UNITED STATES OF AMERICA
CIVIL AERONAUTICS BOARD
WASHINGTON, D.C.

Civil Air Regulations Amendment 4b-3
Effective: March 13, 1956
Adopted: February 7, 1956

AIRPLANE AIRWORTHINESS - TRANSPORT CATEGORIES

MISCELLANEOUS AMENDMENTS RESULTING FROM THE 1955 ANNUAL AIRWORTHINESS REVIEW

There are contained herein amendments with respect to various issues which resulted from the 1955 Annual Airworthiness Review.

With respect to the flight provisions, § 4b.112 is being amended to permit the use of the minimum speed attained during the stall demonstration in determining the required climb and § 4b.160 is being amended to permit determination of the demonstration stall speed in terms of the stall warning speed.

The currently effective gust load requirements are based on wing loading. Research in past years indicated that gust loads are more closely a function of mass parameter than of wing loading. For this reason, there is being included an amendment incorporating the more up-to-date concept of "mass parameters" in the gust load requirements.

In new § 4b.270 there is included a rule which establishes more specific criteria for fatigue evaluation of flight structure, including pressurized cabins. Among other amendments relative to the structural provisions there is a change to § 4b.210 (c) which establishes more realistic criteria for evaluating the strength of the airplane at weights in the vicinity of the zero fuel weight. The new criteria for zero fuel weight are applicable only in conjunction with the application of the new gust load and fatigue evaluation criteria. There are also included amendments which require accounting for compressibility effects at all speeds, the establishment of detailed conditions for the evaluation of gyroscopic loads imposed on engine mounts, and consideration of thermal effects on the structure.

There is an amendment to § 4b.230 (b) which permits, in showing compliance with the ground load requirements, the use of wing lift equal to the weight of the airplane instead of only two-thirds of the weight as is prescribed by the currently effective regulations. To compensate for the relaxatory effect of this amendment, other complementary changes are being made in several of the other ground load requirements.

Three changes are being made with respect to provisions pertaining to control surfaces and their control systems. Two of these entail changes to § 4b.320 which require incorporation of design features or the marking of control system elements to minimize the possibility of incorrect assembly and which require tab control system designs to be such that a failure of any element would not jeopardize the safety of flight. The third change is to § 4b.324 which requires application of the fail safe philosophy to flap actuating systems incorporating a mechanical interconnection to assure against hazardous unsymmetrical flap extension.

There is included a change to § 4b.336 which establishes more up-to-date criteria for the selection of landing gear tires.

The currently effective requirements of § 4b.358 with respect to the restraining of occupants in berths by safety belts are considered unrealistic. A change in these provisions is being made, which excludes safety belts in berths from compliance with the forward inertia load prescribed for emergency landings, and instead, requires that such load with respect to berth occupants be reacted by means of a padded end board, a canvas diaphragm, or other equivalent means.

In addition, there are included other changes which are relatively minor, clarifying, or of an editorial nature.

Interested persons have been afforded an opportunity to participate in the making of this amendment (20 F.R. 8350), and due consideration has been given to all relevant matter presented.

In consideration of the foregoing, the Civil Aeronautics Board hereby amends Part 4b of the Civil Air Regulations (14 CFR Part 4b, as amended) effective March 13, 1956:

1. By amending § 4b.104 (a) by deleting the words "total quantity of engine coolant,".

2. By amending § 4b.104 (b) by deleting the words "fuel, oil, and coolant tanks" and inserting in lieu thereof the words "fuel and oil tanks".

3. By amending § 4b.112 (c) to read as follows:

4b.112 Stalling speeds. * * *

(c) The stall speeds defined in this section shall be the minimum speeds obtained in flight tests conducted in accordance with the procedure of subparagraphs (1) and (2) of this paragraph.

(1) With the airplane trimmed for straight flight at a speed of 1.4 V_{s1} and from a speed sufficiently above the stalling speed to assure steady conditions, the elevator control shall be applied at a rate such that the airplane speed reduction does not exceed one mile per hour per second.

(2) During the test prescribed in subparagraph (1) of this paragraph, the flight characteristics provisions of § 4b.160 shall be complied with.

