that only the highest factor intended for a similar purpose need be applied. However, if castings are used, the casting factor specified in § 4b.307(a) still applies, since this factor is intended for another purpose.

The upper aisle width specified in § 4b.362(h) has been reduced from 20 to 18 inches, for airplanes having a passenger seating capacity of 10 or less, on the basis of studies indicating that this reduction would not adversely affect safe emergency evacuation. However, a further reduction of this dimension to 16 inches, as suggested by several interested persons, has not been justified. Biometric data derived from a general sampling of the civilian population reveals that a significant percentage of passengers have a standing hip-breadth exceeding 16 inches, whereas the percentage exceeding 18 inches is negligible. A 16-inch upper aisle width, therefore, introduces the probability that a single passenger may jam the aisle between seats in the excitement and near-panic of an emergency evacuation; and, in any event, movement along the aisle would be retarded by the awkward sideward gait which large-hipped passengers must assume for passage.

It had been proposed that the optional provision of § 4b.385, which permits the control of fire once it has started, would be deleted. Comments made on that proposal have led to the conclusion that such an amendment might be unnecessarily restrictive and would not be compatible with other requirements which do permit the control of fire in cargo compartments and nacelles. Accordingly, presently effective § 4b.385 remains unchanged. Section 4b.412 dealing with pressure crossfeed lines is being deleted because §§ 4b.370 and 4b.385 cover both the fire control and ventilation aspects of § 4b.412.

As a result of comments received, the specific provisions regarding demonstrations or tests are being deleted from §§ 4b.413 and 4b.416 as they were proposed in the draft release. Adequate authority for any ground or flight tests which might be required continues to rest in presently effective §§ 4b.15 and 4b.16. The flight conditions specified in § 4b.416, used in connection with the selection of unusable fuel supply, are unnecessary if compliance with general fuel flow requirements is obtained and are, therefore, being deleted. The provisions of paragraph (b) of § 4b.416, as proposed in the draft release are being transferred to a new paragraph (c) under § 4b.413, as an editorial change, since the provision for fuel feed belongs more appropriately in the fuel flow section than in the unusable fuel supply section. Presently effective § 4b.415 also covers fuel flow rate, relative to transfer systems and bases required flow rates on horsepower output. Since the changes being made to § 4b.413 eliminate the horsepower basis for establishing flow rate, § 4b.415 is being deleted.

Because of the change made to § 4b.416, material contained in other sections is no longer necessary. Therefore, §§ 4b.416–1, 4b.416–2, 4b.418(a), 4b.418–1, and 4b.426–1 are being deleted. Section 4b.420(d) is also being deleted to eliminate a conflict with the definition of unusable fuel supply in § 4b.416.

In addition to the matter of unusable fuel supply, another question has arisen relating to the flow requirements of § 4b.413. Section 4b.413(a) presently requires that the available fuel flow shall be not less than 125 percent of that needed to develop maximum engine horsepower or thrust. The 25 percent margin is not required to insure adequate fuel flow. Furthermore, a margin is unnecessary to offset system deterioration because such deterioration is precluded by proper maintenance, inspection, and overhaul. Section 4b.413 is being amended as proposed in accordance with the foregoing.

Section 4b.436, dealing with fuel system drains, is being revised to delete redundant and contradictory requirements.

Presently effective §§ 4b.450 through 4b.455 deal with the powerplant cooling capability and specify tests to show that powerplant temperature limits can be maintained. With the exception of § 4b.455, these sections apply to reciprocating engines. Sections 4b.450 through 4b.452 are being clarified by making them generally applicable to turbine engine installations as well as reciprocating engine installations and by specifying test conditions in general terms which are based on the applicable airplane performance requirements. This clarification makes §§ 4b.453 and 4b.455 unnecessary. Accordingly, they are being deleted.

Consistent with the proposed changes to the powerplant cooling requirements, §§ 4b.440(e), 4b.440–1, 4b.450–1, 4b.452–1, 4b.453–1, 4b.454–1, 4b.465, and 4b.465–1 are being deleted inasmuch as the matter of oil cooling and carburetor air cooling is covered in the changes being made to §§ 4b.450 through 4b.455.

Section 4b.488 requires a fireproof diaphragm to isolate the engine power section and all portions of the exhaust system from the engine accessory compartment, unless equivalent protection can be shown by other means. Fire extinguishing systems are required in all cases to be provided in the engine power section, in the engine accessory section, and in complete powerplant compartments. Since it is considered that fire extinguishing systems are equivalent to a diaphragm in providing protection, there is no reason for retaining the provisions of § 4b.488. Accordingly, this section is being deleted. Consistent with this deletion, editorial changes are being made in §§ 4b.484 and 4b.487.

Section 4b.604(q) requires a thrust indicator for each turbojet engine. Because such indicators have not been perfected and because the thrust output information which is desired can be otherwise obtained, this section is being amended to require instead an indicator which will permit the pilot to determine if the thrust of any engine has changed as a result of any engine deficiency. A comment on this section as proposed expressed concern that the proposed phrase "relative to the thrust being obtained by the remaining engines" meant a requirement for a differential thrust indicator between any two engines. Such a meaning was not intended. To prevent the possibility of further misconstrual, the phrase is being deleted. Another comment expressed concern that since pressure ratio indication has been accepted as meeting the requirement for a thrust indicator, it would necessarily be disallowed in meeting a requirement for indication that thrust has changed. A pressure ratio indicator will continue to be acceptable in meeting the amended requirement if it has previously been acceptable in meeting the requirement for a thrust indicator. Since pressure ratio indication might not in all cases fully satisfy the provision that the indicated thrust change results from any engine deficiency, an alternative is being added to the requirement. The alternative will permit the indication of any gas stream pressure which can be related to the thrust output of the engine.

Section 4b.622(b) is being amended by adding two provisions which relate to the proper functioning of the generating system with respect to load equipment. These provisions are a more precise statement of the requirement in currently effective § 4b.627 and permit deletion of that requirement.

To eliminate an unnecessarily restrictive provision requiring that certain electrical protective devices or their controls be accessible for resetting in flight, § 4b.624(d) is being amended. Section 4b.627 is also being amended by deleting the currently effective rule and adding several provisions to insure the validity of electrical system tests under simulated conditions in the laboratory. The wording in the present section is being deleted because: (1) Other sections require such tests as are necessary to show compliance with all airworthiness requirements, including those dealing with the electrical system; and (2) the need for the provision that the electrical system "functions properly and without electrical or thermal distress" has been eliminated by the revision to § 4b.622(b).

Presently effective § 4b.652 deals with the reliability of engine-driven accessories and § 4b.659 specifies that an airplane must be able to continue safe flight in the event of a failure of a high energy rotor. These two sections are being deleted because their substance is covered by the provisions of § 4b.606 which is concerned with the reliability of all equipment, systems, and installations.

Hydraulic system service difficulties have arisen which affect the proposal to add a new § 4b.656, concerning hydraulic system tests. Therefore, the proposed addition of § 4b.656, containing a new test requirement, is not being included at this time. A study of the matter is being made outside the framework of this review.

A change is being made to figure 4b–19 dealing with position light intensities in order to remove an irrational discontinuity.

Operating records show an increasing number of cases of exceeding the airspeed operating limits on transport category airplanes, particularly on turbine-powered airplanes. Also, the present regulations lack definite criteria for the rational determination of speed margins. Among the probable causes of overspeed are the characteristics of turbine-powered airplanes which make it desirable to operate at the limit speed, the somewhat indefinite significance of the present normal operating limit speed, and the increasing preoccupation of pilots with air traffic and other duties which distract them from continuous monitoring of airspeed instruments. Therefore, a series of amendments to the airspeed operating limitations and related requirements are being made. These amendments replace the existing normal operating limit and never exceed speeds (§§ 4b.711 and 4b.712) by a single speed at the previous normal operating limit value. The new single limit is designated as the "maximum operating limit speed," and is defined in the Airplane Flight Manual (§ 4b.741) as a speed which shall not be deliberately exceeded in any regime of flight, except where a higher speed is authorized for flight test or pilot training operations. The amendments provide a rational method (based on a 7.5 degree dive maneuver), as well as alternative arbitrary factors, for calculating the speed margin between the new limit speed and the demonstrated flight or structural dive speeds. To provide for atmospheric conditions and other operational factors not covered by the 7.5 degree dive criteria, the amendments include a minimum speed margin of 0.05 Mach number beyond the operating limit speed. This is 0.04 M beyond the aural warning speed, and is believed to be consistent with the minimum margin on existing airplanes.

A new § 4b.191, high-speed characteristics, is being adopted to cover in general terms the flight tests for speed increase and recovery characteristics, and to establish a maximum speed V_{RC} for certain stability characteristics. The speed margin between design speeds V_C and V_D in § 4b.210 is being replaced by a cross reference to § 4b.711.

To minimize overspeeding due to pilot preoccupation, § 4b.603 is being amended by adding a new paragraph (k) to require an aural warning device on turbine-powered airplanes and on other airplanes having a speed margin of less than 20 percent between limit and demonstrated speeds. To insure early warning and thus to make a major portion of the speed margin available for pilot reaction and recovery maneuvers, the amendment also requires that the warning occur whenever the speed exceeds the limit speed by more than 6 knots or 0.01 M.

The changes in terminology in the airspeed limitations require corresponding changes, including deletions and additions, in §§ 4b.1(d)(9), (15), and (16); 4b.132(e); 4b.141; 4b.142(c); 4b.155; 4b.156; 4b.157; 4b.157–1; 4b.158; 4b.210(b)(4); 4b.210(b)(5); 4b.484–1(b)(1); 4b.603(a); 4b.612(a)(3); 4b.612–4(a); 4b.711; 4b.712; 4b.740–1; and 4b.741(a).

Miscellaneous changes of an editorial or clarifying nature are being made to §§ 4b.1, 4b.11, 4b.155, 4b.160, 4b.221, 4b.306, 4b.306–1, 4b.329–2, 4b.329–6, 4b.435, 4b.447, 4b.612, 4b.642, 4b.645, 4b.718, and 4b.738. Among the miscellaneous amendments there is one to expressly exclude from the provisions of § 4b.11(b) consideration of provisional type certificates. While it was proposed that this be accomplished by a note, it now appears that it is more appropriate to include such a provision within § 4b.11(b) rather than as a note thereto. Furthermore, the proposed § 4b.612(f)(4) requiring two complete static air pressure operating systems for the required instruments at the first pilot's station has been withdrawn in the light of comment received. It has been determined that one such static air pressure operating system as presently required is all that is necessary as a minimum requirement in the interest of safety.

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, Part 4b of the Civil Air Regulations (14 CFR Part 4b, as amended) is hereby amended as follows, effective May 3, 1962:

1. By amending § 4b.1 by amending paragraphs (b)(2), (d)(9), (d)(10), (d)(15), and (d)(16) to read as follows:

§ 4b.1 Definitions.

* * * * *

(b) *General design.* * * *

(2) *Maximum ambient atmospheric temperature.* The maximum ambient atmospheric temperature is the temperature selected by the applicant as the maximum operational limit.

* * * * *

(d) *Speeds.* * * *

(9) V_{DF}/M_{DF}: The demonstrated flight diving speed at which compliance is shown with the applicable flight requirements. (See §§ 4b.190 and 4b.191(a).)

(10) V_F: The design flap speeds for flight loading conditions. (See § 4b.210 (b)(1).)

* * * * *

(15) V_{FC}/M_{FC}: *The maximum speed for* stability characteristics. (See § 4b.191 (b).)

(16) V_{MO}/M_{MO}: The maximum operating limit speed. (See § 4b.711.)

§ 4b.11 [Amendment]

2. By amending § 4b.11(b) by inserting in the first sentence between the words "required" and "except" the phrase "notwithstanding the applicant may have been issued a provisional type certificate".

3. By amending § 4b.130 by adding new paragraphs (c), (d), and (e) to read as follows:

§ 4b.130 Controllability; general.

* * * * *

(c) Compliance with the "strength of pilots" limits in paragraph (b) of this section need not be demonstrated unless the condition is found to be marginal. In the latter case, they shall not exceed the following pilot control force limits, expressed in pounds:

	Pitch	Roll	Yaw
(1) For temporary application	75	60	180
(2) For prolonged application	10	5	20

Pitch and roll forces shall be measured as applied to the control wheel.

(d) For the purpose of complying with the temporary control force limitations of paragraph (c) of this section, the airplane shall be operated in accordance with approved operating procedure or conventional operating practice including being as nearly trimmed as possible at the prior steady flight condition, except that in the case of takeoff the airplane shall be trimmed in accordance with approved operating procedures.

(e) For the purpose of complying with the prolonged control force limitations of paragraph (c) of this section, the airplane shall be as nearly trimmed as possible.

§ 4b.131 [Amendment]

4. By amending § 4b.131(b) by deleting the first sentence and inserting in lieu thereof the following: "During each of the following controllability demonstrations, a change in the trim control shall not be required. In addition, exertion of more than 50 pounds control force, representative of the maximum temporary force which can readily be applied by one hand, shall not be required."

§ 4b.132 [Amendment]

5. By amending § 4b.132(e) by deleting from the last sentence the symbol "V_{NE}" and inserting in lieu thereof "V_{FC}/M_{FC}."

§ 4b.141 [Amendment]

6. By amending § 4b.141 by deleting the words "V_{NO} or to M_{NO}, whichever is the lesser" and inserting in lieu thereof "V_{MO}/M_{MO}."