4. By amending the introductory paragraph of § 4b.160 (c) (2) to read as follows:

4b.160 Stalling; symmetrical power. * * *

(c) * * *

(2) The airplane shall be considered stalled when, at an angle of attack measurably greater than that of maximum lift, the inherent flight characteristics give a clear indication to the pilot that the airplane is stalled, except that for airplanes demonstrating unmistakable inherent aerodynamic warning associated with the stall in all required configurations, the speed need not be reduced below a value which provides an adequate stall warning margin as defined in § 4b.162.

5. By amending the NOTE in § 4b.160 (c) (2) by adding a new sentence at the end thereof to read as follows: "Types of inherent aerodynamic warning considered acceptable include characteristics such as buffeting, small amplitude pitch or roll oscillations, distinctive shaking of the pilots' controls, etc."

6. By amending § 4b.202 by adding a new paragraph (d) to read as follows:

4b.202 Proof of structure. * * *

(d) Proof of compliance of the structure with the fatigue evaluation requirements of § 4b.270 shall be made.

7. By amending Figure 4b-1 by deleting the speed "1.3 V_{s1}" from the abscissa scale and the straight line it identifies, and by deleting the term "0.8 V_D" associated with the V_{Cmin} curve and inserting in lieu thereof the following: "MACH NUMBER SELECTED BY APPLICANT."

8. By amending § 4b.210 by deleting the last sentence in the introductory paragraph and inserting in lieu thereof the following: "Compressibility effects shall be taken into account at all speeds."

9. By amending § 4b.210 (b) (3) to read as follows:

4b.210 General. * * *

(b) Design air speeds. * * *

(3) Design speed for maximum gust intensity, V_B. V_B shall be either the speed determined by the intersection of the line representing the maximum positive lift C_{Nmax} and the line representing the rough air gust velocity on the gust V-n diagram or ($\sqrt{n_g}$) V_{S1}, whichever is the lesser; wherein n_g is the positive airplane gust load factor due to gust at speed V_C in accordance with § 4b.211 (b)(2) at the particular weight under consideration and V_{S1} is the stalling speed with flaps retracted at the particular weight under consideration. V_B need not be greater than V_C.

10. By amending § 4b.210 by adding a new paragraph (c) to read as follows :

4b.210 General * * *

(c) Design fuel loads. The disposable load combinations shall include all fuel loads in the range from zero fuel to the maximum fuel load selected by the applicant. It shall be permissible for the applicant to select a structural reserve fuel condition not exceeding 45 minutes of fuel under operating conditions defined in § 4b.437 (c). If a structural reserve fuel condition is selected, it shall be used as the minimum fuel weight condition for showing compliance with the flight load requirements as prescribed in this subpart, in which case, the provisions of subparagraphs (1) through (3) of this paragraph shall apply.

(1) The structure shall be designed for a condition of zero fuel at limit loads corresponding with:

(i) A maneuver load factor of +2.25, and

(ii) Gust intensities equal to 85 percent of the values prescribed in § 4b.211 (b).

(2) Fatigue evaluation of the structure shall take into account any increase in operating stresses resulting from the design condition of subparagraph (1) of this paragraph (see § 4b.270).

(3) The flutter, deformation, and vibration requirements shall also be met with zero fuel (see § 4b.308).

11. By amending Figure 4b-3 by deleting the references “+40K FPS GUST”, “+30K”, “+15K”, “-15K”, “-30K”, and “-40K”, and inserting in lieu thereof, respectively, the following: “GUST LINE FOR V_B SPEED”, “GUST LINE FOR V_C SPEED”, “GUST LINE FOR V_D SPEED”, “GUST LINE FOR V_D SPEED”, “GUST LINE FOR V_C SPEED”, and “GUST LINE FOR V_B SPEED”.

12. By amending § 4b.211 (b) to read as follows:

4b.211 Flight envelopes. * * *

(b) Gust load factors. The airplane shall be assumed to be subjected to symmetrical vertical gusts while in level flight. The resulting limit load factors shall correspond with the conditions prescribed in subparagraphs (1) through (5) of this paragraph. The shape of the gust shall be assumed to be:

$$U = \frac{U_{de}}{2}\left(1 - \cos\frac{2\pi s}{25\bar{C}}\right);$$

where:

s = distance penetrated into gust (ft.);

$\bar{C}$ = mean geometric chord of wing (ft);

U_{de} = derived gust velocity referred to in subparagraphs (1) through (3) of this paragraph (fps).