§ 4b.142 [Amendment]

7. By amending § 4b.142(c) by deleting the word "V_{NO} or to M_{NO}, whichever is the lesser" and inserting in lieu thereof "V_{MO}/M_{MO}".

8. By amending § 4b.150 to read as follows:

§ 4b.150 General.

The airplane shall be longitudinally, directionally, and laterally stable in accordance with §§ 4b.151 through 4b.158. Suitable stability shall be required in other conditions normally encountered in service if flight tests show such stability to be necessary for safe operation.

§ 4b.150–1 [Deletion]

9. By deleting § 4b.150–1.

10. By amending § 4b.151 by amending the introductory paragraph and paragraphs (a) and (c) to read as follows:

§ 4b.151 Static longitudinal stability.

In the conditions outlined in §§ 4b.152 through 4b.155, the characteristics of the elevator control forces including friction and the elevator control surface displacement shall comply with paragraphs (a) through (c) of this section.

(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, except that if the elevator control forces are not dependent upon the hinge moments of the elevator control surface it shall also be shown that an upward displacement of the elevator trailing edge is required to obtain and maintain speeds below the specified trim speed and a downward displacement of the elevator trailing edge is required to obtain and maintain speeds above the specified trim speed. These criteria shall apply to any speed which can be obtained, except that such speeds need not be greater than the landing gear or the wing flap operating limit speed or V_{FC}/M_{FC}, whichever is appropriate, or need not be less than the minimum speed in steady unstalled flight.

* * * * *

(c) The stable slope of the stick force versus speed curve shall not be less than 0.5 pounds per 3 knots nor shall it exceed a value beyond which control of the airplane is difficult.

§ 4b.151–1 [Deletion]

11. By deleting § 4b.151–1.

12. By amending § 4b.152 to read as follows:

§ 4b.152 Stability during landing.

The stick force curve and, if required by § 4b.151(a), the elevator angle curve shall have stable slopes and the stick force shall not exceed 80 pounds at any speed between 1.1 V_{s_0} and 1.8 V_{s_0} with:

(a) Wing flaps in the landing position;

(b) The landing gear extended;

(c) Maximum landing weight;

(d) Power, or thrust, off on all engines; and

(e) The airplane trimmed at 1.4 V_{s_0} with power or thrust off.

§ 4b.152–1 [Deletion]

13. By deleting § 4b.152–1.

14. By amending § 4b.153 to read as follows:

§ 4b.153 Stability during approach.

The stick force curve and, if required by § 4b.151(a), the elevator angle curve shall have stable slopes at all speeds between 1.1 V_{s_1} and 1.8 V_{s_1} with:

(a) Wing flaps in the approach position;

(b) Landing gear retracted;

(c) Maximum landing weight; and

(d) The airplane trimmed at 1.4 V_{s_1} and with power sufficient to maintain level flight at this speed.

§ 4b.153–1 [Deletion]

15. By deleting § 4b.153–1.

16. By amending § 4b.154 to read as follows:

§ 4b.154 Stability during climb.

The stick force curve and, if required by § 4b.151(a), the elevator angle curve shall have stable slopes 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 takeoff weight;

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

(e) The airplane trimmed at the best rate-of-climb speed except that the speed need not be less than 1.4 V_{s_1}.

§ 4b.154–1 [Deletion]

17. By deleting § 4b.154–1.

18. By amending § 4b.155 to read as follows:

§ 4b.155 Stability during cruising.

(a) *Landing gear retracted; high speed.* The stick force curve and, if required by § 4b.151(a), the elevator angle curve shall have stable slopes at all speeds from V_{FC}/M_{FC} to the speed equal to $V_{FC}-\left(\frac{V_{FC}-1.4\,V_{s_1}}{2}\right)$ or to 50 knots less than the trim speed specified in subparagraph (4) of this paragraph, whichever

is the lesser speed except that it need not be less than 1.4 V_{s_1}, and the stick force shall not exceed 50 pounds with:

(1) Wing flaps retracted;

(2) The most critical weight between maximum landing weight and maximum takeoff weight;

(3) 75 percent of maximum continuous power for reciprocating engines; maximum cruising power selected by the applicant as an operating limitation (see § 4b.718) for turbine engines, except that the power need not exceed that required at V_{MO}/M_{MO}; and

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

(b) *Landing gear retracted; low speed.* The stick force curve and, if required by § 4b.151(a), the elevator angle curve shall have stable slopes at all speeds from a speed equal to

$$V_{FC}-\left(\frac{V_{FC}-1.4\,V_{s_1}}{2}\right)$$

to 1.4 V_{s_1} and the stick force shall not exceed 50 pounds with the wing flaps and weight as specified in paragraph (a) of this section and with:

(1) Power required for level flight at a speed equal to $V_{FC}-\left(\frac{V_{FC}-1.4\,V_{s_1}}{2}\right)$; and

(2) The airplane trimmed for level flight with the power required in subparagraph (1) of this paragraph.

NOTE: At altitudes where Mach number is critical, the calibrated airspeed corresponding with M_{FC} may be used to calculate the speed $V_{FC}-\left(\frac{V_{FC}-1.4\,V_{s_1}}{2}\right)$.

(c) *Landing gear extended.* The stick force curve and, if required by § 4b.151 (a), the elevator angle curve shall have stable slopes at all speeds between 1.4 V_{s_1} and V_{LE} and the stick force shall not exceed 50 pounds with the wing flaps and the weight as specified in paragraph (a) of this section and with:

(1) Power required for level flight at V_{LE}; and

(2) The airplane trimmed for level flight with the power required in subparagraph (1) of this paragraph.

§ 4b.155–1 [Deletion]

19. By deleting § 4b.155–1.

§ 4b.156 [Amendment]

20. By amending § 4b.156 by inserting between the words "airplane" and "shall" the parenthetical expression "(e.g., V_{FE}, V_{LE}, or V_{FC}/M_{FC})".

§ 4b.157 [Amendment]

21. By amending § 4b.157 by deleting from paragraphs (a) and (b)(1) the words "the operating limit speed" and inserting in lieu thereof the words "V_{FE}, V_{LE}, or V_{FC}/M_{FC}, whichever is appropriate to the airplane configuration".

§ 4b.157–1 [Amendment]

22. By amending § 4b.157–1 by deleting paragraphs (e)(3), (e)(4), and (f)(2).

§ 4b.158 [Amendment]

23. By amending § 4b.158 by inserting between the words "airplane" and "shall" the parenthetical expression "(e.g., V_{FE}, V_{LE}, or V_{FC}/M_{FC})".

24. By amending § 4b.160(c)(1) by deleting the phrase "With trim controls adjusted for straight flight at a speed of 1.4 V_{s_1}" and inserting in lieu thereof "With the airplane trimmed for straight flight at the speed prescribed in § 4b.112(c)(1)".

25. By amending § 4b.160(e) to read as follows:

§ 4b.160 Stalling; symmetrical power.

* * * * *

(e) Straight flight stalls shall be entered with wings level. The roll occurring between the stall and the completion of the recovery shall not exceed approximately 20 degrees.

26. By adding a new § 4b.191 to read as follows:

§ 4b.191 High-speed characteristics.

(a) *Speed increase and recovery characteristics.* (1) Operating conditions or characteristics likely to cause inadvertent speed increases, including upsets in pitch and roll, shall be simulated with the airplane trimmed at any likely cruise speed up to V_{MO}/M_{MO}. Allowing for pilot reaction time after effective inherent or artificial speed warning occurs (see § 4b.603(k)), it shall be demonstrated that the airplane can be recovered to a normal attitude and its speed reduced to V_{MO}/M_{MO} without requiring exceptional strength or skill on the part of the pilot, without exceeding V_D/M_D, V_{DF}/M_{DF}, or the structural limitations, and without producing buffeting which would cause structural damage.

NOTE: Examples of operating conditions or characteristics likely to cause speed increases are: gust upsets, inadvertent control movements, low stick force gradient in relation to control friction, passenger movement, leveling off from climb, and descent from Mach to airspeed limit altitudes.

(2) At all speeds up to V_{DF}/M_{DF}, there shall be no control reversal. Any reversal of elevator control force or tendency of the airplane to pitch, roll, or yaw, shall be mild and readily controllable using normal piloting technique.

(b) *Maximum speed for stability characteristics, V_{FC}/M_{FC}.* V_{FC}/M_{FC} shall be the maximum speed at which the requirements of §§ 4b.132(e), 4b.155(a), 4b.156, 4b.157(a), 4b.157(b), and 4b.158 are required to be met with flaps and landing gear retracted. It shall not be less than a speed halfway between V_{MO}/M_{MO} and V_{DF}/M_{DF}, except that in the altitude range where Mach number is the limiting factor, M_{FC} need not exceed the Mach number at which effective speed warning occurs.

27. By amending § 4b.210(b)(1) to read as follows:

§ 4b.210 General.

* * * * *

(b) *Design air speeds.* * * *

(1) *Design flap speeds, V_F.* The design flap speed for each flap position established in accordance with § 4b.323(a) shall be sufficiently greater than the operating speed recommended for the corresponding stage of flight (including balked landings) to allow for probable variations in control of airspeed and for transition from one flap position to another. V_F shall be not less than:

(i) 1.6 V_{s_1} with flaps in takeoff position at maximum takeoff weight;

(ii) 1.8 V_{s_1} with flaps in approach position at maximum landing weight; and

(iii) 1.8 V_{s_0} with flaps in landing position at maximum landing weight.

Where an automatic flap positioning or load limiting device is employed, it shall be permissible to use the speeds and corresponding flap positions programmed or permitted by the device. (See § 4b.323(c).)

28. By amending § 4b.210(b)(4) by adding at the end thereof the parenthetical reference "(See § 4b.711.)"

29. By amending § 4b.210(b)(5) to read as follows:

(b) *Design air speeds.* * * *

(5) *Design dive speed, V_D.* The design dive speed chosen by the applicant shall be used in determining the maximum operating limit speed for the airplane in accordance with § 4b.711.

30. By amending § 4b.212(a) by deleting the introductory paragraph and inserting in lieu thereof the following: "When flaps are intended for use during takeoff, approach, or landing, the airplane shall be assumed to be subjected to symmetrical maneuvers and gusts within the range determined by the following conditions, at the design flap speeds established for these stages of flight in accordance with § 4b.210(b)(1) and with the flaps in the corresponding positions."

31. By amending § 4b.212(b) by deleting from the introductory paragraph the words "V_{FE} speed established in accordance with § 4b.714(c)" and inserting in lieu thereof "the flap design speed chosen for this condition."

32. By amending § 4b.212 by deleting paragraph (d) and amending paragraph (c) to read as follows:

§ 4b.212 Effect of high lift devices.

* * * * *

(c) The airplane shall be designed for the conditions prescribed in paragraph (a) of this section, except that the airplane load factor need not exceed 1.0, taking into account the following effects as separate conditions:

(1) Propeller slipstream corresponding with maximum continuous power at the design flap speeds V_F, and with takeoff power at not less than 1.4 times the stalling speed for the particular flap position and associated maximum weight; and

(2) A head-on gust of 25 feet per second velocity (EAS).

33. By amending § 4b.216 by amending paragraphs (c)(4) and (d) to read as follows:

§ 4b.216 Supplementary flight conditions.

* * * * *

(c) *Pressurized cabin loads.* * * *

(4) Where a pressurized cabin is separated into two or more compartments by partitions, bulkheads, or floors, the structure supporting the prescribed flight and ground loads and other structure the failure of which could interfere with continued safe flight and landing of the airplane, shall be designed to withstand the effects of sudden release of pressure in any compartment through an opening resulting from the failure or penetration of an external door, window, or windshield panel, or from structural fatigue or penetration of the fuselage in such compartment unless it is shown that the probability of failure or penetration is extremely remote. In determining the probability of failure or penetration and probable size of openings, it shall be acceptable to take into account fail-safe features of the design, provided possible improper operation of closure devices and inadvertent door openings are also taken into account. It shall be acceptable to take into account pressure relief provided by intercompartment venting. It can be assumed that parts of the airplane, other than the structure specified in this paragraph, may be damaged, in which case reasonable design precautions shall be taken to minimize the probability of parts becoming detached which may injure occupants while in their seats.

NOTE: The aforementioned precautions might include, for example, designing internal doors so that they will remain attached to supporting structure even though forced open by differential pressure.

(d) *Unsymmetrical loads due to engine failure.* The airplane shall be designed for the unsymmetrical loads resulting from the failure of the critical engine. Turbopropeller airplanes shall be designed for the conditions prescribed in subparagraphs (1) through (4) of this paragraph in combination with a single malfunction of the propeller drag limiting system (see § 4b.408), taking into account the probable pilot corrective action on the flight controls.

(1) At all speeds between V_{MC} and V_D, the loads resulting from engine power failure due to fuel flow interruption shall be considered as limit loads.

(2) At all speeds between V_{MC} and V_C, the loads resulting from the disconnection of the engine compressor from the turbine or from loss of the turbine blades shall be considered as ultimate loads.

(3) The time history of the thrust decay and drag build-up occurring as a result of the prescribed engine failures shall be substantiated by test or other data applicable to the particular engine-propeller combination.

(4) The timing and magnitude of the probable pilot corrective action shall be conservatively estimated, considering the characteristics of the particular engine-propeller-airplane combination.

NOTE: It may be assumed that pilot corrective action will be initiated at the time maximum yawing velocity is attained, but not earlier than two seconds after the engine failure. The magnitude of the corrective action may be based on the control forces specified in § 4b.220(a)(1), except that lower forces may be assumed where it is shown by analysis or test that such forces will be sufficient to control the yaw and roll resulting from the prescribed engine failure conditions.