(1) Positive (up) and negative (down) rough air gusts of 66 fps at the speed V_B shall be considered at altitudes between sea level and 20,000 feet. At altitudes above 20,000 feet, it shall be acceptable to reduce the gust velocity linearly from 66 fps at 20,000 feet to 38 fps at 50,000 feet.

(2) Positive and negative gusts of 50 fps at the speed V_C shall be considered at altitudes between sea level and 20,000 feet. At altitudes above 20,000 feet, it shall be acceptable to reduce the gust velocity linearly from 50 fps at 20,000 feet to 25 fps at 50,000 feet.

(3) Positive and negative gusts of 25 fps at the speed V_D shall be considered at altitudes between sea level and 20,000 feet. At altitudes above 20,000 feet, it shall be acceptable to reduce the gust velocity linearly from 25 fps at 20,000 feet to 12.5 fps at 50,000 feet.

(4) Gust load factors shall be assumed to vary linearly between the specified conditions B' through G', as shown on the gust envelope of Figure 4b-3.

(5) In the absence of a more rational analysis, the gust load factors shall be computed in accordance with the following formula:

$$n = 1 + \frac{K_g \; U_{de} V_a}{498 \; (W/S)};$$

where:

$$K_g = \frac{.88\ \mu g}{5.3 + \mu g} = \text{gust alleviation factor;}$$

$$\mu_g = \frac{2(W/S)}{\rho \bar{C}\ a\ g} = \text{airplane mass ratio;}$$

U_{de} = derived gust velocities referred to in subparagraphs (1) through (3) of this paragraph (fps);
ρ = density of air (slugs/cu. Ft.);
W/S = wing loading (psf);
$\bar{C}$ = mean geometric chord (ft.);
g = acceleration due to gravity (ft/sec.²);
V = airplane equivalent speed (knots);
a = slope of the airplane normal force coefficient curve C_{NA} per radian if the gust loads are applied to the wings and horizontal tail surfaces simultaneously by a rational method. It shall be acceptable to use the wing lift curve slope C_L per radian when the gust load is applied to the wings only and the horizontal tail gust loads are treated as a separate condition.

13. By amending § 4b.212 (a) (2) by deleting "15 fps nominal intensity" and inserting in lieu thereof the following: "25 fps derived".

14. By amending § 4b.212 (b) (2) to read as follows:

4b.212 Effect of high lift devices. * * *

(b) * * *

(2) Positive and negative derived gusts as prescribed in § 4b.211 (b) acting normal to the flight path in level flight.

15. By amending § 4b.212 (c) by deleting the last sentence and inserting in lieu thereof the following: "For other than tractor type airplanes, a head-on gust equivalent to the intensity prescribed in § 4b.211 (b) (3) with no alleviations acting along the flight path shall be considered."

16. By amending § 4b.213 (d) (3) by deleting the term "K" and inserting in lieu thereof "Kg".

17. By amending § 4b.215 (b) to read as follows:

4b.215 Yawing conditions. * * *

(b) Lateral gusts. The airplane shall be assumed to encounter derived gusts normal to the plane of symmetry while in unaccelerated flight. The derived gusts and airplane speeds corresponding with conditions B' through J' on Figure 4b as determined by §§ 4b.211 (b) and 4b.212 (a)(2) or 4b.212 (b)(2) shall be investigated. The shape of the gust shall be as specified in § 4b.211 (b). In the absence of a rational investigation of the airplane's response to a gust, it shall be acceptable to compute the gust loading on the vertical tail surfaces by the following formula:

$$L_t = \frac{K_{gt} U_{de} V a_t S_t}{498};$$

where:

L_t = vertical tail load (lbs.);

$$K_{g_t} = \frac{.88 \mu_{g_t}}{5.3 + \mu_{g_t}} = \text{gust alleviation factor;}$$

$$\mu_{g_t} = \frac{2W}{\rho \bar{C}_t g \, a_t S_t} \left(\frac{K}{l_t}\right)^2 = \text{lateral mass ratio;}$$

U_{de} = derived gust velocity (fps);

ρ = air density (slugs/cu. Ft.);

W = airplane weight (lbs.);

S_t = area of vertical tail (ft.^{2});

$\bar{C}_t$ = mean geometric chord of vertical surface (ft.);

a_t = lift curve slope of vertical tail (per radian);

K = radius of gyration in yaw (ft.);

l_t = distance from airplane C.G. to lift center of vertical surface (ft.);

g = acceleration due to gravity (ft./sec.^{2});

V = airplane equivalent speed (knots).