34. By amending § 4b.221 to read as follows:

§ 4b.221 Wing flaps.

Wing flaps and their supporting structure and operating mechanism shall be designed for the critical loads resulting from the conditions prescribed in § 4b.212, taking into account the loads occurring during transition from one flap position and airspeed to another.

§ 4b.235 [Amendment]

35. By amending § 4b.235 by deleting from the last sentence of the introductory paragraph the phrase "of paragraph (b) (1) and (2)" and inserting in lieu thereof "paragraphs (b) (1) and (2), and (e) (3)".

36. By amending § 4b.235(e)(2) by adding at the beginning thereof a new sentence to read as follows: "It shall be acceptable to apply the conditions of this subparagraph to the design of only the nose gear, its attaching structure, and the fuselage structure."

37. By amending § 4b.235 by adding a new paragraph (e)(3) to read as follows:

§ 4b.235 Ground handling conditions.

* * * * *

(e) *Nose-wheel yawing.* * * *

(3) This subparagraph shall apply to the landing gear and airplane structure. The loading conditions shall be those prescribed in subparagraph (2) of this paragraph, except that the forward acting load at the center of gravity need not exceed the maximum drag reaction on one main gear determined in accordance with the introductory paragraph and paragraph (b)(2) of this section.

§ 4b.270 [Amendment]

38. By amending the title of § 4b.270 to read *"Fatigue evaluation of flight structure."*

39. By adding a new § 4b.271 to read as follows:

§ 4b.271 Fatigue evaluation of landing gear.

The strength, detail design, and fabrication of those portions of the landing gear and its attachment fittings in which fatigue may be critical shall be evaluated in accordance with the provisions of either paragraph (a) or (b) of this section.

(a) The fatigue strength of the structure shall be evaluated and, when indicated by such evaluation, inspection or other procedures shall be established to prevent catastrophic fatigue failure. The evaluation shall include the loading spectrum expected in service and the identification and analysis or repeated load testing of the principal structural elements and detail design points where catastrophic fatigue failure could occur. It shall be acceptable to utilize the service history of airplanes of similar structural design, taking due account of differences in operating conditions and procedures.

(b) It shall be shown by analysis or tests that catastrophic failure is not probable after fatigue failure or obvious partial failure of a single principal structural element. After such failure the remaining structure shall be capable of withstanding static loads corresponding with 80 percent of the limit loads resulting from the conditions prescribed in § 4b.230. These static loads shall be considered ultimate loads.

40. By amending § 4b.306(c) and the note to read as follows:

§ 4b.306 Material strength properties and design values.

* * * * *

(c) Values contained in MIL-HDBK-5, MIL-HDBK-17 Part I, ANC-17 Part II, ANC-18, MIL-HDBK-23 Part I, and ANC-23 Part II shall be used unless shown to be inapplicable in a particular case.

NOTE: MIL-HDBK-5, "Strength of Metal Aircraft Elements"; MIL-HDBK-17, "Plastics for Flight Vehicles, Part I—Reinforced Plastics"; ANC-17, "Plastics for Aircraft, Part II—Transparent Glazing Materials"; ANC-18, "Design of Wood Aircraft Structures"; MIL-HDBK-23, "Composite Construction for Flight Vehicles, Part I—Fabrication Inspection Durability and Repair"; and ANC-23, "Sandwich Construction for Aircraft, Part II—Material Properties and Design Criteria", are published by the Department of Defense and the Federal Aviation Agency and may be obtained from the Superintendent of Documents, Government Printing Office, Washington 25, D.C.

§ 4b.306-1 [Amendment]

41. By amending § 4b.306-1 by deleting from paragraph (a) the expression "ANC-5" and inserting in lieu thereof "MIL-HDBK-5"; by deleting from paragraph (c) and the footnote words "The ANC-5 Bulletin" wherever they appear and inserting in lieu thereof "MIL-HDBK-5"; and by deleting from the footnote the phrase "to § 3.111 'Design Mechanical Properties'" and inserting in lieu thereof "to § 3.1.1 'Material Properties'".

42. By amending § 4b.307(a) to read as follows:

§ 4b.307 Special factors.

* * * * *

(a) *Casting factors.* For structural castings, the factor of safety precribed in § 4b.200 shall be multiplied by the casting factors specified in subparagraphs (1) and (2) of this paragraph. The prescribed tests and inspections shall be in addition to those necessary to establish foundry quality control. Castings shall be inspected in accordance with approved specifications.

(1) Each casting, the failure of which would preclude continued safe flight and landing of the airplane or which would result in serious injury to occupants, shall have a casting factor of at least 1.25 and shall receive 100 percent inspection by visual, radiographic, and magnetic particle or penetrant inspection methods or approved equivalent nondestructive inspection methods. Where such castings have a casting factor less than 1.50, three sample castings shall be static tested. The test castings shall comply with the strength requirements of § 4b.201 at an ultimate load corresponding with a casting factor of 1.25 and shall comply with the deformation

requirements at a load equal to 1.15 times limit load.

NOTE: Examples of castings to which this subparagraph applies are: structural attachment fittings; parts of flight control systems; control surface hinges and balance weight attachments; seat, berth, safety belt, and fuel and oil tank supports and attachments; cabin pressure valves.

(2) For structural castings other than those specified in subparagraph (1) of this paragraph, the casting factors and inspections shall be in accordance with the following table except that it shall be acceptable to reduce the percentage of castings inspected by nonvisual methods when an approved quality control procedure is established. For castings procured to a specification which guarantees the mechanical properties of the material in the castings and provides for demonstration of these properties by test of coupons cut from castings on a sampling basis, it shall be acceptable to use a casting factor of 1.0. The inspection requirements for such castings shall be in accordance with those specified in the following table for casting factors of 1.25 to 1.50, and the testing requirements shall be in accordance with subparagraph (1) of this paragraph.

Casting factor	Inspections
2.0 or greater	100 percent visual.
Less than 2.0 greater than 1.5.	100 percent visual, and magnetic particle or penetrant or equivalent nondestructive inspection methods.
1.25 to 1.50	100 percent visual, magnetic particle or penetrant, and radiographic, or approved equivalent nondestructive inspection methods.

(3) Castings which are pressure tested as parts of a hydraulic or other fluid system shall not be required to comply with the provisions of this section unless such castings support airplane structural loads.

(4) The casting factor need not exceed 1.25 with regard to bearing stresses regardless of the method of inspection employed. A casting factor need not be employed with respect to the bearing surface of a part if the bearing factor used (see paragraph (b) of this section) is greater than the casting factor.

§ 4b.329–2 [Amendment]

43. By amending § 4b.329–2 by deleting from table I the expression "MIL–C–5424" and inserting in lieu thereof "MIL–W–5424" and by deleting from note 3 the words "Air Force-Navy Aeronautical Design Standard AND 10482" and inserting in lieu thereof "Military Standard Drawing MS33591(ASG)".

§ 4b.329–6 [Amendment]

44. By amending § 4b.329–6 by deleting the expression "ANC–5" and inserting in lieu thereof "MIL–HDBK–5".

45. By amending § 4b.334(e)(2) by deleting the word "all" and inserting in lieu thereof "one or more".

46. By amending § 4b.334 by adding a note at the end of paragraph (e)(1); and by adding a new paragraph (g) to read as follows:

§ 4b.334 Retracting mechanism.

* * * * *

(e) *Position indicator and warning device.* (1) * * *

NOTE: An acceptable method for indicating to the pilot when the landing gear is secured in the extended and in the retracted positions is by means of lights. For example, landplanes may display a green light when the landing gear is down and locked; a red light to indicate an intermediate or unlocked landing gear position; and "all lights out" when the landing gear is up and locked. An acceptable method for sensing when the landing gear is secured in the extreme positions is to locate the sensing devices so that they are operated by the landing gear locking latch.

* * * * *

(g) *Protection of equipment in wheel wells.* Equipment located in wheel wells, which is essential to safe operation of the airplane, shall be protected from the damaging effects of a bursting tire unless it is shown that a tire cannot burst from overheat, or from the damaging effects of a loose tire tread unless it is shown that a loose tire tread cannot cause damage.

§ 4b.352 [Amendment]

47. By amending § 4b.352(d) by adding at the end thereof, after the parenthetical expression, two new sentences to read as follows: "Strength shall be provided in the windshield and window panels to withstand the maximum cabin pressure differential loads (see § 4b.216(c)(1)) combined with critical aerodynamic pressure and temperature effects, after failure of a single load-carrying element of the windshield or window. It shall be acceptable to assume that after a single failure occurs, which is obvious to the flight crew, the cabin pressure differential will be reduced from the maximum in accordance with appropriate operating limitations enabling continued safe flight of the airplane with a cabin pressure altitude of not more than 15,000 feet. (See 4b.374(b).)"

§ 4b.357 [Deletion]

48. By deleting § 4b.357.

§ 4b.358 [Amendment]

49. By amending § 4b.358(c)(2) by adding at the end thereof the words "in lieu of the fitting factor prescribed in § 4b.307(c)."

50. By amending § 4b.362(h) to read as follows:

§ 4b.362 Emergency evacuation.

* * * * *

(h) *Width of main aisle.* The main passenger aisle width at any point between seats shall not be less than the values in the following table:

Passenger seating capacity	Minimum main passenger aisle width	
	Less than 25 inches from floor	25 inches and more from floor
	Inches	*Inches*
10 or less	12	18
11 to 19	12	20
20 or more	15	20

§ 46.371 [Amendment]

51. By deleting § 4b.371(d).

§ 46.412 [Deletion]

52. By deleting § 4b.412.

53. By amending § 4b.413 to read as follows:

§ 4b.413 Fuel flow.

(a) The fuel system shall provide not less than 100 percent of the fuel flow required by the engines when the airplane is operated under all intended operating conditions and maneuvers.

(b) In determining compliance with the provisions of paragraph (a) of this section, the provisions of subparagraphs (1) through (4) of this paragraph shall apply.

(1) Fuel shall be delivered to the engine at a pressure within the limits specified in the engine type certificate.

(2) The quantity of fuel in the tank being considered shall not exceed the sum of the amount established as the unusable fuel supply for that tank, as determined in accordance with the provisions of § 4b.416, and whatever minimum quantity of fuel it may be necessary to add for the purpose of determining compliance.

(3) Such main pumps shall be used as are necessary for each operating condition and airplane attitude for which compliance is determined, and, in addition, for each main pump so used, the appropriate emergency pump shall be substituted. (See § 4b.430(b).)

(4) If a fuel flowmeter is provided, operation of the meter shall be blocked in determining compliance with this section and the fuel shall flow through the meter or its bypass.

(c) If an engine can be supplied with fuel from more than one tank, it shall be possible to regain the full fuel pressure of that engine in not more than 20 seconds after switching to any fuel tank when engine malfunctioning becomes apparent due to the depletion of the fuel supply in any tank from which the engine can be fed.

§ 4b.415 [Deletion]

54. By deleting § 4b.415.

55. By amending § 4b.416 to read as follows:

§ 4b.416 Unusable fuel supply.

The unusable fuel supply shall be selected by the applicant and shall be established for each tank as not less than the quantity at which the first evidence of malfunctioning occurs under the most adverse condition from the standpoint of fuel feed during all intended operations and flight maneuvers involving use of that tank.

§§ 4b.416–1, 4b.416–2 [Deletion]

56. By deleting §§ 4b.416–1 and 4b.416–2.

57. By amending § 4b.418 to read as follows:

§ 4b.418 Flow between interconnected tanks.

If it is possible to pump fuel from one tank to another in flight, the design of the fuel tank vents and the fuel transfer

system shall be such that no structural damage to tanks will occur in the event of overfilling.

§ 4b.418–1 [Deletion]

58. By deleting § 4b.418–1.

§ 4b.420 [Amendment]

59. By deleting § 4b.420(d).

§ 4b.426–1 [Deletion]

60. By deleting § 4b.426–1.

61. By amending § 4b.435(d) to read as follows:

§ 4b.435 Fuel strainer or filter.

* * * * *

(d) Provision shall be made to maintain automatically the fuel flow when ice-clogging of the filter occurs, unless means are incorporated in the fuel system to prevent the accumulation of ice particles on the filter.

62. By amending § 4b.436 to read as follows:

§ 4b.436 Fuel system drains.

Drainage of the fuel system shall be accomplished by fuel strainer drains and other drains as provided in § 4b.424. The drains shall discharge clear of all portions of the airplane and shall incorporate means for positive locking of the drain in the closed position, either manually or automatically.

§ 4b.440 [Amendment]

63. By deleting § 4b.440(e).

§ 4b.440–1 [Deletion]

64. By deleting § 4b.440–1.

65. By amending § 4b.447 to read as follows:

§ 4b.447 Oil filters.

If the powerplant installation incorporates an oil filter (strainer), the filter shall be constructed and installed so that oil will continue to flow at the normal rate through the remainder of the system when the flow of oil through the filter element is completely blocked.

66. By amending § 4b.450 to read as follows:

§ 4b.450 General.

The powerplant cooling provisions shall be capable of maintaining the temperatures of powerplant components and engine fluids within the temperature limits established for such components and fluids, under all surface (ground or water) and flight operating conditions. (For cooling systems instruments see §§ 4b.604 and 4b.734.)

§ 4b.450–1 [Deletion]

67. By deleting § 4b.450–1.

68. By amending § 4b.451 to read as follows:

§ 4b.451 Cooling tests.