18. By amending § 4b.216 (c) (1) by adding a new sentence at the end thereof to read as follows: “Stress concentration and fatigue effects shall be accounted for in the design of pressure cabins (see § 4b.270).”

19. By amending § 4b.216 (c) (3) by deleting from the first sentence the following words: “to provide for such effects as fatigue and stress concentration”.

20. By amending § 4b.216 by adding a new paragraph (e) to read as follows:

4b.216 Supplementary flight conditions. * * *

(e) Gyroscopic loads. The structure supporting the engines shall be designed for gyroscopic loads associated with the conditions specified in §§ 4b.213 through 4b.215 with the engines operating at maximum continuous rpm.

21. By amending a § 4b.230 (b) (1) by deleting the words “when landing the airplane” and inserting in lieu thereof the words “in the attitude and subject to the drag loads associated with the particular landing condition, and”.

22. By amending § 4b.230 (b) (2) by deleting the words “two-thirds of”.

23. By amending a § 4b.231 (a) by deleting the first sentence and inserting in lieu thereof the following: “In the level attitude the airplane shall be assumed to contact the ground at forward velocity components parallel to the ground ranging from V_{L1} to 1.25 V_{L2} and shall be assumed to be subjected to the load factors prescribed in § 4b.230 (b) (1), where V_{L1} is equal to V_{so} (TAS) at the appropriate landing weight and in standard sea level conditions and where V_{L2} is equal to V_{so} (TAS) at the appropriate landing weight and altitudes in a hot day temperature of 41°F. above standard.”

24. By amending § 4b.231 (a) by deleting from the second sentence the clause “or landings at elevations higher than 5,000 feet”.

25. By amending § 4b.231 (a) by deleting the last sentence from subparagraphs (1) and (3) and inserting in lieu thereof in each instance the following: “It shall be acceptable to apply this condition only to the landing “gear, directly affected attaching structure, and large “mass items; i.e., external fuel tanks, nacelles, etc.”

26. By amending the introductory paragraph of § 4b.232 to read as follows:

4b.232 Tail-down landing conditions. In the conditions of paragraphs (a) and (b) of this section the airplane shall be assumed to contact the ground at forward velocity components parallel to the ground, ranging from V_{L1} to V_{L2}, where V_{L1} and V_{L2} are as indicated in § 4b.231 (a). The load factors prescribed in § 4b.230 (b)(1) shall apply. The combination of vertical and drag components specified in § 4b.231 (a)(1) and 4b.231 (a)(3) shall be considered acting at the main wheel axle centerline.

27. By amending Figures 4b-8 and 4b-9 by deleting in four instances the numerical value “2/3” from the expression “2/3 W (TOTAL)”.

28. By amending Figure 4b-9 by showing in two instances a horizontal drag component “D_M” acting at the main wheel axle centerline.

29. By amending Figure 4b-10 by deleting the term “W/3” in two instances and inserting in lieu thereof the term “W/2”.

30. By amending Figure 4b-11 by deleting the term “W/3” in two instances and inserting in lieu thereof the term “W/2”, by deleting from the expression “V_M = 2 + .67W” the numerical value “.67”, and by deleting from the expression “V_M = 0.25 (n-0.67)W” the numerical value “0.67” and inserting in lieu thereof the value “1.0”.

31. By adding a new § 4b.234a to read as follows:

4b.234a Rebound landing condition. The landing gear and its supporting structure shall be investigated for the loads occurring during rebound of the airplane from the landing surface. With the landing gear fully extended and not in contact with the ground, a load factor of 20.0 shall act on the unsprung weights of the landing gear. This load factor shall act in the direction of motion of the unsprung weights as they reach their limiting positions in extending with relation to the sprung portions of the landing gear.

32. By amending § 4b.235 by adding new paragraphs (g) and (h) to read as follows:

4b.235 Ground handling conditions. * * *

(g) Reversed braking. The airplane shall be in a three point static ground attitude. Horizontal reactions parallel to the ground and directed forward shall be applied at the ground contact point of each wheel equipped with brakes. The limit loads shall be equal either to 0.55 times the vertical load at each wheel or to the load developed by 1.2 times the nominal maximum static brake torque, whichever is the lesser. For nose-wheel types, the pitching moment shall be balanced by rotational inertia. For tail-wheel types, the resultant of the ground reactions shall pass through the center of gravity of the airplane.

(h) Towing loads. Towing loads shall be those specified in Figure 4b-26, considering each condition separately. These loads shall be applied at the towing fittings and shall act parallel to the ground. A vertical load factor equal to 1.0 shall be considered acting at the center of gravity. The shock struts and tires shall be in their static positions. The towing load, F_{TOW}, shall be defined as equal to .3 W_T for W_T less than 30,000 pounds, equal to $\frac{6W_T + 450{,}000}{70}$ for W_T between 30,000 and 100,000 pounds and equal to .15 W_T for W_T over 100,000 pounds, where W_T is the design maximum take-off weight. For towing points not on the landing gear but located near the plane of symmetry of the airplane, the drag and side tow load components specified for the auxiliary gear shall apply. For tow points located outboard of the main gear, the drag and side tow load components specified for the main gear shall apply. In cases where the specified angle of swivel cannot be obtained, the maximum obtainable angle shall be used.

33. By adding a new Figure 4b-26.

34. By adding a new heading and a new § 4b.270 to read as follows:

FATIGUE EVALUATION

4b.270 General The strength, detail design, and fabrication of those portions of the airplane's flight structure in which fatigue may be critical shall be evaluated in accordance with the provisions of either paragraph (a) or (b) of this section.

(a) Fatigue strength The structure shall be shown by analysis and/or tests to be capable of withstanding the repeated loads of variable magnitude expected in service. The provisions of subparagraphs (1) through (3) of this paragraph shall apply.

(1) Evaluation of fatigue shall involve the following:

(i) Typical loading spectrum expected in service;

(ii) Identification of principal structural elements and detail design points, the fatigue failure of which could cause catastrophic failure of the aircraft; and

(iii) An analysis and/or repeated load tests of principal structural elements and detail design points identified in subdivision (ii) of this subparagraph;

			Load	
Tow Point	**Position**	**Magnitude**	**No.**	**Direction**
Main Gear		.075 F_{TOW} per main gear unit	1	Forward, parallel to drag axis.
			2	Forward, at 30° to drag axis.
			3	Aft, parallel to drag axis.
			4	Aft, at 30° to drag axis.
Auxiliary gear	Swiveled forward	1.0 F_{TOW}	5	Forward
			6	Aft.
	Swiveled aft		7	Forward.
			8	Aft.
	Swiveled 45° from forward	0.5 F_{TOW}	9	Forward, in plane of wheel.
			10	Aft, in plane of wheel.
	Swiveled 45° from aft.		11	Forward, in plane of wheel.
			12	Aft, in plane of wheel

BALANCING FORCES

The side component of the towing load at the main gear is reacted by a side force at the static ground line at the wheel to which load is applied.

The towing loads at the auxiliary gear and the drag components of the towing loads at the main gear are reacted in each of the following ways:

a. Reaction applied at the axle of the wheel to which load is applied, this reaction having a maximum value equal to the vertical reaction. Airplane inertia is applied as required for equilibrium.

b. The loads reacted by airplane inertia.

Figure 4b-26.--Towing Loads

NOTE: Usually tests of principal structural elements include major fittings, samples of joints, spar cap strips, skin units, and other representative sections of the flight structure.

(2) 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.

(3) When circumstances require substantiation of the pressure cabin by fatigue tests, the cabin or representative portions of it shall be cycle-pressure tested, utilizing the normal operating pressure together with the effects of external aerodynamic pressure combined with the flight loads. It shall be acceptable to represent the effects of flight loads by an increased cabin pressure, or to omit the flight loads if they are shown to have no significant effect upon fatigue.