(a) *General.* Compliance with the provisions of § 4b.450 shall be demonstrated by test under critical surface (ground or water) and flight operating conditions. If the tests are conducted under conditions which deviate from the maximum ambient atmospheric temperature (see paragraph (b) of this section), the recorded powerplant temperatures shall be corrected in accordance with the provisions of paragraphs (c) and (d) of this section. The corrected temperatures determined in this manner shall not exceed the established limits. In the case of reciprocating engines, the fuel used during the cooling tests shall be of the minimum grade approved for the engines involved, and the mixture settings shall be those normally used in the flight stages for which the cooling tests are conducted. The test procedures shall be as outlined in §§ 4b.452 and 4b.454.

(b) *Maximum ambient atmospheric temperature.* A maximum ambient atmospheric temperature corresponding with sea level conditions shall be established by the applicant as a limitation on the operation of the airplane (see § 4b.718). The temperature lapse rate shall be 3.6° F. per thousand feet of altitude above sea level until a temperature of −69.7° F. is reached above which altitude the temperature shall be constant at −69.7° F.

(c) *Correction factor.* Temperatures of all powerplant components and engine fluids, except cylinder barrels, for which temperature limits have been established, shall be corrected by adding the difference between the maximum ambient atmospheric temperature and the temperature of the ambient air at the time of the first occurrence of the maximum component or fluid temperature recorded during the cooling test, unless a more rational correction is shown to be applicable.

(d) *Correction factor for cylinder barrel temperatures.* Cylinder barrel temperatures shall be corrected by adding 0.7 of the difference between the maximum ambient atmospheric temperature and the temperature of the ambient air at the time of the first occurrence of the maximum cylinder barrel temperature recorded during the cooling test, unless a more rational correction is shown to be applicable.

69. By amending § 4b.452 to read as follows:

§ 4b.452 Cooling test procedures.

(a) *General.* Compliance with the provisions of § 4b.450 shall be established for the takeoff, climb, en route, and landing stages of flight which correspond with the applicable performance regulations. The cooling tests shall be conducted with the airplane in the configuration and operating under the conditions which are critical relative to cooling during each stage of flight.

(b) *Temperature stabilization.* For all stages of flight, temperatures shall be stabilized under conditions from which entry is made into the stage of flight for which a test is conducted, except when the entry condition normally is not one during which component and engine fluid temperatures would stabilize. In such case, operation through the full entry condition shall be conducted prior to entry into the stage of flight for which the test is conducted in order to allow temperatures to attain their natural level at the time of entry. In particular, the takeoff cooling test shall be preceded by a period during which the powerplant component and engine fluid temperatures are stabilized with the engines at ground idle. A temperature shall be considered stabilized when its rate of change is less than 2 degrees F. per minute.

(c) *Duration of test.* Cooling tests for each stage of flight shall be continued until one of the following conditions is fulfilled:

(1) Component and engine fluid temperatures stabilize;

(2) The stage of flight is completed; or

(3) An operating limitation is reached.

NOTE: In the case of reciprocating engines, it may be assumed for cooling test purposes that the takeoff stage of flight is complete when the airplane has attained an altitude of 1,500 feet above the takeoff surface or a point in the takeoff where the transition from the takeoff to the en route configuration is completed and a speed is reached at which compliance with § 4b.120(c) is shown, whichever point is at a higher altitude.

§ 4b.452–1 [Deletion]

70. By deleting § 4b.452–1.

§§ 4b.453, 4b.453–1 [Deletion]

71. By deleting §§ 4b.453 and 4b.453–1.

§ 4b.454–1 [Deletion]

72. By deleting § 4b.454–1.

§ 4b.455 [Deletion]

73. By deleting § 4b.455.

§§ 4b.465, 4b.465–1 [Deletion]

74. By deleting §§ 4b.465 and 4b.465–1.

§ 4b.484 [Amendment]

75. By amending § 4b.484(a)(1) by deleting from the third sentence the words "complying with the provisions of § 4b.488".

§ 4b.484–1 [Amendment]

76. By deleting from § 4b.484–1(b)(1) the words "Never Exceed" and inserting in lieu thereof "maximum operating limit".

§ 4b.487 [Amendment]

77. By amending § 4b.487(c) by deleting from the first sentence the words "complying with § 4b.488" and inserting in lieu thereof "to isolate the engine power section from the engine accessory section,".

§ 4b.488 [Deletion]

78. By deleting § 4b.488.

79. By amending § 4b.603(a) by deleting the symbol "V_{NE}" and inserting in lieu thereof "V_{MO}/M_{MO}".

80. By amending § 4b.603 by adding a new paragraph (k) to read as follows:

§ 4b.603 Flight and navigational instruments.

* * * * *

(k) Speed warning device for all turbine-powered airplanes and for all other airplanes for which V_{MO}/M_{MO} is greater than 0.8 V_{DF}/M_{DF} or 0.8 V_D/M_D. The device shall provide effective aural warning to the pilots which is distinctively different from aural warnings used for other purposes, whenever the speed exceeds V_{MO} plus 6 knots or $M_{MO}+0.01$. The upper limit of the production toler-

ance permitted for the warning device shall be at a speed not greater than the prescribed warning speed.

81. By amending § 4b.604(q) to read as follows:

§ 4b.604 Powerplant instruments.

* * * * *

(q) An indicator for each turbojet engine to indicate a change in thrust, resulting from any deficiency in the engine or an indicator to indicate a gas stream pressure which can be related to thrust.

§ 4b.612 [Amendment]

82. By amending § 4b.612(a)(3) by deleting the symbol "V_{NO}" and inserting in lieu thereof "V_{MO}".

§ 4b.612–4 [Amendment]

83. By amending § 4b.612–4(a) by deleting the symbols "V_{NE}" and "M_{NE}" and inserting in lieu thereof "V_{FC}" and "M_{FC}".

84. By amending § 4b.612(f) to read as follows:

§ 4b.612 Flight and navigational instruments.

* * * * *

(f) *Duplicate instrument systems.* If duplicate flight instruments are required by the operating parts of the Civil Air Regulations (see note under § 4b.610), the provisions of subparagraphs (1) through (3) of this paragraph shall apply.

(1) The operating system for flight instruments used by the first pilot, which are required to be duplicated at other flight crew stations, shall be completely independent of the operating system provided for other flight crew stations.

(2) Only the required flight instruments and duplicates of required instruments provided for use of the first pilot shall be connected to the operating system provided for the first pilot.

(3) When other than required instruments and duplicates are connected to other than the first pilot's operating system, provision shall be made to disconnect or isolate in flight such other instruments.

85. By amending § 4b.622(b) to read as follows:

§ 4b.622 Generating system.