(b) Fail safe strength. It shall be shown by analysis and/or tests that catastrophic failure or excessive structural deformation, which could adversely affect the flight characteristics of the airplane, are 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 the flight loading condition specified in subparagraphs (1) and (2) of this paragraph. These loads shall be multiplied by a factor of 1.15 unless the dynamic effects of failure under static loads are otherwise taken into consideration. In the case of a pressure cabin, the normal operating pressures combined with the expected external aerodynamic pressures shall be applied simultaneously with the flight loading conditions specified in this paragraph.

(1) An ultimate load factor of 2.0 at V_C.

(2) Gust loads as specified in § 4b.211 (b), except that these gust loads shall be considered to be ultimate and the gust velocities shall be as follows:

(i) At speed V_B, 49 fps from sea level to 20,000 feet altitude, thereafter decreasing linearly to 28 fps at 50,000 feet altitude.

(ii) At speed V_C, 33 fps from sea level to 20,000 feet altitude, thereafter decreasing linearly to 16.5 fps at 50,000 feet altitude.

(iii) At speed V_D, 15 fps from sea level to 20,000 feet altitude, thereafter decreasing linearly to 6 fps at 50,000 feet altitude.

35. By amending § 4b.306 (b) by adding a new sentence at the end thereof to read as follows: "The effects of temperature on allowable stresses used for design in an essential component or structure shall be considered where thermal effects are significant under normal operating conditions."

36. By amending § 4b.306 (d) by adding at the end thereof the reference "(See also § 4b.270.)"

37. By amending § 4b.320 to read as follows:

4b.320 General. All controls and control systems shall operate with ease, smoothness, and positiveness appropriate to their function. The elements of the flight control system shall incorporate design features or shall be distinctively and permanently marked to minimize the possibility of incorrect assembly which could result in malfunctioning of the control system. Tab control systems shall be such that disconnection or failure of any element at speeds up to V_C cannot jeopardize the safety of flight. (See also §§ 4b.308, 4b.350, and 4b.353.)

38. By amending § 4b.324 (a) by adding a new sentence at the end thereof to read as follows: "When a mechanical interconnection is employed, means shall be provided to insure against hazardous unsymmetrical operation of the wing flaps after any reasonably possible single failure of the flap actuating system."

39. By amending § 4b.332 (b) (2) by deleting from the definition of "L" the numerals "0.667" and inserting in lieu thereof the numerals "1.0".

40. By amending § 4b.336 to read as follows:

4b.336 Tires. Landing gear tires shall be of a proper fit on the rim of the wheel, and of load ratings which are not exceeded under the following conditions:

(a) Main wheel tires: Equal static loads on all main wheel tires corresponding with the most critical combination of maximum take-off weight and center of gravity position.

(b) Nose wheel tires: Equal loads on all nose wheel tires corresponding with the following conditions:

(1) The static ground reaction per tire corresponding with the most critical combination of take-off weight and center of gravity position. This load shall correspond with the static rating of the tire.

(2) The dynamic ground reaction per tire at maximum landing weight, assuming the mass of the airplane concentrated at the most critical location of the center of gravity for this weight and exerting a force of 1.0g downward and 0.31g forward, the reactions being distributed to the nose and main wheels by the principles of statics with a 0.31g drag reaction at the ground applied at those wheels which have brakes. This load shall correspond with the dynamic rating of the tire.

(3) The dynamic ground reaction per tire at design take-off weight, assuming the mass of the airplane concentrated at the most critical location of the center of gravity for this weight and exerting a force of 1.0g downward and 0.20g forward, the reactions being distributed to the nose and main wheels by the principles of statics with a 0.20g drag reaction at the ground applied at those wheels which have brakes. This load shall correspond with the dynamic rating of the tire.

41. By amending § 4b.337 (a) (2) by deleting the word “connection” and inserting in lieu thereof the word “connecting”.

42. By amending § 4b.358 (b) by adding a new subparagraph (4) to road as follows:

4b.358 Seats, berths, and safety belts. * * *

(b) Arrangement. * * *

(4) Berths shall be so designed that the forward portion is provided with a padded end board, a canvas diaphragm, or other equivalent means, capable of withstanding the static load reaction of the occupant when subjected to the forward inertia force specified in § 4b.260. Berths shall be free from corners and protuberances likely to cause serious injury to a person occupying the berth during emergency conditions.

43. By amending § 4b.358 (c) by adding a new sentence between the first and second sentences to read as follows: “In the case of berths, the forward inertia force shall be considered in accordance with subparagraph (b)(4) of this section and need not be considered with respect to the safety belt.”

44. By amending § 4b.386 (g) to read as follows:

4b.386 Combustion heater fire protection. * * *

(g) Heater exhaust. Heater exhaust systems shall comply with the provisions of § 4b.467 (a) and (b). In addition, provisions shall be “made in the design of the heater exhaust system so that the products of combustion will be safely conveyed overboard to prevent the occurrence of the following:

(1) Fuel leakage from the exhaust to surrounding compartments;

(2) Exhaust gas impingement on surrounding equipment or structures;

(3) Ignition of flammable fluids by the exhaust, when the exhaust is located in a compartment containing flammable fluid lines;

(4) Restriction by the exhaust of the prompt relief of backfires which can cause heater failure due to pressure generated within the heater.

45. By amending § 4b.413 (b) by adding a new subparagraph (4) to read as follows:

4b.413 Fuel flow rate. * * *

(b) * * *

(4) In systems where § 4b.435 (d) requires a fuel filter by-pass arrangement, the fuel flow rate corresponding with 100 percent of the engines' maximum fuel demand at standard atmospheric conditions shall be demonstrated with the fuel filter blocked.

46. By amending § 4b.414 by adding at the beginning of paragraph (a) the words: “For reciprocating engines,”.

47. By amending § 4b.414 by deleting from the first sentence of paragraph (b) the words “paragraph (a) of”, by redesignating paragraph (b) as paragraph (c), and by adding a new paragraph (b) to read as follows:

4b.414 Pump systems. * * *

(b) For turbine engines, the fuel flow rate for pump systems shall be 125 percent of the fuel flow required to develop the standard sea level atmospheric condition take-off power selected by the applicant and included as an operating limitation in the Airplane Flight Manual.

48. By amending § 4b.420 by deleting paragraph (c) and by redesignating paragraphs (d) and (e) as (c) and (d), respectively.

49. By amending § 4b.421 (a) to read as follows:

<u>4b.421</u> <u>Fuel tank tests</u>

(a) Fuel tanks shall be demonstrated capable of withstanding the most critical of the following pressures without failure or leakage as mounted in the airplane:

(1) Internal pressure of 3.5 psi;

(2) 125 percent of the maximum air pressure developed in the tank from ram effect;

(3) The fluid pressures developed during maximum limit accelerations of the airplane with a full tank. If any of these pressures exceed the greater of the pressures prescribed in subparagraphs (1) and (2) of this paragraph, the test shall be conducted so as to simulate the pressure distribution insofar as practicable. The minimum pressure at any point in the tank shall not be less than the greater of the pressures prescribed in subparagraphs (1) and (2) of this paragraph.

50. By amending the introductory paragraph of § 4b.421 (b) to read as follows:

<u>4b.421</u> <u>Fuel tank tests</u> * * *

(b) Tanks with large unsupported or unstiffened flat surfaces, the failure or deformation of which could cause fuel leakage, shall be capable of withstanding a vibration test in accordance with the conditions of subparagraphs (1) through (4) of this paragraph, or other equivalent test, without leakage or excessive deformation of the tank walls.

51. By amending § 4b.421 (b) (2) to read as follows:

<u>4b.421</u> <u>Fuel tank tests</u> * * *

(b) * * *

(2) The tank assembly shall be vibrated for 25 hours while filled two-thirds full of water or any suitable test fluid. The amplitude of vibration shall not be less than one thirty-second of an inch, unless otherwise substantiated.

52. By amending § 4b.421 (b) (4) to read as follows:

<u>4b.421</u> <u>Fuel tank tests</u> * * *

(b) * * *

(4) During the test, the tank assembly shall be rocked at the rate of 16 to 20 complete cycles per minute through an angle of 15° on either side of the horizontal (30° total) about the most critical axis for 25 hours. If motion about more than one axis is likely to be critical, the tank shall be rocked about each axis for 12½ hours.