* * * * *

(b) The generating system shall be designed so that:

(1) The power sources function properly when independent and when connected in combination;

(2) The failure or malfunctioning of any power source cannot create a hazard or impair the ability of the remaining sources to supply essential loads;

(3) The system voltage and frequency (as applicable) at the terminals of all essential load equipment can be maintained within the limits for which the equipment is designed, during any probable operating condition; and

(4) System transients initiated by switching, fault clearing, or other causes, do not render essential loads inoperative, and do not introduce a smoke or fire hazard.

86. By amending § 4b.624(d) to read as follows:

§ 4b.624 Electrical protection.

* * * * *

(d) If the ability to reset a circuit breaker or to replace a fuse is essential to safety in flight, such circuit breaker or fuse shall be so located and identified that it can be readily reset or replaced in flight.

87. By amending § 4b.627 to read as follows:

§ 4b.627 Electrical system tests.

When laboratory tests of the electrical system are conducted they shall be performed on a mock-up utilizing the same generating equipment complement as in the aircraft. The equipment shall simulate the electrical characteristics of the distribution wiring and connected loads to the extent necessary for valid test results. Laboratory generator drives shall simulate the actual prime movers on the airplane with respect to their reaction to generator loading, including loading due to faults. When the conditions of flight cannot adequately be simulated in the laboratory or by ground tests on the prototype airplane, flight tests shall be conducted.

§ 4b.634 [Amendment]

88. By amending Figure 4b–19 referred to in § 4b.634 by deleting the phrase "At least 2 candles" in the intensity column and inserting in lieu thereof "0.05 *I*".

§ 4b.642 [Amendment]

89. By amending § 4b.642(a) by deleting the word "danger" and inserting in lieu thereof "probability".

§ 4b.643 [Amendment]

90. By amending § 4b.643 by adding at the end of the third sentence the words "in lieu of the fitting factor prescribed in § 4b.307(c)."

§ 4b.645 [Amendment]

91. By amending § 4b.645 by deleting from the introductory paragraph the phrase "through (d)" and inserting in lieu thereof "through (e)"

§ 4b.652 [Deletion]

92. By deleting § 4b.652.

§ 4b.659 [Deletion]

93. By deleting § 4b.659.

94. By amending § 4b.711 to read as follows:

§ 4b.711 Maximum operating limit speed V_{MO}/M_{MO}.

The maximum operating limit speed is a speed which shall not be deliberately exceeded in any regime of flight (climb, cruise, or descent), except where a higher speed is authorized for flight test or pilot training operations. This operating limitation, denoted by the symbols V_{MO}/M_{MO} (airspeed or Mach number, whichever is critical at a particular altitude), shall be established to be not greater than the design cruising speed V_C and sufficiently below V_D/M_D or V_{DF}/M_{DF} to make it highly improbable that the latter speeds will be inadvertently exceeded in operations. The speed margin between V_{MO}/M_{MO} and V_D/M_D or V_{DF}/M_{DF} shall be determined in accordance with either paragraph (a) or (b) of this section, but shall not be less than the margin found necessary in flight tests in accordance with § 4b.191. (Also see § 4b.603(k) concerning speed warning means.)

(a) The minimum margin shall be the greater of the values determined in accordance with subparagraphs (1) and (2) of this paragraph.

(1) From an initial condition of stabilized flight at V_{MO}/M_{MO}, the airplane shall be assumed to be upset, flown for 20 seconds along a flight path 7.5 degrees below the initial path and pulled up at a load factor of 1.5 (.5g acceleration increment). It shall be acceptable to calculate the speed increase occurring in this maneuver, provided reliable or conservative aerodynamic data are used. Power, as specified in § 4b.155(a), shall be assumed until the pullup is initiated, at which time power reduction and the use of pilot controlled drag devices may be assumed.

(2) The margin shall be sufficient to provide for atmospheric variations, such as horizontal gusts, penetration of jet stream or cold front, and for instrument errors and airframe production variations. It shall be acceptable to consider these factors on a probability basis, but the margin at altitudes where M_{MO} is limited by compressibility effects shall not be less than 0.05M.

(b) V_{MO}/M_{MO} shall not be greater than 0.8 V_D/M_D or 0.8 V_{DF}/M_{DF}.

§ 4b.712 [Deletion]

95. By deleting § 4b.712.

96. By amending § 4b.714 to read as follows:

§ 4b.714 Flap extended speeds, V_{FE}.

Flap extended speeds, V_{FE}, shall be established not to exceed the design flap speeds, V_F, chosen in accordance with §§ 4b.210(b)(1) and 4b.212 for the corresponding flap positions and engine powers.

97. By amending § 4b.718(c) to read as follows:

§ 4b.718 Powerplant limitations.

* * * * *

(c) *Fuel grade or specification designation.* The minimum fuel grade for reciprocating engines or the fuel designation for turbine engines, required for the operation of the engine within the limitations prescribed in paragraphs (a) and (b) of this section.

98. By amending § 4b.718 by adding a new paragraph (d) to read as follows:

(d) *Maximum ambient atmospheric temperature.* The maximum ambient atmospheric temperature at which compliance with the cooling provisions of §§ 4b.450 through 4b.452 is established.

§ 4b.738 [Amendment]

99. By amending § 4b.738(b)(1) by deleting the words "octane number" and inserting in lieu thereof "grade or designation".

100. By amending § 4b.740–1 by deleting paragraph (b)(4)(ii) and by amending paragraphs (b)(4) (i), (vii), and (viii) to read as follows:

§ 4b.740–1 Preparation of Airplane Flight Manuals for aircraft certificated in the transport category (FAA policies which apply to § 4b.740).

* * * * *

(b) *Operating limitations.* * * *

(4) *Speed limitations.* * * *

(i) *Maximum operating limit speed, V_{MO}/M_{MO}.* In accordance with § 4b.741 (a)(1), the manual should include a statement that the maximum operating limit speed shall not be deliberately exceeded in any regime of flight (climb, cruise, or descent), except where a higher speed is authorized for flight test or pilot training operations.

* * * * *

(vii) *Compressibility effects.* Where a speed limitation (e.g., M_{MO}) is based on compressibility effects, the manual should include information concerning warning symptoms, probable behavior of the airplane, and recovery procedures.

(viii) *Airspeed and Mach indicator markings and placards.* An explanation of any markings, limit hands, placards, etc., provided in complying with § 4b.732, should be included.

101. By amending § 4b.741(a) by deleting subparagraph (2) and revising subparagraph (1) to read as follows:

§ 4b.741 Operating limitations.

(a) *Airspeed limitations.* * * *

(1) The maximum operating limit speed V_{MO}/M_{MO} (see § 4b.711), together with a statement that this speed limit shall not be deliberately exceeded in any regime of flight (climb, cruise, or descent), except where a higher speed is authorized for flight test or pilot training operations.

(Secs. 313(a), 601, 603; 72 Stat. 752, 775, 776; 49 U.S.C. 1354(a), 1421, 1423)

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N. E. HALABY,
Administrator.

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