53. By amending § 4b.421 (b) by deleting subparagraph (5).

54. By amending § 4b.424 (a) to read as follows:

<u>4b.424</u> <u>Fuel tank sump</u>

(a) Each fuel tank shall be provided with a sump having a capacity of not less than either 0.10 percent of the tank capacity or one-sixteenth of a gallon, whichever is the greater, except that a smaller capacity shall be acceptable if operating limitations are established to assure that in service the accumulation of water will not exceed the sump capacity.

55. By amending § 4b.430 (a) (3) by adding the word "Reciprocating" at the beginning of the second sentence.

56. By amending § 4b.430 (b) (1) by inserting the words "reciprocating engine" between the words "of" and "installations".

57. By amending § 4b.431 (a) by adding a new sentence at the end thereof to read as follows: "In turbine engine fuel systems, provisions shall be made to maintain the fuel pressure at the inlet to the engine fuel system within the limits established for engine operation."

58. By amending § 4b.435 by adding a new paragraph (d) to read as follows:

<u>4b.435</u> <u>Fuel strainer</u> * * *

(d) When filter or strainers susceptible to icing are incorporated in the fuel system, a means shall be provided to maintain automatically the fuel flow in the event ice particles accumulate and restrict flow by clogging the filter or screen.

59. By amending § 4b.437 (c) by adding a new sentence at the end thereof to read as follows: "For turbine powered airplanes, the design of the jettisoning system shall be such that it would not be possible to jettison fuel in the tanks used for take-off and landing below the level providing climb from sea level to 10,000 feet and thereafter providing 45 minutes cruise at a speed for maximum range."

60. By amending § 4b.451 (c) to read as follows:

<u>4b.451</u> <u>Cooling tests</u> * * *

(c) <u>Correction factor for cylinder head, oil inlet, and carburetor air temperatures.</u> The cylinder head, oil inlet, and carburetor air temperatures shall be corrected by adding the difference between the maximum anticipated air temperature and the temperature of the ambient air at the time of the first occurrence of maximum head, oil, or air temperature recorded during the cooling test, unless a more rational correction is shown to be applicable.

61. By amending § 4b.604 by deleting paragraph (b).

62. By amending § 4b.637 by adding a new sentence at the end thereof to read as follows: "If an additional anti-collision light is installed on the bottom of the fuselage, the prescribed limits of effective flash frequency in the overlap region of the two light beams need not be meet."

63. By amending § 4b.643 by adding a new sentence at the end thereof to read as follows: "In the case of safety belts for berths, the forward load factor need not be applied."

64. By amending § 4b.711 (b) by adding a note at the end thereof to read as follows:

NOTE: Where speeds are limited by compressibility effects, this section is intended to provide an adequate margin between M_{NE} and the lowest of the following Mach values: M_D, M_{DF}, or the Mach number where adverse flight characteristics, such as the following, occur: Undue reduction in ability to recover; rapid or large changes in stability during level flight or recovery which would cause the airplane to exceed structural limits; buffeting so severe as to endanger the structural integrity of the airplane. The speed margin required usually depends upon the effectiveness of the warning provided to the pilots whenever M_{NE} is reached or exceeded, and upon the recovery or speed control characteristics of the airplane. In any case the margin should be sufficient: To enable recovery from mild upsets due to gusts or inadvertent control movements or trim changes; to allow for inadvertent increases in Mach number due to horizontal gusts or temperature inversions; and, for instrument inaccuracies or airplane production differences. The probability of the simultaneous occurrence of the aforementioned speed margin conditions are usually considered, but the effects of all such conditions are not necessarily additive.

65. By amending §§ 4b.718 (a) (4), (a) (5) and (b) (3) by deleting in each instance the words "or coolant outlets".

66. By amending § 4b.738 (b) by deleting the title and inserting in lieu thereof the following: "<u>Fuel and oil filler openings</u>"

67. By amending § 4b.738 (b) by deleting subparagraph (3).

68. By amending § 4b.738 by deleting paragraph (d) and by redesignating paragraph (e) as paragraph (d).

(Sec. 205 (a), 52 Stat. 984, 49 U.S.C. 425 (a). Interpret or apply secs. 601, 603, 52 Stat 1007, 1009, as amended, 49 U.S.C. 551, 553)

By the Civil Aeronautics Board:
/s/ M. C. Mulligan
M. C. Mulligan
Secretary

(SEAL)

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